Fama-Shiller, Economic Sciences Prize Committee and the "efficient markets hypothesis"

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> "People with knowledge of financial economics may be further surprised that this year Eugene Fama and Robert Shiller are both recipients. Prof Fama made his name by developing the efficient market hypothesis, long the cornerstone of finance theory. Prof Shiller is the most prominent critic of that hypothesis. It is like awarding the physics prize jointly to Ptolemy for his theory that the Earth is the centre of the universe, and to Copernicus for showing it is not." (John Kay, 2013).

> "The old joke about the economics Nobel was that it had been shared by two men who disagreed with each other: Friedrich von Hayek and Gunnar Myrdal. Profs Fama and Shiller, at first glance, are another example: Prof Fama showed that markets were efficient; Prof Shiller showed that they were not." (Tim Harford, 2013)

These two comments are typical of the journalists or academics' reactions after the *Economic Sciences Prize Committee of the Royal Swedish Academy of Science* announced that Fama, Hansen and Shiller were awarded with the 2013 prize in economics. Everybody is convinced that the prize committee wanted to highlight the importance of the "efficient markets hypothesis" (EMH). This may be true, but if so, the committee's praise took a very indirect and subtle manner, since in its "scientific background" report, *Understanding Asset Pricing*, the Economic Sciences Prize Committee *never mentions* this "hypothesis" and never uses the terms "efficient markets" or "market efficiency. We see two reasons why they preferred to abstain from mentioning these terms. (1) Efficiency is a well-defined concept in economics, which means it cannot be used in a vague or ambiguous way. (2) It is unknown what exactly the "efficient markets hypothesis" is, as it has never been clearly defined.

Why the prize committee fails to mention "market efficiency" and the EMH

The phrase "efficient markets" was coined by Fama in his 1970 paper "Efficient Capital Markets: A Review of Theory and Empirical Works". As its title lets on, this paper is simply a "review" of an idea that has been around for quite some time and to which Fama is only giving a new label. If none of the authors mentioned in the paper (Bachelier, Cowles, Kendall, Workings, Osborne, Samuelson, among others) ever used the expression "market efficiency" when they discussed this idea, it is not because they didn't think of it. It is because they knew, obviously, that efficiency, in economics, is a synonym of a very different concept: the Pareto optimality – that is, a very strong condition on resource allocation. So, it is quite surprising how economists didn't question the expressions "efficient markets" or "market efficiency" and even accepted it. To be precise, those expressions have only been used in finance, but nobody seems to object when finance economists, such as Fama, suggest that they concern resource allocation – "market efficiency" in finance, whatever it means, is supposed to imply

efficiency in the economic sense (Pareto optimality).

Another surprising fact about Fama's 1970 paper is that the "efficient markets hypothesis" is never really defined. The definition of the "hypothesis" is only given through a metaphor: according to Fama, an "efficient market" is "a market in which prices at any time 'fully reflect' all available information" (Fama, 1970, p 383). The use of quotation marks around the words "fully reflect" implies that this expression needs itself to be defined. In 1970, Fama seemed to be aware of this problem as he explains, a few lines further, that:

> "the definitional statement that in an efficient market prices 'fully reflect' available information is so general that it has no empirical testable implication. To make the model testable, the process of price formation must be specified in more details. In essence, we must define somewhat more exactly what is meant by the term 'fully reflect'".

But, immediately thereafter, he writes: "One possibility would be to posit that …". Thus, "fully reflect" could have many possible meanings ("possibilities") and, consequently, so does the expression "market efficiency". From the beginning, the worm was in the fruit[1].

The fact that the EMH was only vaguely defined in Fama's 1970 paper has another surprising consequence: as Stephen LeRoy pointed out in a "comment" published in 1976, the mathematical presentation of this "hypothesis" is flawed – more precisely, it is tautological[2]. The prize committee couldn't ignore Fama's 1970 paper anomalies. It is probably why, in its 2013 report, it doesn't mention EMH and never uses the expressions "fully reflect" or even "market efficiency". It also eludes the opposition between Fama (Ptolemy) and Shiller (Copernicus) – or vice versa. On the contrary, it presents them as complementary – Fama is right in "the short term" and Shiller in "longer terms". Both have contributed to "understanding asset prices" and deserve to share the prize[3]. *QED*.

The justification of the prize by the Economic Sciences Prize Committee

The committee's report uses moderately the language of finance, but enough to make it difficult to identify – at least for the non-specialist – the "contributions" of the awardees. Fortunately, in the report, two figures help us to understand where lays the problem with the "efficient market hypothesis".

