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Financial Markets, Efficiency, and Credit Intermediation

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Abstract

Research and teaching in financial economics very often assumes that the efficient market hypothesis is verified. Nonetheless, financial markets are still very far from reaching substantial levels of efficiency. Moreover, different perspective of market efficiency can be subsumed. In this paper, we provide a clearcut taxonomy of the different nuances of financial markets efficiency, useful for economic research and teaching. We also argue that scholars should necessarily disclose in advance the perspective of market efficiency assumed for the research analysis or teaching purposes and discuss the limitations in the inference that can derive.

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1. Introduction

The concept of efficiency permeates all, or almost all, of the literature on financial matters. References to the efficiency, or inefficiency, of the markets are widespread, sometimes they are, more or less consciously, concealed or taken for granted, as if to bring back to a single interpretation a concept that in reality presents different interpretative perspective.[2] This often leads to theoretically unsound inferences from the results, misunderstandings in the readers, confusion in terms, and, from a teaching perspective, unclearness and ineffective classes.

The main goal of these notes is to disentangle misperception and provide a clearcut taxonomy of the different nuances of financial markets efficiency, useful for economic research and teaching. In doing that, we believe in contributing both to the literature on market efficiency and setting the pave for more meaningful and theoretically sound scientific work in the field of finance.

The concept of efficiency adopted in these pages is the classic one that, starting from Pareto, has developed in the works of Keynes, Arrow and Debreu, Modigliani, Fama, Jensen, Tobin to reach the current contributions of Shiller and Stiglitz. This is a traditional perspective that disregards the numerous, and often misleading, variations on the theme that have followed one another over time:

the efficiency of financial markets expresses the ability of the markets themselves to perform their functions appropriately.

The rest of the paper is organized as follows. The next section offers the theoretical foundations of financial markets functions. Section 3 develops the concept of market efficiency. Section 4 explores the allocative efficiency. Section 5 describes the technical-operative efficiency. Section 6 deals with the description of the informative efficiency. Section 7 analyses the concept of evaluation efficiency. Section 8 discusses the implications of the insurance efficiency. The last section concludes.

2. The Functions of Financial Markets

Since the efficiency of financial markets expresses the ability of the markets themselves to perform their functions appropriately, preparatory to the development of a theory of market efficiency is the precise identification of the functions that financial markets perform.

There is no universal agreement in doctrine on the concrete functions performed by financial markets. Alongside almost unanimous consensus on some of them, there are differences of opinion on others.

[2] "regrettably, 'efficiency' is one of the most overused and abused words in financial economics. Assertions are often made that markets are efficient or – more commonly – inefficient, little or no attention being given to the term's inherent ambiguities." (Bailey, 2005).

In these pages, we will recognize the functions that are indisputably attributable to the financial markets. This will represent the starting point for the analysis of the different profiles to which the broader concept of financial market efficiency can be traced back.

- Allocative function. Relates to the ability of financial markets of transferring, directly or indirectly (i.e. through intermediaries), financial resources from surplus entities to entities with the need to cover their cash needs.
- Technical-operational function. An adequate system of rules, procedures, and controls, as well as an appropriate organization of the market, allow participants to conclude the various financial transactions more easily, with lower counterparty research and transaction costs and with lower counterparty and settlement risks.
- Information function. The market allows participants to have information on prices and other conditions under which they can exchange money, instruments, and financial products.
- Evaluative function. The price at which a financial exchange is concluded represents the most appropriate evaluation that the market can assign to a specific financial asset at that moment. The evaluation function of the markets can be traced back to the signalling content of the price.
- Insurance or completeness function. It relates to the ability of financial markets to allow each agent to trade risk. The ability to diversify and the ability to trade financial contracts for any future event and maturity are the main features that allow markets to perform this function.

It is not excluded that financial markets may also play other, equally important functions. Nonetheless, it is believed that those listed above qualify, if carried out jointly, a financial market.

The contribution of financial markets to the development of the economic system depends on their ability to perform their functions adequately and stably, i.e. their efficiency and stability.[3]

3. Functions and Efficiency of Financial Markets

As said, an efficient market is one that is able to perform its economic functions adequately. Since there are multiple functions performed by financial markets, their efficiency can be observed, and measured, from several angles, each of which focuses on the ability to perform a specific function.

[3] In this work, the aspect of the stability of financial markets will be dealt with marginally, only. For those wishing to learn more about the subject, please refer to the copious literature on the subject, including Ramlall (2018), Kregel (2020) and Mishkin and Eakins (2023).

