

BEHAVIOUR AND INFORMATION ON FINANCIAL MARKET

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Abstract

Generally, the main three logical models of financial markets (Efficient Market Hypothesis – EMH, Adaptive Market Hypothesis – AMH, and even – partially – Behavioural Market Hypothesis – BMH) take for granted the idea that information drives behaviour, therefore, information is always the channel through the decision is taken, no matter whether such a decision is optimal or sub-optimal. The paper critically examines such an „axiom” and proposes a causally inversion of the relation, that is, it argues that (in the most part), in fact, behaviour drives information, To this end, a new typology of information as well as a new typology of information mixes available to the economic agent are provided and discussed. The research is conducted in a logical key, and the two main findings are: a) the informational-based model of financial market should be replaced by a behaviour-based one; b) the informational efficiency of financial market should be replaced by a behavioural efficiency one. The paper claims its origin and target from institutionalism and evolutionism in the microeconomic academic research.

Keywords *information, behaviour, financial market, EMH, AMH*

JEL classification: *B41, D40, D81*

1. Introduction

The model of financial market known as Efficient Market Hypothesis (EMH) (Fama, 1970) provides an informational view of (financial) market efficiency, while its rival (but not too), Adaptive Market Hypothesis (AMH)

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(Lo, 2004) seeks to go beyond information and approach a behavioural view of market efficiency, although, in my opinion, without going to the upshot. It is easy to see that both theoretical models of the functioning of the financial market have as a benchmark or as a condition for assessing the state of the market the concept of efficiency. Efficiency is seen, in both visions, as a state of equilibrium – no opportunity to "beat" the market based on information, in the case of EMH, no opportunity to "beat" the market based on behaviours/strategies, in the case of AMH (Lo, 2019). Given the different views of the two established models, in the following I shall offer a brief discussion on the relationship between information and behaviour in achieving the efficiency/balance of the financial market.

Information (as concept) already has an impressive status among the concepts with which financial science (and even politics in the financial field) operates:

- (a) information has gained enormous "prestige" as consequence of results obtained in scientific research in various fields: 1) communication theory (Claude Shannon); 2) control theory in dynamical systems (Norbert Wiener); 3) chemical structure of DNA (James Watson and Francis Crick); 4) relationship between entropy and information (Shannon's informational entropy); 5) issue of information in relation to black holes in the Universe (Stephen Hawking); 6) knowledge theory (transformation of information into knowledge); 7) semiotics etc.;
- (b) in economics, information is sacrosanct – price, for example, is considered to integrate all relevant market information (this is also the origin and the basis of EMH). Also, many microeconomic approaches (e.g. signal theory) or macroeconomic ones (self-fulfilment of prophecies, or Oedipus effect) base their axioms and theorems on the concept of information.

And yet, there are signals that also come from scientific research (also in the form of ... information) that things need to be looked at more nuanced. The most important source for such a change of vision comes from biochemistry and indicates that something else appears before the information, namely the behaviour (*Nota bene*: Biochemistry is an interdisciplinary approach, at the border between biology and chemistry, i.e. in the territory of the origin of life. The fundamental concept here is that of the *hypercycle*, which could be "borrowed" and successfully applied in economics, including

in the study of the adaptive or co-evolutionary financial market, which was introduced in the literature by Manfred Eigen – see *The Hypercycle: A Principle of Natural Self-Organization*, parts A, B, C, in *Naturwissenschaften* – in English, No. 11, 1977, respectively from the book *From Strange Simplicity to Complex Familiarity. A Treatise on Matter, Information, Life, and Thought*, Oxford University Press, 2013). This idea is extremely important and, although Andrew Lo (who has coined the model of AMH – 2004) does not mention it in any of his works, as being able to underlie a new approach in economic research in general, I consider it to have this potential. There is, also in the literature on biology and biochemistry (hopefully, only for now staying outside the financial theory), clear demonstrations (including mathematical formalizations) that not information (not even encoded in DNA) generates behaviour, but conversely, behaviour generates information (Froese et al., 2012). Unconsciously, signal theory in microeconomics (e.g., firm financial theory) or EMH testing from the perspective of so-called event analysis, appeals to this implicit assumption, that is, to the assumption of the primacy (both logical and chronological) of information over behaviour.