Figure 1 gives an example of how new information (here, dividend announcements) is "quickly incorporated" in stock prices, "without generating predictable price movements" (ESPC report, p 12). The horizontal axis shows trading days before and after the announcement. The price adjustment is quick enough to make unsuccessful any attempt to gain by buying the stock "immediately" after the announcement and selling it later.

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[1] In fact, quotations marks for "fully reflect" quickly disappeared in Fama's and others' papers. Everybody seemed to know what this expression means: the force of habit ... Twenty years later, in a paper called "Efficient Capital Markets II", the 1970 EMH has become a "simple statement" : "I take the market efficiency hypothesis to be the simple statement that security prices fully reflect all available information" (Fama 1990, p 1575).

[2] For more details, see http://rwer.wordpress.com/2011/03/11/rwer-issue-56-guerrien-and-gun/.

[3] Hansen, an econometrician who shared the prize with Fama and Shiller, refuses to choose between them about "market efficiency" (see http://economix.blogs.nytimes.com/2013/11/16/a-talk-with-lars-peter-hansen-nobel-laureate/?_r=0)

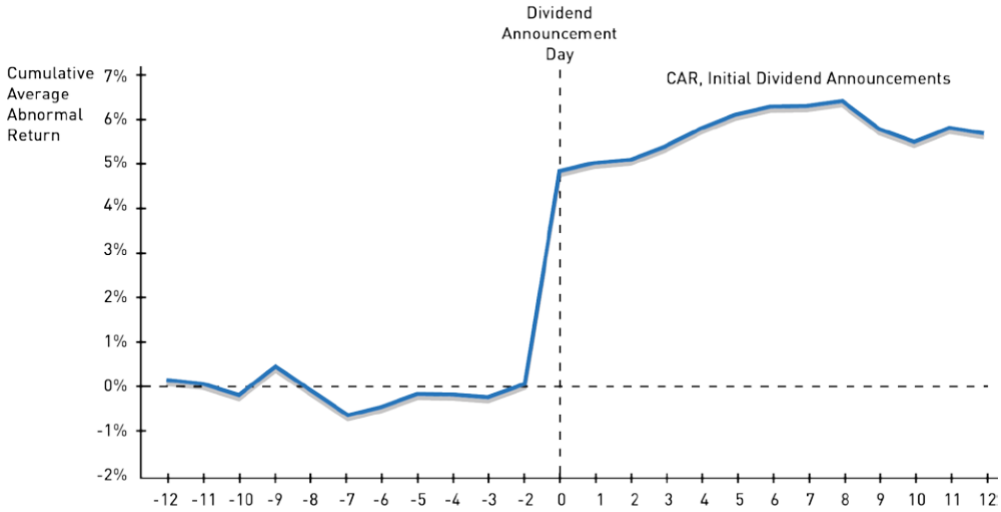

Figure 1: Abnormal stock returns for initial dividend announcements

"Market efficiency" means, in this case, that "abnormal returns" are only possible by chance - the chance to possess the stock before the announcement. Said in more general terms, this means that it is not possible "to beat the market". This is the central contention of Fama's work. There may be anomalies – the possibility to make "abnormal returns" – but those disappear as soon as they are detected by "the markets" (investors, or some of them).

The other figure in the Economic Sciences Prize Committee report (Figure 2) gives the Real Standard and Poor's Composite Stock Price Index, *p*, compared to an "*ex post* rational price", *p**, during one century (1870 and 1970)".

