

Are financial markets efficient ?

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I am Nicolas Bouleau, a mathematician, I directed for 10 years a research center in mathematics in Paris, I was a student of Laurent Schwartz, Gustave Choquet, Paul-André Meyer and Paul Malliavin. My work focuses on the stochastic analysis, Dirichlet forms and Wiener space.

I came to economics thirty years ago, via mathematical finance, arbitrage theory, hedging and pricing of options, etc., I worked and taught economy at different academic levels.

Currently I teach history and philosophy of science at the University Paris-Est.

My purpose here is to explain and discuss the concepts involved in the works of recent Nobel Prizes in economics and especially of Eugene Fama on efficiency and of Robert Shiller on volatility.

My plan will be as follows:

First I will clarify the various meanings of the word information to see what is meant when we say that prices contain or do not contain the whole information.

Then I will show the special epistemic place of economic models expressed in term of prices.

The third part will examine the defects of the governance of production and exchanges imposed by financial markets. I will focus on exhaustible resources and the preservation of the environment.

This criticism asks for alternative solutions, some of which are sketched in the 4th part.

And lastly I will return, in conclusion, on the significance of the recent Nobel Prize in economics and its political issue.

I.

When, for example, John Cochrane writes in 1999 "Market prices already contain most information about fundamental value" information what does it mean ? This concept is not clear. It can be relevant as an argument only if a precise acception is chosen among its various meanings. This is inescapable.

There is the knowledge with all its social and historical depth, and various simplifications or dummies called information, which are methods of quantification or mathematization of the content of meaning. We can distinguish at least six different. It was not until the twentieth century that the attempts to evaluate of the content of meaning have succeeded in render service to the scientific disciplines.

The first idea was to use the accuracy of the representation, we must distinguish

- *The statistical Information* : it is based on the variance, in fact its inverse, and the improvements of this idea. There are several variants: the Fisher information which is a matrix quantity as the variance, the Kullback information which qualifies a distance between two probability distributions, etc. The fact that variances add for the sum of independent random variables gives to this quantity properties of additivity and growth in accordance with what is expected from an "amount of information".

- then comes *the probabilistic information* concerning transmission through a channel of a randomized family of signals. Mainly due to Shannon and Weaver in nineteen forty-eight. If p_i are the probabilities of the disjoint cases, the quantity $S = -\sum p_i \log p_i$ is maximal when all the p_i 's are equal and this expression possesses algebraic properties which allow to interpret it as an information.

- *Information is also present in thermodynamics, linked to the concept of entropy*. By Boltzmann's formula, the entropy is the logarithm of a probability and its opposite has been interpreted as an information by Dennis Gabor, Léon Brillouin and Leo Szilard. This use of the word information in that case was considered as an abuse by Nicholas Georgescu-Roegen in 1971,

though this discussion, in my opinion, had been perfectly clarified by Norbert Wiener in his book *Cybernetics* as early as 1947.

- We should also mention *the algorithmic information* which uses the complexity instead of probabilities to quantify whether a message is banal or original, it is due to Kolmogorov and Chaitin. The idea is roughly to say that the information of a binary sequence (finite sequence of zeros and ones) is the length of the shortest algorithm that generates it. Economists to date, have not used it.

But of which information speaks Friedrich Hayek in his famous article "The use of knowledge in society" of 1945, when he pleads for decentralized decisions that allows liberalism and explains that the price variation provides sufficient information to the entrepreneur to manage its production function? "It is more than a metaphor, he writes, to describe the price system as a kind of machinery for registering change, or a system of telecommunications which enables individual producers to watch merely the movement of a few pointers, as an engineer might watch the hands of a few dials, in order to adjust their activities to changes of which they may never know more than is reflected in the price movement."

Or, when Eugene Fama puts the following definition "A market in which prices always 'fully reflect' available information is called 'efficient' " which information is involved ?

Or, when Jean Tirole in microeconomics speaks of "asymmetry of information". A firm does not let all the data available to another. In particular, it generally knows its production costs and may wish to let them know or not to its competitor, etc., what does not prevent such data of being subject to uncertainties.

This is essentially the idea that the economic agent sees, or does not see, the whole scene. There may be hidden parts as in a theater if one is hampered by the curtain or a column. We should call it *field-of-vision information*. Only a part of the world is seen.