It will therefore be reasonable to speak of:

- Allocative efficiency. The concept of allocative efficiency can be conceived according to two different perspectives. The first concerns the market's ability to allocate resources in such a way that there is no other allocative solution that increases the satisfaction of some without decreasing that of the other participants (this is the classic concept of Pareto efficiency). The second examines the market's ability to allocate resources in such a way as to maximize the well-being of the entire community. We will examine both concepts and analyse some of their implications for the functioning of financial markets.
- Technical-operational efficiency. It concerns the ability of the market to provide its services immediately and at minimum costs.
- Information efficiency. It pertains to the ability of the prices that are formed on the market to correctly and perfectly reflect all the information that may influence their determination.
- Evaluation efficiency. It relates to the circumstance that the correct value of a financial instrument or transaction is reflected in its price.
- Efficiency of insurance (or completeness). It concerns the market's ability to guarantee, to all agents, contracts relating to any possible future expiry, situation, or eventuality.

The concept of efficiency (and the derived ones, relating to the five single profiles above traced) lends itself to both qualitative and quantitative interpretations that often overlap and can be a source of confusion. The qualitative aspect relates to the generic ability or inability of the market to carry out its functions appropriately. Measuring the degree of efficiency of the market (quantitative perspective) responds to the need to understand and compare its operating capabilities in time and space.

Finally, it is also important to underline that the concept of market efficiency should not be confused with the connected but different concept of the “perfect market”. A perfect financial market is a market in which the actions of individual operators do not affect the price, arbitrage between markets or between financial instruments is not possible, everyone has unrestricted access to the capital market, each agent knows the price at which goods are traded, it is possible to lend and borrow money at the risk-free rate and there are no "friction" factors such as transaction, operating or currency restrictions, costs of failure, etc. (Stigler, 1967).

In the rest of the paper, I'll speculate on the five perspectives of market efficiency, disentangling possible misunderstandings, overlapping, and disguising views.

4. Allocative Efficiency

A financial market is called Pareto-efficient if there is no other feasible allocative combination through which it is possible to increase the expected utility of some of the participants without decreasing that of the others.

Alternatively, the concept of allocative efficiency can be expressed in terms of maximizing the utility of a subject given the level of utility achieved by the other market agents and given the feasibility constraints imposed by the available resources.

The concept of Paretian efficiency was developed concerning the entire economic system. In these pages, it will be understood with specific reference to the financial market. Given the links between the markets of goods and the financial markets, it is, however, to be considered impossible that a Pareto optimal allocation can be achieved in the financial market without the simultaneous achievement of identical conditions in the rest of the economic system.

An allocation to be efficient must necessarily be feasible, i.e. concretely achievable given the budgetary constraints of each market agent. The possibility of freely and voluntarily making exchanges is the key mechanism underlying the achievement of a Pareto optimal condition. If everyone can freely and voluntarily trade and adopt rational behaviours, they will negotiate until they have been able to maximize their utility.

Accepting some simplifications, including being in perfectly competitive markets, limiting the number of exchangers[4] and goods to 2[5], a graphical representation of the concept of allocative efficiency can be provided using the Edgeworth's box (Figure 1).

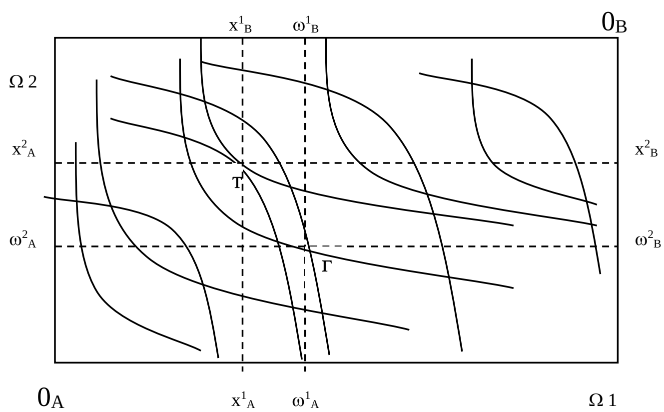

Figure 1: Allocative efficiency, Edgeworth's box

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[4] It is also assumed that each subject is perfectly describable through his preferences and the initial distribution of goods and that (s)he implements a rational and competitive behaviour (which implies, among other things, that he will consider the market price as an exogenous variable).

[5] The analysis can, however, be generalized to economies with more than two individuals and more than two goods. The generic hypotheses formulated do not exclude that one of the two goods could be money.

Let ω^{1A} be the initial endowment of subject A of good 1 and ω^{2A} his endowment of good 2. ω^{1B} and ω^{2B} indicate the initial endowment of the two assets of the second individual. Let Γ be the initial combination of assets 1 and 2 held by the two individuals (initial endowment). On the Cartesian axes, only the total quantity of each good ($\Omega_1=\omega^1{}_A+\omega^1{}_B$ e $\Omega_2=\omega^2{}_A+\omega^2{}_B$) available in the economic system is represented, so that each point of the graph can represent a concretely feasible allocation. If we consider the respective indifference curves, the area between the two indifference curves passing through the initial endowment contains a whole series of combinations of goods 1 and 2 that would improve - or at most would not worsen for one of the two if we consider the boundary points - the satisfaction of both individuals (all these combinations are in fact on preferable indifference curves - or at most on the same indifference curve as the initial endowment). If the market is competitive and both implement rational behaviours, the two subjects will have the convenience of exchanging part of their initial endowment of one good to have a greater endowment than the other and thus increase their satisfaction. All possible combinations of the area between the indifference curves passing through the initial endowment are better allocative solutions (or at most indifferent to one of the two). There is, however, at least one allocation such that it is not possible to make further exchanges that are convenient for both (or at most convenient for one and indifferent for the other). If the assumptions made above are valid, this allocation will be the one ultimately achieved by the two subjects through the exchange. This allocation is Pareto-efficient: there is no other allocation that can improve the satisfaction of at least one of the two individuals without sacrificing the other. In the hypothesis of the graph, the Pareto-efficient allocation is achieved through this exchange: A gives up to B ω^{1A} - x^{1A} of the first good in exchange for $\omega^2{}_B$ - $x^2{}_B$ of the second.