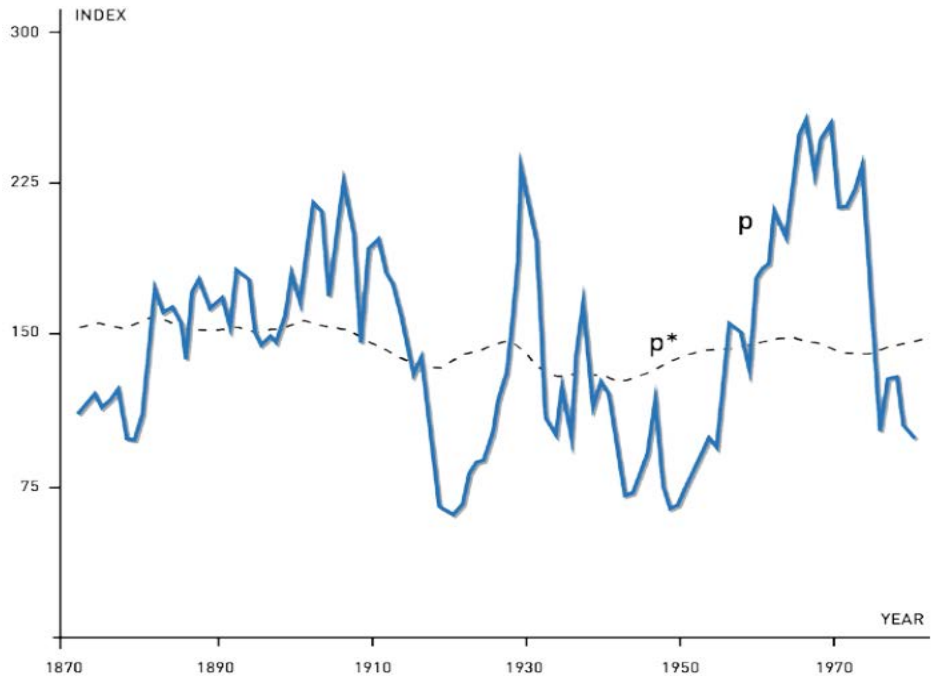

Figure 2: Real Standard and Poor's Composite Stock Price Index (solid line *p*) and *ex post* rational price (dotted line *p**), 1871–1979, both detrended by dividing a long-run exponential growth factor.

It is obvious at first sight that figure 1 and figure 2 describe two different kinds of phenomena: the first one is relative to variations lasting a few days, the other is relative to movements throughout a century! For Fama, figure 1 validates the "efficient markets hypothesis", and for Shiller figure 2 invalidates it – deviations of *p* from *p** are too important to be random. But the committee doesn't want to get involved with that "hypothesis" and prefers to establish a link between Fama and Shiller through "predictability":

> "In the short term, predictability in stock returns is very limited, which is consistent with stock prices quickly reflecting new public information about future cash flows" and "In the longer term, there is economically significant predictability in stock returns"[4] (ESPC report, p 42).

Fama and Shiller are both awarded for their (complementary) work on "short term" and "longer term" predictability, respectively. The prize share is justified. Except that nobody – including Fama and Shiller themselves – agrees with this interpretation! For Fama, financial markets are almost always "efficient", because stock returns are not predictable, and for Shiller they are not, because of stock prices "excess volatility". There is, in fact, a very large consensus about the first point – the Economic Sciences Prize Committee's "short term". It is not possible to predict stock returns and, thus, "to beat the market". The disagreements arise about "the longer term" and its "joint hypothesis" problem.

Joint hypothesis, "rational prices" and "market efficiency"

In his "reply" to LeRoy's comment on his 1970 paper, Fama explained that "tests must be based on a model of equilibrium, and any test is a joint test of efficiency and of the model of equilibrium" (Fama, 1976, p 143). That is, in committee terms: "postulating a specific model of asset prices as a maintained hypothesis allows further study of whether deviations from that model are random or systematic" (p 10). In figure 2, *p** is the model of equilibrium price and *p* – *p** the deviation from that model.

Any test of "efficiency" supposes, thus, that a model of equilibrium has been chosen. In the example given by figure 2, the model of equilibrium price *p** of a firm's stock is given by the present value of its actual subsequent (future) dividends – that is, *p** is the "fundamental value" of the firm, in a perfect competitive equilibrium. As the future is, by nature, unknown, the assumption of rational expectations (or perfect foresight) is added to the model and, then, the "*ex post* rational price" *p** of figure 2 can be computed. "Future dividends" in, say, 1947, became actual (observed *ex post*) dividends between, say, 1947 and 1957 – the present value *p** is computed using actual discount factors during the same period. "Rational" means here "perfect foresight".

In figure 2, deviations between observed prices *p* and "rational prices" *p** are too important to be attributed to randomness. If they are taken as an indicator of "market efficiency", the EMH must be rejected. Now, proponents of the "hypothesis" can blame the model of equilibrium which is "jointly tested" with "market efficiency". As the committee argues: "finding that deviations are systematic might be attributed to an incorrectly specified …asset pricing model" (p 9). The "efficient markets hypothesis" cannot be tested separately from an asset pricing model – thus, it is not falsifiable.

[4] This predictability is quite special: "expected returns in 'good' times (at the peak of the business cycle) are lower than expected returns in 'bad' times" and "expected returns in 'bad' times (at the bottom of the business cycle) are higher than expected returns in "good" times" (ESPC report, p 42). Whoever knows when the business cycle is at its peak or its bottom?

Fama, Shiller and many others proposed different kinds of "models of equilibrium". The most popular among them is the *CCAPM* (*Consumption Capital Asset Price Model*) which:

> "extends the static *CAPM* (*Capital Asset Price Model*) theory of individual stock prices by providing a dynamic consumption-based theory of the determinants of the valuation of the market portfolio" (Economic Sciences Prize Committee, p 7).