Of course, besides, the vision may be inaccurate, slightly blurred, depending on the quality of eyes and glasses of everyone, and then we arrive at the idea of randomized fields of vision in the language of subjective probability.

We have more information if we see more. There are no problems of interpretation here, in most of economic texts, agents see the same things. This is still true for the probabilistic form simply with a more sophisticated mathematical formalism.

Now, obviously the world, it is also projects, intentions, wills, and the readings that the economic agents may have, cannot be reduced to assign probabilities to a field of possible on which everyone would agree. Conflicts of interpretation, that is to say, the opposition between two or more ways of understanding reality, are a social tearing always present when begin economic crises.

Let us examine how from the ideas of Hayek, in the second half of the 20th century, new arguments supported the story of " prices as informational summary " .

A more mathematical argumentation appears with the Arrow-Debreu statement in 1954 of the general equilibrium : it is discrete in time and deterministic: we have a finite economy with k goods and m consumers (buyers-sellers) having resources which are baskets of goods, and whose wishes are described by regular utility functions.

For each distribution of prices each agent can determine the basket he would like to have.

An equilibrium is said to be achieved if the distribution of prices is such that the desired baskets are compatible with the total quantities of each good.

It is obvious that if prices have this property, every consumer does not have to worry about global problems, nor about what make the others, he has only to buy and to sell to optimize his utility.

This phenomenon is commented in textbooks by saying that the equilibrium price "contains all the information on the economy that people need."

If we keep in mind the mathematical property involved, we see that this is a type of information similar to the information field-of-vision but according to a variant which concerns the number of useful parameters in the problem.

It is a situation of systems control theory. Is it possible to pilot a plane by using only six, nine or twelve parameters on its position, speed, and acceleration? Is it needed to know in addition the weight of the device and the available engine power etc.? We shall call it *the parametric information*.

Two theoretical steps remained for the installation of the financial markets of the Thatcher-Reagan neo-liberal period : to be able of thinking the equilibrium of markets in the presence of randomness and of passing to continuous time. For the randomness, it was done in the 1970s by Radner among others. To preserve the properties of prices as sufficient parameters it is necessary to add a market of contingent claims, from where the justification for setting in market the derivative products.

As for the passage to continuous time, it was made, in my opinion, too goes-quickly, it is the case to say it, by forgetting in particular that the models in discrete time always do possess a trend, at least towards the past, but that it's no more the case in continuous time. The passage to continuous time is a great jump to abstract idealities.

We can summarize Eugene Fama's theses as follows:

- First he assumes the identity of the *parametric information* that we have just spoken about and measurability properties with respect to some sigma-algebras of random processes, properties that for a long time mathematicians were handling with the vocabulary of information.

- And then, he calls it weak, semi-strong, or strong efficiency to suggest that it has something to do with a good management of exchanges and investments.

For any scientific mind, there is undoubtedly in this double assimilation a discomfort, which we are going to clarify at best.

For this we need to deepen the random processes that we are talking about, in order to situate their role in economics.

II.

• Economics uses models like most sciences. They can be intended to predict or more modestly to understand.

For example, in the 1970s the work of Box and Jenkins on time series launched a controversy because purely descriptive models seemed better than explanatory models.

The neoclassical models of supply and demand equilibrium of Walras and Jevons were inspired by the equations of mechanics.

In the 20th century the Arrow-Debreu model of general equilibrium is of explanatory type, if the Pareto equilibrium is not achieved because of social or institutional constraints, it can be improved in a second best Pareto optimal model.

In political economy and environmental economics one distinguishes top-down models which have planning ambitions and bottom-up models which try to synthesize local or participative sights.

For me, here, the most important distinction will be between models whose conclusions are expressed in terms of prices and other models which do not go so far.

In all sciences forecasting presents a risk. Even in astronomy all the scientific community agrees that the Halley's comet will return in 2061 unless an unforeseen phenomenon occurs. But it's different in economics to predict prices of quantities quoted on financial markets (commodities, equities, currencies, bonds, and their contingent futures products) for the reason that if everybody agreed on a certain tendency, the speculation would make that this tendency would not take place.

In other words, the models of evolution of quoted prices cannot aspire to universal objectivity.

We must refine the reflection a little here. Without being objective a published model can bring certain interesting facts and be convincing on certain phenomena if it is well made. Then the agents take account of it partially. We see that the model is *performative*: it modifies its object of study. This concept has been studied by the sociologist Michel Callon.