2. Information on financial market

Based on its nature, information on financial market can be of three nature/origin: a1) formal information; a2) implicit information; a3) bound information;

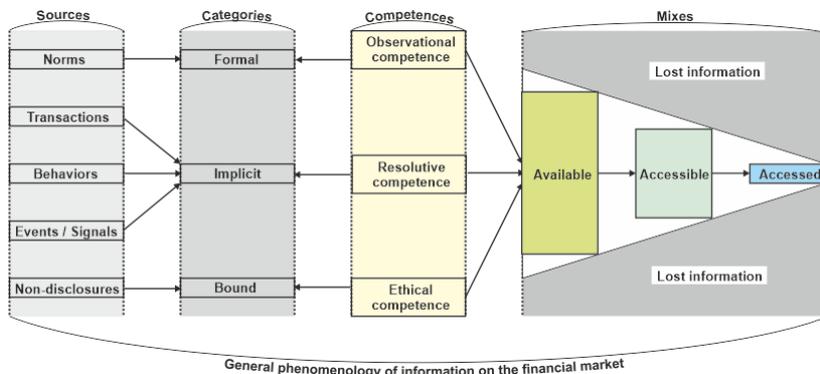
(a1) *formal* information (FI) is about the information available equally to all individuals, whether they operate or not operate on the financial market, namely the information available in the normative framework of society. This information is integrated *ex ante* into any decision/behaviour, namely in its entirety, immediately and without search or risk costs (*Nota bene*: of course, some agents, depending on the model of rationality, may choose not to integrate free information (either in whole or in part) – for example, those who decide to commit tax evasion or engage in illegal business transactions. In this case, there is a so-called cost of non-compliance, which is a potential cost, although some more ... sophisticated agents, as Eugen Fama would say, may introduce both cost and risk into their decision optimization calculations (Becker, 1978). It should be noted that, in this case, we have a cost not to search for information, but to evade/ignore the information – this aspect is almost

not sufficiently addressed in the literature dedicated to the functioning of the financial market;

- (a2) *implicit* information (II) is information that refers to events (and is contained, in nutshell, in events) on the financial market, available to all attentive and reflective economic agents (these qualities of economic agents do not, of course, imply any connotation of the nature of financial competence) or what, in the literature, is even called event information; implicit information is quasi-free, unlike formal information, because it involves what in economic theory is called implicit cost – in the case discussed below, it is the cost of "transformation" (more precisely, "translation") of the event observed in the information usable in one's own decision and behaviour. (*Nota bene*: decision and behavior which, in turn, constitute events containing implicit information for other financial market agents, in what is called the financial market information network (Onnela et al, 2006).
- (a3) *bound* information (BI) is about information that can (and must) be bought – either by ordering studies from companies specialized in financial market research, or, in illegal cases, by acquiring it through corruption, bribery or theft (in the latter case, it is about a variety of related information, namely, about the internal information of an agent or organization). Obviously, the bound information is not free, it involves both a search cost (e.g., payment of information acquisition studies) and the cost (coverage) of risk of discovering the illegal way of obtaining internal information (e.g., in the case when the information is stolen).

Of the three categories of information, implicit information (explicitly) refers to behaviour. In other words, the implicit information is not actual information (such as formal information or bound one), but an information deduced, inferred from observed behaviour of financial market. This is the exact the meaning in which I claim that on the financial market there may be a primacy of behaviour over information. The implicit information is therefore that information that the (potential) user of it produces himself, through idiosyncratic means: intuition (flair), calculation of rationality (e.g., CAPM, BSM, etc.), coincidence (luck, chance) and so on. General functioning of information on financial market can be synoptically represented as in Figure 1.

Figure 1: The phenomenology of information on financial market



Source: author

Therefore, in the financial market, an agent will use a mix of the three categories of information, one of which – the bound information – is "manufactured" by the user him/herself of that information, having as primary or of first instance source, the behaviour. Of the three categories of information, only one is free – formal information – and of the other two categories of information that require costs, the most expensive is bound information. In the case of this last category of information, there is also the risk of acquiring the information, which is an additional sui generis cost, thus increasing the yield required for the individual business transaction based on the information mix. As indicated above, any additional costs (searching for information, processing it, hedging the risk) must be covered by the return on the financial market, so that a net positive result is obtained, whether or not that return is above average of the market.