The allocative efficiency condition does not take into account how utility is distributed among agents. Allocative efficiency must not, therefore, be understood in an absolute sense as maximizing the overall utility of the economy but as maximizing the utility of the individual without making sacrifices to others with respect to the previous situation.

Time is a dominant variable of allocative efficiency. Indeed, it is reasonable to assume that the available resources and the utility that can be obtained from the different allocations change over time). The Pareto optimum, therefore, must be interpreted in a dynamic and not static sense.

The set of efficient allocations constitutes the so-called contract curve (or Pareto set). Graphically, using the Edgeworth box, it can be represented as a curve that joins all the points of tangency of the indifference curves of the two individuals (see Figure 2).

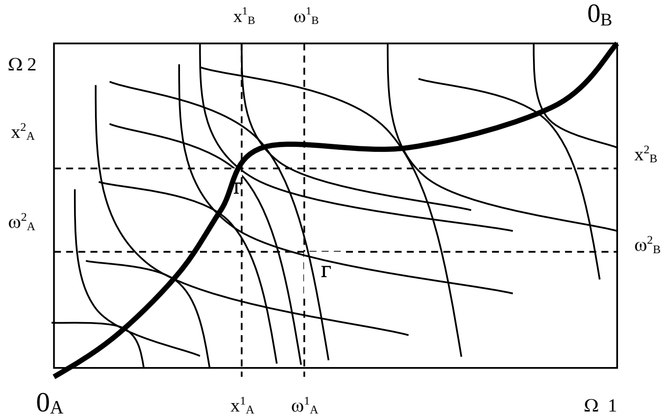

Figure 2: Allocative efficiency, the contract curve

Contract curve is quite intuitive. It represents the equilibrium solutions that could be had after the exchanges: if there's a different allocation, it would always be possible to enter into further contracts to improve the position of at least one of the two agents without sacrificing the other (Salvatore, 1997).

However, the allocative efficiency must not be considered in a static sense. Its dynamic qualities have to be taken into account. In this regard, at least three types of considerations must be made.

First, from the first graph we have argued that given the indifference curves of individuals A and B and given the initial endowment W, A, and B would both have the convenience at exchanging part of their endowment to reach positions of greater satisfaction. If the assumptions of market functioning are valid, the exchanges would end once a point of allocative efficiency had been reached. From the second graph, however, it is clear that several equilibrium allocations are possible. A Pareto subset is defined as the set of efficient Pareto allocations that can be achieved given an initial endowment. Graphically, it is given by the part of the contract curve that falls within the area between the indifference curves passing through the initial endowment. Each of these allocations is equilibrium and is Pareto-efficient. Each of the exchangers will try to conclude the negotiation most favourably; that is, by moving, along the Pareto subset, on the highest indifference curve. One of the fundamental axioms of consumption theory is that if each individual chooses the best basket of goods among those he can buy, the ratio of prices must be equal to the rate of substitution between the goods themselves. In a perfectly competitive market, individuals are faced with the same prices: the marginal rate of substitution is, therefore, identical for everyone. The equilibrium in a market of perfect competition cannot, therefore, but be reached at the point of tangency between the budget line (if p_α and p_β indicate the respective prices of goods then the budget line will have a slope $-p_\alpha/p_\beta$) and the indifference curves of the two individuals (the equilibrium is in this case defined as competitive or Walrasian[6]), see Figure 3. Otherwise, individuals would conveniently conclude further exchanges or, if the net demands of the exchangers were in disequilibrium, the price would vary and consequently the substitution ratio between goods.