And there are also models which are not published and which remain only known by certain agents. These models are more or less relevant for the action of these agents according to the data they collect and the processing of these data.

Then, in these conditions, how can be situated a theory as the arbitrage stochastic theory which models the prices of financial markets and which is publicly taught in Massive Open Online Courses of most major universities ?

The arbitrage stochastic theory does not make forecasts. What does it do ? It represents prices of organized markets as paths of random processes, semi-martingales, and succeeds in building convincing reasoning (option pricing, neutral delta hedging, etc.) under certain hypotheses. It is a *language*.

One can say that this theory is to financial markets what the musical theory is to orchestral music. Musical theory describes the major and minor chords, dominant seventh chords, alterations, rhythms, etc., but it does not say what will play the Boston Symphony Orchestra.

Arbitrage stochastic theory is a language developed by a group of economists in the 1970s based on stochastic analysis developed after the Second World War by the Japanese, French and American mathematical schools. I do not expose this theory here, there are very good textbooks to which I refer.

But I want to stress two very important points that have not been sufficiently emphasized so far. The first one concerns the exhaustible resources, the second the notion of sigma-algebra.

- The good models of exhaustible resources quoted on financial markets are positive martingales tending to zero in the long term. Let us explain that in more details. It is a good example of the role of reasoning of stochastic theory.

The concept of martingale was introduced in economics by Samuelson in the 1960s. Already in discrete time, many martingales encountered in economics are positive martingales tending to zero at infinity, this is very common in continuous time. This is related to *the exponential family*.

The heart of the argumentation of the Club of Rome was to consider phenomena with constant relative growth and to show that sooner or later they “go in the wall”. These are quantities whose speed is proportional to the value currently reached with a positive coefficient. This exponential growth cannot last and will necessarily be thwarted by a phenomenon whose role of brake will develop gradually. Hence the “overshoot-collapse” curves.

A fundamental phenomenological point is that this is completely modified in case the quantity presents randomness. If a quantity following an exponential dynamics is submitted to a constant noise with respect to the quantity, two cases can occur. If the noise is low the general look of the path will be what we wait: it is going to follow the exponential curve with fluctuations upward and downward that are increasing. But if the noise exceeds a certain threshold (very often reached on financial markets especially when the growth is weak) the behavior of the paths will be completely different from what we wait intuitively: they will all eventually, after oscillations, tend to zero.

The random agitation not only erases the tendencies but also is able of pulling down an increasing exponential towards zero. For example if you place your money in a fund which brings back 4.5 % and if you reinvest your dividends there permanently, you realize an exponential growth. If, besides, there is uncertainty that comes to add some volatility and if this volatility exceeds 30 %, the oscillations are such that in the long run you certainly become ruined.

Another example, if you put your money at 10% and every year you play half your fortune at heads or tails, the cumulative effect of the gain and this hazard leads you irrevocably to ruin. We

thus see that this strength towards zero is capable of pulling down the underlying deterministic exponential.

A generic example of such a positive martingale tending to zero is the Brownian exponential.

The most significant point of this phenomenology, is that if there is noise, and if it reaches a value which is commonly achieved by volatility on raw materials, it is impossible on the sight of the path to measure what it would have been without the noise. In other words, exponential dynamics is not seen on what is objectively observable. Thus, an observation such as the figure, does not make it possible to detect a possible subjacent exponential dynamics.

If we randomize the reflections of Harold Hotelling (1931) we are led to consider that good models for the prices of exhaustible resources are positive martingales tending to zero. It highlights the paradox of the peak oil: everybody thinks that the prices are going to rise, but that is not seen on the spot because the instantaneous price already takes in account all what is expected. The rarity and the uncertainty on stocks and on exploration will increase the agitation until the time it prevents the liquidity of the market and then the use will turn away from this resource. We arrive to *the punk hairstyle curve*.

- The second point on which I want to insist is the notion of sigma-algebra used in arbitrage stochastic theory and in the idea of weak or strong efficiency of Fama.

The concept of sigma-algebra is dizzyingly abstract.

The most common sigma-algebra is the Borel sigma-algebra on the line generated by the open intervals. Starting from the open intervals it contains also

- the countable intersections of open intervals
- the countable unions of sets of the preceding class
- the countable intersections of sets of the preceding class
- etc.

and, once this procedure of alternatively unions and intersections is done infinitely many times, the obtained sets are not yet the whole Borel sigma-algebra. *We must perform this procedure a number of time equal to the first uncountable ordinal to get the whole sigma-algebra !*

Let us add that the mathematicians do not really know the magnitude of this ordinal which depends on the – undecidable – continuous hypothesis.