3. Behaviour on financial market

By behaviour on financial market, I understand the actions – either as acts or as abstentions – (based on decisions which are, perhaps, unobservable) those economic agents perform in relation with the transactions concerning the financial assets which are legally traded on that financial market. However, the condition of legality is not mandatory here, although it is, generally, presumed.

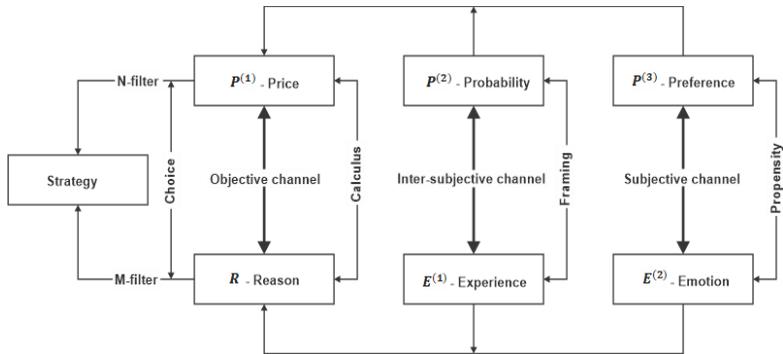
As the financial behaviourism claims (and the black-box-ism assumes), the decision, that is, the information beyond the behaviour is not only invisible but is revealed exactly by the behaviour concerned. By fixing an economic agent, we can say, generally, that for him/her, all s/he notices about the financial market functioning are the behaviour of the other economic agents involved. In the terminology used in the present paper, the fixed/given economic agent must acquire his/her implicit information needed for his/her own decision and behaviour from the observed of other's behaviour. Of course, both the formal information and the bound one is directly acquired *qua* information.

Therefore, it can be said that, in the most part, on the financial market, behaviour has a primacy over information, because the implicit information – which is exclusively inferred from observed behaviours – constitutes the most part of all information needed (and effectively used) in decision taking for own behaviour.

As Figure 1 shows, the translation of behaviours into implicit information is provided by what I have called the *resolutive competence* of economic agent. The very mechanism of such a translation is not yet provided neither by EMH nor AMH (less than that, the two well-known models do not provide neither the structure of information, tacitly accepting that this structure must be considered as a self-organizing black box).

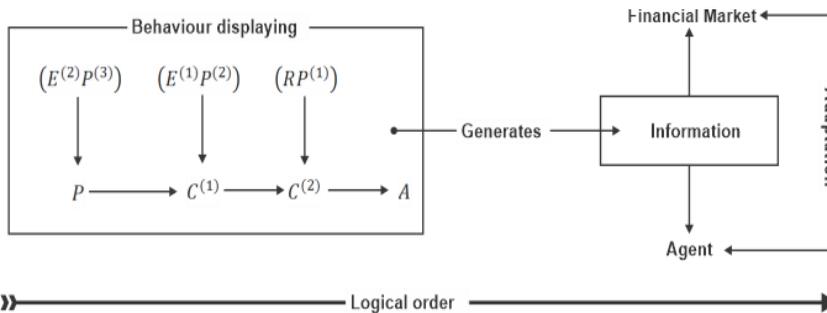
In my opinion, the behaviour on financial market has four degrees of liberty: a) price – $P^{(1)}$; b) context (or contextualization) – $C^{(1)}$; c) calculus – $C^{(2)}$; d) action – A . So, in order to choose a trading strategy, the economic agent must browse all the four mentioned phases – any of them, once achieved (and, to say so, selected) reduces with one the number of degrees of liberty of that economic agent. If we take into consideration also: (i) $P^{(2)}$ – probability associated with the choice; (ii) $P^{(3)}$ – preference; (iii) R – rationality (or reason); (iv) $E^{(1)}$ – experience of economic agent; (v) $E^{(2)}$ – emotion, then we can logically describe the abstract model of the behaviour on financial market (Figure 2, and Figure 3).