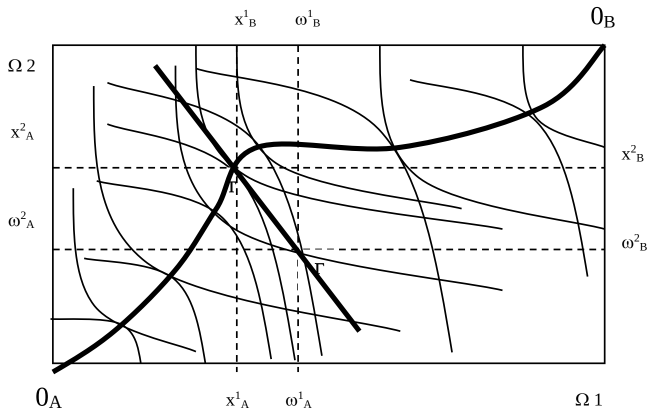

Figure 3: Allocative efficiency, Walrasian equilibrium

In conditions of markets that are not perfectly competitive or in the hypothesis of non-rational behavior of some operators, Walrasian equilibrium allocations will not necessarily be reached, although these allocations can be qualified as Pareto-efficient. The Walrasian equilibrium must, therefore, be understood as a special case of Pareto-efficient allocation. Leaving aside non-rational behaviour, bargaining power is certainly the main factor that determines, in conditions of imperfect market competitiveness, equilibrium. The greater the bargaining power, the greater the benefits that will be obtained from the exchange at the expense of the other subject[7]. Furthermore, in the event of market imperfections, efficient equilibria in the Pareto sense will not necessarily be achieved.

The second and third considerations are more dependent on the time variable. Over time, the preferences of the subjects may change. As a result, the indifference curves are modified, and the contract curve is modified. What might be an efficient allocation today may not be efficient tomorrow. The ability to trade at later times allows agents to reach new equilibrium positions at new levels of preference. Graphically, the equilibrium point reached at the end of the exchanges (T) can be understood as the initial endowment of the subsequent period.

Finally, it should be noted that the quantity of goods available on the market may vary over time. In this case, more or less allocative solutions would be possible

[6] In honor of Léon. Walras (1874) first theorized this model of general equilibrium. For a detailed analysis, see also Maskin and Roberts (1980).

[7] In practice, the individual with the greatest bargaining strength will be able to conclude exchanges that allow her to position within the Pareto subset at a point that is better for her than that of Walrasian equilibrium.

(depending on whether the quantity of goods available on the market decreases or increases). At the same time, the initial endowment of at least one of the individuals would also be varied. The consequences is clear: new exchanges may be necessary to achieve new solutions of Pareto efficiency and competitive equilibrium (Hildenbrand and Kirman,1988).

4.1 Socially efficient allocation

The achievement of efficient market operating conditions in the Pareto sense is certainly a desirable goal. However, a Pareto equilibrium says nothing about how utility is distributed among different agents. Pareto equilibrium conditions can be reached both in perfectly competitive markets, and in markets with a discriminating monopolist, and if there is a single agent that owns everything. In practice, the criterion of allocative efficiency in the Pareto sense does not observe how well-being is distributed among the subjects operating in the economic system.

Another view of the concept of allocative efficiency of markets can, therefore, reasonably be the one that takes into account the well-being of the community and considers an efficient market as one in which the distribution of resources reaches conditions of equilibrium in which the overall utility of society is maximized.

Consider a community composed of *n* individuals and a market in which there are *k* goods[8]. $X^1, X^2, \ldots, X^k$, are the total quantities of the different assets allocated, and $x_i = x_{i1}, x_{i2}, \ldots, x_{ik}$, the quantities of each asset held by subject *i* and $u_i(x_i)$ the relative utility function. Socially efficient allocation maximizes the well-being of the community, namely:

$$\max W\,(u_1(x_1), u_2(x_2) \ldots a(x_n))$$
$$\text{such that } \sum_{i=1}^{n} x_{i1} = X^1,\ \sum_{i=1}^{n} x_{i2} = X^2, \ldots, \sum_{i=1}^{n} x_{ik} = X^k, \qquad (1)$$

i.e. such that allocations are feasible, and where $W\,(u_1(x_1), u_2(x_2) \ldots un(x_n))$ is a function that expresses social welfare.

This allocation, by the way, can only be Pareto-efficient. Socially efficient allocation, such as Walrasian, is, therefore, a special case of Pareto efficiency. We will make a few other considerations on this point later.

Arrow (1951) impossibility theorem shows that a social welfare function cannot perfectly reflect the preferences of all individuals in society. To construct a meaningful function of social welfare, it is necessary to renounce at least at one of the properties that the function itself should possess to be considered perfectly

[8] Generic reference is being made to undifferentiated goods. The microeconomic analysis carried out in this paragraph can, however, be referred to the financial markets by qualifying generic goods as a set of financial assets.

expressive of the preferences of all individuals in society. Therefore, if it were possible to build a social welfare function, even if significant from a microeconomic point of view, it would not be able to perfectly aggregate individual decisions and derive the preferences of the community in a univocal way.

It can be demonstrated (see among others, Negishi, 1970) that in conditions of perfect competition and the absence of externalities of consumption, the equilibrium achieved by the market is an equilibrium of maximum social well-being. However, another question remains open: is the equilibrium allocation thus obtained (efficient in both the Pareto and social senses) a socially equitable allocation?