Behind these impressive words, there is the ghostly "representative agent":

> "The most basic dynamic pricing model, the *CCAPM*, starts from the assumption that the economy can be described by a representative agent who maximizes expected utility" in a complete set of markets (*ibid*, p 21).

There are countless ways to modify the parameters of this "basic model" with a view to "better fit the data". For example, "recursive preferences", "wealth", "sensitive to *changes* in consumption levels", "representative agent's uncertainty about the true model (sic)" have been considered – they all concern representative agent preferences or "psychology". But, according to the committee, "it is fair to say that currently no widely accepted 'consensus model' exists". We can add it will never exist, with the concept of a representative agent being so absurd.

Fama's contorsions in defense of "market efficiency"

Fama couldn't ignore the attacks from Shiller and others. According to the former, "market efficiency" is not at question, the problem coming from the equilibrium model – what he identified as "the bad- model problem". In a paper titled "Market efficiency, long-term returns, and behavioral finance", he intends to explain by a bad-model problem the differences between the kind of situation depicted in figures 1 and 2:

> "The bad-model problem is less serious in event studies that focus on short return windows (a few days) since daily expected returns are close to zero and so have little effect on estimates of unexpected (abnormal) returns. But the problem grows with the return horizon. A bad-model problem that produces a spurious abnormal average return of *x*% per month eventually becomes statistically reliable in cumulative monthly abnormal returns" (Fama 1998, p 291).

He accepts that there are "cumulative abnormal returns" but continues to defend "market efficiency"[5], giving to it a new meaning: "overreaction" of stock prices are in the more or less long term offset by "underreaction". Apparent gains, for example during a bubble, are offset by losses when the bubble bursts. To "the hope" of Michealy et al. (Michealy et al. 1995) that "future research will help understand why the markets appear to overreact in some circumstances and underreact in others", Fama replies:

> "the market efficiency hypothesis offers a simple answer to this question – chance. Specifically, the expected value of abnormal returns is zero, but

[5] The committee adopts also the short term and "longer term" approach, but it doesn't use the terms "bad model" and "market efficiency".

> chance generates apparent anomalies that split randomly between overreaction and underreaction" (*ibid,* p. 287).

We are far away from the idea that an efficient capital market is, in Fama's words, "a market in which prices provide accurate signal for resource allocation" (Fama 1970, p 383). This is typical of Fama's attitude. When "market efficiency" is under attack – remember that there were a lot of financial crises all over world during the 80s and the 90s –, he adopts the "(abnormal) gains only by chance" exit strategy. If necessary, he adds the "bad-model" argument: all the troubles come from the theoreticians and governments (badly) adviced by economists. For Fama, finance is never guilty.

Conclusion

In the first edition of *The New Palgrave: A Dictionary of Economics* (1987), Burton Malkiel writes under the entry "efficient market hypothesis":

> In general, the empirical evidence in favor of EMH is very strong. Probably no other hypothesis in economics or finance has been more extensively tested (p 122).

In the second edition of the same *Dictionary*, Andrew Lo explains that the "efficient markets hypothesis" was:

> "...developed independently by Paul A. Samuelson and Eugene F. Fama in the 1960s…" and that "…it has been applied extensively to theoretical models and empirical studies of financial securities prices, generating considerable controversy as well as fundamental insights into the price-discovery process" (Lo, 2007)[6].

How is it possible that a theory with "very strong" empirical evidence in 1987 has "generated considerable controversy" twenty years later – without any important change in evidence? It is obvious that Malkiel refers to "the market can't be beaten" hypothesis – the only one with very strong empirical evidence, before and after the 80s. On the other hand, Lo is totally confused when: (1) He attributes the EMH to Samuelson, who warned against any attempt to establish a link between his theorem ("properly anticipated prices fluctuate randomly") and efficiency[7]. (2) He says that the EMH provides "fundamental insights into the price-discovery process". Andrew Lo is here referring to the models of equilibrium needed for the EMH "joint test". However, these models have *nothing to do* with the EMH – as the Economic Sciences Prize Committee implicitly recognizes it in its report "Understanding Asset Prices".

It is surprising, and disappointing, that the most prestigious dictionary in Economics entertains the confusion initiated by Fama and continued by Shiller and others – even if it is with opposed (ideological) intentions.

[6] http://papers.ssrn.com/sol3/papers.cfm?abstract_id=991509
[7] "One should not read too much into the established theorem. It does not prove that actual competitive markets work well. It does not say that speculation is a good thing or that randomness of price changes would be a good thing. It does not prove that anyone who makes money in speculation is ipso facto deserving of the gain or even that he has accomplished something good for society or for anyone but himself" (Samuelson, 1965, p 48).

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