We see that the notion of filtration (that is to say a growing family of sigma-algebras) is of an abstraction such that it is out of the question to approach it empirically.

Do not forget that the arbitrage stochastic theory is a language and that it makes no prediction.

How this filtration-information reflects the economic reality ? We do not know. Statistics and econometrics do not provide sigma-algebras. How does it change when we learn that the Fed modified its policy rate or that China has purchased lands in Africa ? If I am an insider, how "my" sigma-algebra does reflect what I know ?

The language of stochastic processes is an abstract light whose only interest is to develop a certain logic. The reality provides a path, half a path actually (multidimensional if we consider several assets). From this path to pull a sigma-algebra is a mathematical nonsense. For this, we must first invent infinitely many marginal distributions of order n. Where is this process? It does not exist. It is an instrument of logical reasoning.

III.

I now come to the practical aspect of efficiency : Does the financial markets govern well production and exchange of goods and services ?

- Prices yielded by financial markets stirs enormously

Walras had in mind that price fluctuations around the equilibrium were low. He did not speak of the same markets. He aimed at markets where the purchaser buys for his personal use.

- here the evolution of the Dow Jones index
- the evolution of metals. Let us emphasize that on all these graphs the Y-axis starts at zero.
- derivative products are also enormously agitated
- about crude oil price and peak oil : do not forget that the costs of exploration and exploitation are themselves prices dependent on the vagaries of energy. We see on the chart that forward prices indicate nothing clear in the medium term, sometimes they raise sometimes they come down.

- This agitation erases any tendency, for the only continuous curve with no tangent is the instantaneous zigzag. It appears also no trend in the medium or long term. The yield curve itself is greatly stirred.

Let us clarify a point on this matter. Some economists (Grossman and Stiglitz 1990) argued that if the trends are not visible to everyone, they are for some because speculation is expensive (it takes time therefore wages) it would not take place if it were not paid.

This observation is correct but somewhat scholastic. The reality is that there are specialized teams that operate continuously and from all continents to detect any possible arbitrage, the lower viscosity on all organized markets, with considerable mathematical and computational means. Under these conditions, for everyone, for the manufacturer who wants to plan its supply, there is no discernible trend.

- The cause of this enormous agitation is the speculation. So far speculation was mostly criticized in the moral standpoint and from a political angle

- moral reasons are the most ancient:

- It may be recalled the golden calf episode of the Bible, also authors like Péguy, Nell-Breuning etc.

- From an ethical point of view, it was often considered problematic that the one who knows certain things – who has a better field of vision — can take advantage of it without having contributed by his work. The boundaries of the insider trading are not clear. And what about the profits made by sales-purchases on illiquid markets as there are so many on derivative products, where selling pushes prices down allowing a profit by buying anew ?

- The political criticism derived from this question of *work* through unemployment.

In his famous advocacy of Chapter XII of *the General Theory* where he stigmatizes speculators — focused on immediate profit and psychological game — as opposed to "entrepreneurs" who think long-term projects, Keynes uses actually both moral and political bases to conclude the excessive economic role of the purse which is the cause of crises by mimetic behavior.

- I criticize here the speculation for a third reason: the erasing of the parameters

Not only there is no more trend, but the parameters that enter into the constitution of prices, have disappeared. Households and all economic agents only see the prices and the prices do not reveal anything about the famous changes that Hayek placed at the heart of managerial intelligence.

- The quite smooth curves of the Meadows report, nobody sees them, they are unseen on the prices. One has really the feeling by looking at the prices of raw materials and stocks that the economy is in the whole always in the same situation. As agents' behaviors are conditioned by the economic landscape much more than by moral or environmental considerations, the business as usual continues unabated.

- Today all the prices are influenced by financial markets. The small farmer of the South sells to a wholesaler who imposes him prices deducted from the world prices which are the ones of cargo freighters :

- consequences on agriculture : the shearing of the prices prevents the choice of species and equipment on medium term (fruit trees, cattle, engines) and contributes to the impoverishment of the small farming community which flows into suburbs of large cities.