We define a fair allocation as no individual prefers the basket of other people's assets to his own. A fair allocation, however, is not necessarily Pareto efficient. Let's assume that we divide the set of goods available to the economy into equal parts among all the individuals in society. Each individual will have the same basket: no one, therefore, will be in a position to be able to prefer the basket of others to his own. However, this allocation may not be optimal since there may be some allocation that could increase the satisfaction of at least one of the individuals without compromising that of the others (a simple exchange would be enough to achieve this condition of greater social well-being).

A socially fair and at the same time efficient Pareto allocation is defined as “just”. This would be an important social result achieved by the economic system. However, it can only be achieved starting from initial equal distributions (ω^{1A}, ω^{2A}, ... , $\omega^{nA} = \omega^{1B}$, ω^{2B}, ... , $\omega^{nB} = ... = \omega^{1K}$, ω^{2K}, ... , ω^{nK}) and in the presence of perfectly competitive markets without consumption externalities. The exchange process leads in these hypotheses to efficient Pareto equilibrium, Walrasian equilibrium, and maximization of social well-being.

The right allocations could therefore give a glimpse of a further interpretative angle of the concept of allocative efficiency: markets capable of allocating resources in a socially just way. An essential prerequisite, however, is the initial equitable distribution of the endowments.

A financial market could only be fair in an allocative sense if the initial endowments are equal [9]. The evident utopia of this condition leads us to conclude any considerations here.

5. Technical-Operational Efficiency

A market capable of carrying out its functions of exchange and transfer of funds, to all agents, in an immediate time and at minimum costs is efficient in an operational sense. An operationally efficient market may also be known as an "internally efficient market."

The concept of operational efficiency therefore pertains to the technical, organizational, and industrial aspects of financial markets. A market is reported to

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[9] In addition, of course, to having a perfectly competitive market and absence of consumption externalities.

be operationally efficient when conditions exist allowing participants to execute transactions and receive services at a price that equates fairly to the actual costs required to provide them.

Operationally efficient markets are typically a byproduct of competition. A high level of competition between financial instruments, intermediaries, and markets is essential for an operationally efficient market.

Technological and regulatory advances appear to be equally important; the former to improve the time and costs of execution of financial transactions, the latter to ensure certainty at the conclusion of trades and eliminate (or reduce as much as possible) the risks associated with the settlement of the same[10].

Operationally efficient markets can help to improve the overall efficiency of investment portfolios. Greater operational efficiency in the investment markets means that capital can be allocated without excessive frictional costs that reduce the risk/reward profile of an investment portfolio.

The focus on technical-operational efficiency shifts attention to the operational aspects of financial markets, such as the underlying infrastructure, trading mechanisms, liquidity, transaction costs, and the overall speed and reliability of market functions.

Technical-operational efficiency encompasses various aspects of market infrastructure, including: a) Market infrastructure: the systems, technologies, and institutions that facilitate trading and settlement; b) Liquidity: the ease with which assets can be bought or sold without significantly affecting their price; c) Transaction costs: the costs incurred during trading, including commissions, bid-ask spreads, and slippage; d) Speed and reliability: the quickness and dependability of executing transactions and processing orders.

The technical-operational efficiency of financial markets has significant implications for all market participants. Institutional investors benefit from highly efficient markets as they can execute large trades at minimal cost and with reduced risk. Retail investors, who may lack the resources to engage in sophisticated trading strategies, also benefit from improved operational efficiency. Reduced transaction costs, lower fees, and faster execution allow individual investors to participate more actively in the market. Market makers, who provide liquidity by offering buy and sell quotes for various assets, rely on market efficiency to mitigate the risk associated with holding large inventories. Regulators play a key role in maintaining market efficiency by ensuring that trading rules are enforced and that systemic risks are mitigated. In their perspective, efficient markets reduce the potential for market manipulation, insider trading, and other forms of market abuse.

[10] The regulation of financial systems itself can be a vehicle for operational inefficiencies.

6. Information Efficiency

A financial market is efficient in an informational sense if the prices of the traded instruments correctly and perfectly reflect all and only all, the information available and influence their determination (Fama, 1970; Fama, 1976; Ball, 1989).

The concept of information efficiency can, borrowing Jensen (1978) insights, alternatively be expressed in terms of profits that can be obtained by exploiting information. In this sense, a market is efficient if it is impossible (except by pure chance) to obtain extra profits (i.e. profits higher than those consistent with the degree of risk of the financial asset) using a given set of information.

The information efficiency assumption assumes that markets are efficient in a technical-operational sense. In fact, the impossibility of achieving extra profits using a given set of information can be the consequence not of the information efficiency of the market but of high transaction costs, long trade execution times, barriers imposed by financial authorities, etc. (Grossman and Stiglitz, 1980; Fama, 1991).

In an informationally efficient market, prices follow a random path: the correlation of future prices with past prices is practically zero and cannot, therefore, be exploited to obtain profits (Melkiel, 1973; Cragg and Melkiel, 1982)[11], price changes reflect correctly and promptly only new information; the prices that are formed are always equilibrium prices.

Wanting to give a mathematical connotation, the concept of information efficiency it can be represented as equality between the expected price conditioned by a given set of information and the current price multiplied by the expected return conditioned by the same set of information:

$$E_t(p_{j,\,t+1}|\Phi_t)= [1+ E(r_{j,t+1}|\Phi_t)]\ p_{j,\,t} \qquad (2)$$

Where the operator E indicates the expected value, $\Phi\tau$ is the set of information influencing the price at time t, p, and r are respectively prices and yields, and j indicates a generic financial instrument.

If the relationship is verified, today's price correctly incorporates all the available information, and the market can be considered efficient in an informative sense. The assumption of information efficiency of the markets does not exclude the possibility of forecasting errors. Instead, it assumes that $\varepsilon\varphi,_{t+1}$ and $\eta\varphi,_{t+1}$ (i.e. excess returns) are not correlated with the set of available information.

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[11] The term random walk, as understood in the theory of corporate finance, does not coincide perfectly with the analogous statistical meaning, where a series that follows a random path means a series that presents a constant expected variation and a uniform degree of variability. On the contrary, in finance, it is admitted that risks or returns can vary over time.

That is:

$$E_t(\varepsilon_{j,\, t+1}|\Phi_t) = 0 \tag{3}$$

$$E_t(\eta_{j,\, t+1}|\Phi_t) = 0 \tag{4}$$

and

$$\sum_{j=1}^{n} \alpha_j(\Phi_t)\, E_t(\eta_{j,\, t+1}|\Phi_t) = 0 \tag{5}$$

where $\alpha\varphi$ indicates the funds invested, in period t, in financial instrument j, given a specific investment rule and given the information set $\Phi\tau$ (see Samuelson, 1965, and Mandelbrot, 1966) for the mathematical demonstration).

The universally accepted scale of comparison of the degree of information efficiency is based on the quality of the information set reflected in the prices of the securities derived from the landmark articles of Roberts (1959) and Fama et al. (1969). As is well known, a distinction is made between:

- *Weak efficiency*: the set of information available includes only all prices (or rates of return) and quantities traded in the past.
- *Semi-strong efficiency*: the set of available information consists of all publicly available information (including information on past prices and quantities).
- *Strong efficiency*: the available set of information includes all possible public and internal information.

The market will therefore be defined as weakly efficient if prices reflect only the information contained in past prices and quantities (prices will therefore follow a random path), semi-strong if they reflect all (and only all) publicly available information (prices, therefore, they will immediately adapt to the arrival of new public information), strong if they also reflect internal information (even insiders in this hypothesis would not be able to take advantage of extra-profit opportunities as even if they had inside information these would be immediately reflected in prices through their operations).

In a market characterized by low efficiency, therefore, an investor with more information can exploit it, in compliance with the insider trading regulations. In a market characterized by low efficiency, there is, therefore, an incentive to acquire "private" information, i.e. not available to the public. Since acquiring new information is often expensive, investors must be considered to be inclined to such an activity as long as the marginal cost of the new information equals the marginal gain from its use. If the market were efficient in the strong sense, however, prices would already reflect any information. There would be no convenience for investors to incur costs for their acquisition. Hence the paradox that if no investor has the convenience of bearing the costs for the acquisition of new information, prices will not be able to reflect unknown information. Unless all the information is freely and without costs available, it is, therefore, to be considered impossible for the markets to present a strong efficiency (Grossman and Stiglitz, 1980). From these considerations and those reported in the previous note, it can be considered that the market can succeed in reaching equilibrium conditions in a state of efficiency that tends but does not reach, a strong one in an informative sense.

The information efficiency of financial markets presupposes that market agents have homogeneous views on the implications of price information: different perceptions of the consequences of the information may cause prices to reflect information in an altered way.

It is evident that while from a definitional point of view, the concept of information efficiency may seem clear and precise, from an empirical point of view the question remains open about the exact composition of Φτ. In this regard, four problems cannot be overlooked. The first relates to the number of information that could influence the price, the second concerns the practical difficulties of assessing whether such information would be able to influence the price in an efficient market, the third deals with the circumstance that the set Φτ could be different from financial instrument to financial instrument, the last relates to the possibility that different market participants have a different set of information or, even if they have the same information set, they use it differently. These issues often lead to talk about efficient market hypotheses (EMHs) in an informative sense in generic terms, without specifying what the information of the σετ Φτ is. This approach makes it possible to overcome the multiple methodological problems of measurement and can be useful in situations where the information efficiency of the market can be treated as an exogenous and independent variable; in many other circumstances, however, it cannot be accepted, without at least underlining its limits of validity.