- But the problem is more general and goes to the heart of any environmental policy where cost-benefit analysis would be applied.

Suppose we have succeeded, by dint of political struggles to agree a price for common goods and non-market services, in order to stop their degradation and try their repair when possible.

Take for instance a specific area of marshland in destructive competition with a deposit of fossil fuel, the two rarities do not evolve in the same fashion.

There are sharp, random fluctuations in the course of the fossil fuels (due to anticipatory speculation) and progressive adjustments in the calculations of "ecosystemic services" made by expert committees, since they are not tradable goods. With a high probability, the deposit will one day or another be listed higher than the clever estimates calculated for the swamp.

By internalizing externalities, in the presence of financial markets, it is the possibility of speculating that is protected, not the environment.

This does not mean that a high valuation of the commons is not a good initial policy in the present ratio of forces and legal systems. But it can be a good solution only temporarily. In the long term it will be necessary that the economic logic lose ground.

- The cause of this fog is speculation. But the approach of economists (Arrow, Debreu, Radner, Hurwicz, etc., etc.) must also be questioned. To replace trends by derivative products, it does not work. One cannot direct his business by paying only insurances.

They did a purely internalist work. They did not ask how to organize exchanges on a planet that receives a finite energy flow.

Not at all, they thought about how to preserve a mathematical property of deterministic markets in discrete time with a finite number of goods when moving to continuous time with uncertainty.

IV.

Since capitalism does not really care about environment, we must address the most urgent : that is to change the control variables of the economic engine.

- To quieten down markets, in the sense of running them in a frame regulated by control authorities, I do not believe very much in this solution for this afternoon. The actors on markets are partisans of the greatest freedom and control raises a question of power and of its legitimacy. Many actors think that the best way of fighting against corruption, clientelism, is to organize free and very liquid markets. For these actors the market is a moral safeguard and since the traffics damage the economy they think that it is necessary to preserve financial markets. Let us remember the words of Margaret Thatcher September twentieth, 1988: "And that means action to *free* markets, action to *widen* choice, action to *reduce* government intervention. Our aim should *not* be more and more detailed regulation from the center : it should be to deregulate and to remove the constraints on trade."

- This is why the tax on financial transactions encounters difficulties.

I see two pillars that can be immediately implemented on which can be based a new economic logic:

- constructing indicators, without prices, in quantity, mass, volume, surface, temperature, level of remaining resources, recycling rate, level of pollution, state of nature, level of social protection and on the trend consequences of business as usual. A lot of work has already begun in this direction by many organizations or international associations to try syntheses (ecological footprint, human development index, genuine progress indicator, index of sustainable economic welfare, etc.). It must be borne in mind however that as soon as these indicators are close to what interests the economic life, the definition of aggregates and of public interest is not so simple as when it is done by the market and this needs to reactivate the role of democracy and of the state to build a legitimate collective power (rather than the heads of States behave as commercial travelers, they would much better have to work on the commons). This is a formidable opportunity to give a real role to citizens.

The role of the public authorities had been recognized as essential by Robert Solow in 1974 for managing the exhaustible resources : "The market for exhaustible resources, he writes, might be one of the places in the economy where some sort of organized indicative planning could play a constructive role. This is not an endorsement of centralized decision-making, which is likely to have imperfections and externalities of its own. Indeed it might be enough to have the government

engaged in a continuous program of information-gathering and dissemination covering trends in technology, reserves and demand. [...] In the case of exhaustible resources, it could have the additional purpose of generating a set of consistent expectations about the distant future."

- The second pillar is the social bind of transactions: rebuild creditor-borrower relationship, especially for states, but also for businesses and households. I cannot develop this point here, let's just say that, with the securitization, receivables work with truncated parametric information. The only parameter that is taken in account is the default risk represented by a rate, it is not enough to manage projects. We must convince savers not to let the markets take care of their savings, they have a role to play in the future of their region and the world, through contracts with specially selected actors in order that the economic activity take care of the context.

We're talking here of changes made necessary by the finiteness of the planet and the solar flux. This goes beyond the problem of financial markets and concerns liberal economy itself. We notice more and more that it focuses on what people want in the short term for themselves and their families, these desires being formulated in a world *ne varietur* : what is well for oneself *incrementally*, could one say. The sociologists Ulrich Beck and Antony Giddens within their investigation on the modernism they call "reflexive" underline this point. It may well be, that people make certain choices that are relevant to them if the world is what it is, but the result of all these choices go in a general direction that nobody desired.