7. Evaluation Efficiency

James Tobin's insights are the basis of a modern reinterpretation of the valuation efficiency of the markets and the rediscovery of the values and fundamental variables of a financial instrument as the main elements for its correct evaluation. The concept of valuation efficiency is based on the cash flows that a financial asset will be able to generate in the future. A market will be efficient in the evaluation sense if the price of financial assets reflects the value of expected cash flows discounted at a rate that expresses the opportunity cost of capital, i.e. if the price reflects the valuation of the fundamentals of the financial asset.

Assuming valuation efficiency, the market price will be equal to the present value of the cash flows expected for the financial instrument to produce. In the most generic mathematical formulation, denoting *with P* the price, *t* the time, E(*FdC)* the expected cash flow, and *r* a discount rate expressive of the opportunity cost of capital:

$$P_t = \sum_{t}^{n} \frac{E(FdC_t)}{(1+r_t)^t} \tag{6}$$

Pt is commonly referred to as *intrinsic* or *fundamental* value. The nature, amount, and timing of the cash generated by the financial instrument depend on its technical and financial features (dividends, coupons, redemptions or capital increases, sale or liquidation price, etc.).

The market will be efficient in a valuation sense if the price of financial instruments equals its fundamental value.

Obviously, the efficient evaluation hypothesis does not impose a perfect correlation between the current valuation and the one that would have been obtained if the real cash flows of the financial instrument had been known (values that can only be known at a later time after their achievement). On the other hand, it admits that forecasting errors may be made on actual cash flows or the consistent capitalization rate, namely:

$$P_t = \sum_{t}^{n} \frac{E(FdC_t)}{(1+r_t)^t} = P_t^* + \varepsilon_t \tag{7}$$

Where:

$$P_t^* = \sum_{t}^{n} \frac{FdC_t}{(1+r_t)^t} \tag{8}$$

is the actual fundamental value of the financial instrument, at time *t*, calculated at a time subsequent to *t* based on the real cash flows produced; $\varepsilon\tau$ represents the evaluation error.

As for information efficiency, the evaluation efficiency is verified if the forecast errors are not correlated with each other (and with the cash flow forecasts) and tend on average to 0, i.e. if there is no room to obtain extra profits systematically. An essential condition for such a dimension of efficiency to be achieved is that all agents agree on the fundamental value of the financial instrument. Otherwise, the exchanges would be concluded at prices even far from the intrinsic value. The analysis of the evaluation efficiency of the markets cannot therefore ignore a decisive aspect: how much objective the measurement of the fundamental value of a financial instrument can be.

Suppose that all agents have the same fundamental valuation for each financial instrument traded at the same time. Market prices, assuming that they function properly and that there is no irrational behavior or regulatory constraints, would stabilise at that fundamental value. New scenarios that could affect the estimates of cash flows and the discount rate would be immediately reflected in the equilibrium price. As a consequence, a dramatic reduction in the volume of trading on the secondary market is to be expected since negotiations would be limited to the need for portfolio adjustments and the entry or exit of subjects from the market. In practice, speculative behaviour would not be convenient.

A second dimension of the concept of evaluation efficiency needs to be underscored. Suppose that the subjectivity of market agents leads to different fundamental evaluations. In this case, each agent, if he implements rational behaviour, will exchange financial instruments if the market price, *Pm*, is different from the intrinsic valuation, *Pt*, which he has subjectively determined; in particular, he will buy the financial instrument if $Pm < P_t$ and will sell it if $Pm > P_t$. The market price, therefore, will not reflect the objective fundamental value of the financial instruments but will be influenced by the behaviour of the agents which in turn will reflect the fundamental evaluations that they subjectively assign to the financial instruments, which we have assumed are not perfectly in agreement. The price, therefore, can be understood as the average fundamental valuation, weighted by the quantities traded by market agents. Under certain conditions, it is possible to consider that this market price can reasonably be considered the best fundamental valuation that can be assigned at a given time to the financial instrument, precisely because it incorporates the subjective evaluations of all market agents.

Different views on the fundamentals of a financial asset, and, therefore, different expectations on the timing and extent of the cash flows produced or different appreciations of the risk associated with the investment, can reasonably lead to different valuations of the same financial asset and consequently explain the high fluctuations around the theoretical fundamental value measured by empirical analyses. Differences in evaluation can be explained by "informative" differences. Subjects who have different information can evaluate the fundamentals of a financial asset differently. Information inefficiencies can lead to evaluative inefficiencies. Evaluative efficiency therefore implies information efficiency. On the contrary, information efficiency does not presuppose evaluation efficiency.

8. Efficiency from Insurance

The insurance perspective of financial market efficiency postulates that a market is considered efficient if it allows any good to be exchanged in any "state of nature" (i.e. in any external environmental situation) independent of the actions of market agents. The insurance efficiency theory can be traced back to the pioneering contributions of Arrow and Debreu (1954) and assumes that two goods are different not only if they have different characteristics, but also if they are available in different times, places, or circumstances, that is, if they are available in *different states of nature* and mutually exclusive.