This is typically the case in case of energy, but the phenomenon can also involve perinatal techniques, moral choices etc.. in other words, the dissolution of ethical and environmental challenges in the economy, obliges a "crab walk" of society, it cannot do otherwise than comply with the result of the sum of individual desires which are based in the people's minds only if the society *does not follow all these claims*.

V.

Let us return to this Nobel Prize, what should we think of it ? Let us make the synthesis of our survey.

Alfred Nobel had not envisaged a prize in economy. That a lobby of economists and bankers managed to convince the Foundation Nobel, the royal Academy of sciences and the Swedish government in 1969 to found this missing prize and finance it by the Bank of Sweden is an exemplary blow of communication, worthy of the practical exercises of best MBA. But the recent choice of the award-winnings 2013 goes much further : academic prestige comes to the rescue of finance by transforming two untruths into article of faith: the efficiency of the markets and the foreseeability of the trends.

Today the common sense of ordinary people is right in wishing finance be the good handmaid of the economy. It is the center of the question. Let us forget the speculation and let us replace in the vision which had the economists when the stock exchange had only a secondary role, we see that there are two basic ideas which are really at the heart of the economy and which determine the conduct of the affairs still today.

The first was luminously expressed by Friedrich Hayek, we mentioned it : to lead a company is to take account of the changes. The consideration of the trends of the prices makes it possible to the entrepreneur to modify the quantities and the nature of the raw materials used in its manufacturing.

The second idea is that the price of the depletable resources is going to grow with their rarity realizing a virtuous feedback and inciting companies to turn away from energy-consuming techniques or from rare minerals.

But these two beliefs of the liberal economic doctrine are completely flouted by the finance today.

The markets of currencies, actions, raw materials, control the world activities. And their agitation is such that it completely deletes the signal-price of the products useful to the entrepreneur of Hayek. The entrepreneur sees nothing, neither in the short run nor in the medium term, he is forced to take insurances by buying OTC derivatives. That will protect him but will not indicate the

direction of the changes to make. You cannot drive a boat with only insurance against the waves, you need a force and a rudder.

And what about exhaustible resources ? The truth is that the virtuous feedback does not work on speculative markets.

The course of exhaustible resources — that are well represented by positive martingales tending to zero in the long term — are so agitated that their future values, seen from today, cannot be included in any angle that could be used to frame rates for investments.

Thus one sees that finance does not answer legitimate waitings, the useful information does not pass more. All is scrambled.

Eugene Fama's thesis that the economic efficiency of financial markets can be seen in terms of stochastic processes and sigma-algebras is an abusive extension of properties of some finite models. The fact is that, *financial markets are bad economic instruments precisely because they resemble the stochastic processes considered by Fama.*

The other two winners Robert J. Shiller and Lars P. Hansen, worked one on the volatility, the other in econometrics, they are there to support these theoretical considerations by more practical studies. In the press release, the Royal Swedish Academy of Sciences states that "it is quite possible to foresee the broad course of the prices over longer periods, such as the next three to five years" and attributed this allegation to Shiller in the 1980s. It should be recognized that it is truly a feat to succeed in making an Academy of Sciences tell such ineptitudes. For this remark obviously applies only to courses whose volatility is very low, those where there is virtually no uncertainty and no conflict of interpretation. This is never the case for resources in both exploration and exploitation. In fact we do not know how the uncertainty translates into agitation, Shiller begins his four hundred fifty pages book *Market Volatility* in 1989 with the phrase "The origin of price movements are poorly known on all speculative markets." The public announcement of this foreseeability is a pure and simple imposture. The story of the recent crises shows it obviously sufficiently.

The image of finance had to be restored. The exemplary behavior of his followers could obviously not be used. Scandals, corruption, lies, are too many. A clever idea was to present finance as a leading activity based on prestigious mathematics.

Then, it is taken advantage of an aura, as the esoteric physics of the boson of Higgs, which the journalists cannot unravel. The jury and academics simply do not see how the mathematics behind the work of Fama is completely disconnected from any measurable reality, they agreed to pretend to see the clothes of the emperor!

They could have given the Nobel Prize in Economic Sciences to Herman Daly, to Lester Brown, or still better to Dennis Meadows as the Peace Prize was awarded to the IPCC, it would have been braver and more useful.

Thank you