An efficient market in its insurance meaning is the market that allows exchange, incurring negligible costs of finding the counterparty and transacting any good (understood as above), even, for example, face masks in a place experiencing a massive epidemic. In this case, the good facial mask, *in a place experiencing a* *massive epidemic*, is to be considered different from the generic *facial mask good.* Such a market would make it possible at any time to *insure* each agent from any state of nature, present or future; the budgetary constraints of each agent would ensure the equilibrium of prices and the relative quantities demanded and supplied (Balasko, 2016).

In addition to a redefinition of the concept of good, the insurance efficiency perspective reinterprets the concept of market, which must be understood in the sense of *a complete* market, i.e. a market in which goods can be exchanged on a spot, forward basis, or for conditional future delivery, without any limitation of any kind and to which all agents can freely access or exit based on rational criteria of economic convenience. Insurance efficiency leads to the overall efficiency of the economic system and the optimization of competitive markets (Radner, 1968).

Let us consider an economy of pure exchange and an individual *j*, at time *t*, who must use his income y_j in anticipation of the period t+1 (let's abstract for simplicity from the possibility of intertemporal consumption). The individual will make exchange choices in such a way as to maximize utility at time t+1. Her/his choices are conditioned by the fact that he is not able to know the actual states of nature that will occur in t+1; however, she/he can know all the states of nature *s* (where s=1, 2, ... , S) that can occur and determine their relative probability π (where $\Sigma\ \pi_{s=1}$). It is also assumed that j is able to know the exogenous endowment of goods, *djbs*, which will be received in t+1 upon the occurrence of each state of nature.

By indicating *by b* a generic good (where b = 1, 2, ... , B), *xbjs* expresses the quantity of the good b available to the individual j at the occurrence of the state of nature s. If the markets are complete, there will exist, at time t, SxB markets in which contracts to have the different goods at time t+1 will be exchanged, depending on the state of nature that will occur. Let *pbs* be the equilibrium price of one of these markets, i.e. the price of the right that ensures to receive, in t+1, a unit of the technical good b upon the occurrence of state s. The individual, if adopts rational behaviours, will try to maximize the expected utility, which can be expressed as:

$$Xj(x_{1j1,}x_{1j2,\dots,}x_{2j1,\dots,}x_{bjs,\dots,}x_{BjS,}) = \sum_{s=1}^{S} \pi_{s}U_{j}(x_{1js,}\ x_{2js,\dots,}x_{bjs,\dots,}x_{Bjs}) \tag{9}$$

given the budgetary constraint:

$$\sum_{s=1}^{S}\sum_{b=1}^{B} x_{bjs}\, p_{bs} = y_j + \sum_{s=1}^{S}\sum_{b=1}^{B} d_{bjs}\, p_{bs} \tag{10}$$

where X_j indicates the set of future goods that in t the individual j secures in t+1, through the acquisition of contracts, if the state of nature s occurs; U_j is the utility function of j.

If the markets were not efficient in the sense of completeness, j could not trade the BxS future goods conditioned by the state of nature and would have to wait for t+1 and based on the actual state of nature that is realized, s*, exchange quantities x_{bs*} of goods on the B spot markets. Not having the possibility of guaranteeing ex-ante the preferred quantities of goods at the occurrence of the various states of nature in t+1, j will not be able to maximize its utility function, obtaining a lower level of satisfaction (Arrow, 1964; Malinvaud, 1973).
The concept of insurance efficiency can be transferred, under the same conditions and reaching the same conclusions, to the financial system and the goods traded in it. The exchange of financial assets allows the transfer of risk in time and space, as well as the exchange between current and future consumption. The financial market allows to insure against specific financial risks and to secure the preferred time mix of consumption. Complete and efficient financial markets in the insurance sense would trade financial assets and liabilities relating to any state of nature, allowing the coverage of any type of present, future, or conditional need (Cootner, 1965; Townsend, 1978). An alternative scheme capable of achieving the same results can be built through the use of futures on goods.
Multiple states of nature are not insurable today (or are partially insurable). Nevertheless, in various sectors (think of supplementary pensions, health insurance, the meteorological derivatives market, swaps, and options) it is possible to exchange contracts relating to a wide range of states of nature.

9. Conclusions

The cost for the functioning of complete and efficient markets in the perspectives outlined above is excessive. Moreover, the exchanges on many goods would be too thin to be considered competitive. If these appear to be the main brakes on the development of markets in the sense of efficiency and completeness, financial innovation is the main driving force to move towards more efficient financial markets. Financial innovation has produced important changes in the markets by introducing new instruments, new financial techniques, new agents, new contractual schemes, etc., creating a greater (and better) possibility of hedging risks and a wider capacity for intertemporal exchange of consumption.
It remains, however, evident that today's financial markets are still very far from reaching the highest levels of efficiency, whatever the perspective adopted for financial research or teaching purposes. Consequently, it is unavoidable to disclose in advance the perspective of market efficiency assumed for the research analysis or teaching purposes and discuss the limitations in the inference that is derived.

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