Figure 2. The abstract model of behaviour on financial market (I)



Source: author

Figure 3. The abstract model of behaviour on financial market (II)



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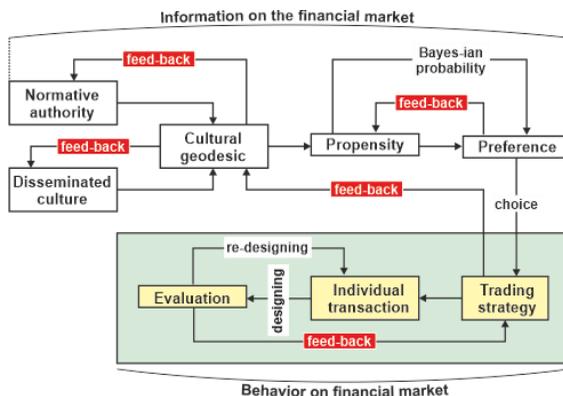
4. Information and behaviour connected

Therefore, at least at the level of category of implicit information, it seems that behaviour is the cause of information but not vice-versa, as usually accepted. This outcome could be of great importance (and relevance) for the development of financial theory beyond EMH and even beyond AMH, in order to better connect the financial action to the psychological features of humans. Since this connection stays at the basis of many (both theoretical and methodological) departures from the neoclassical economic theory – including here behaviourism, institutionalism, evolutionism and other of the same – I

think such a proposition can be deepened and refined so a reconstruction of the financial theory and model to gain consistency and pregnancy.

The logical connection between information and behaviour, inside the above considerations, can be graphically expressed as in Figure 4.

Figure 4. The logical scheme of connection between information and behaviour



Source: author

5. Hypothesis of behaviour primacy over information

The hypothesis of behaviour primacy over information (BPIH) brings, in my opinion, some useful added value, among which I would mention the followings:

- For the financial *theory*
 - an additional step to integrate the (surprisingly) results of behaviorism into the core theoretical body of financial theory;
 - a conceptual gate through which the institutionalism and evolutionism enter the financial theory.
- For the financial *methodology*
 - price changes should be not associated anymore with information changes, but with behavior changes (which, in turn, „produces” information – the implicit one);
 - so, the changes in behavior causes (directly) changes in behavior, often without any intermediation of information (e.g. herd effect as species of memes).

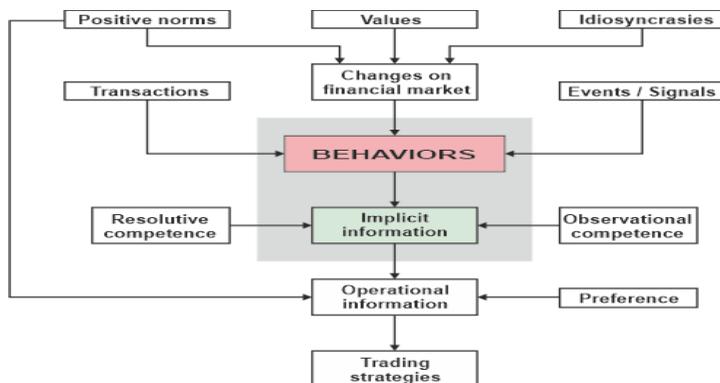
- For the financial *empirical studies*
 - instead of the correlation between prices in time series, it becomes more relevant to calculate the correlations (or, better, the causalities) between behaviors on financial market;
 - because of the subjectivity of actualize the behavior, Popper's falsifiability should be adjusted: for example, it is not anymore of certainty the refutation of the hypothesis whose associated empirical prediction is rejected in a particular event.

At the same time, the impact of the BPIH could be assessed as below:

- Impact on *principles/axioms*
 - eliminating/avoiding of the (non-natural) axiom of integral, instantaneously, and free cost capturing of information into price (see EMH);
 - ✓ some (perhaps, most of) information is not observed or is not derived from observed behaviors.
 - putting the primacy of behavior over information in line with the new principles of evolutionary theory of life.
- Impact on *conjectures*
 - informational testing should be replaced by the behavioral testing, when empirical (that is, factual) tests are performed
 - it is not needed anymore that economic agents be homogenous nor hyper-rationals
- Impact on *tools*
 - replacing of objective probabilities with subjective ones (e.g. Bayes probabilities)
 - ✓ because the information inferred from behaviors are subjected to own preferences
 - the modelling of optimality should be replaced by modelling of sufficiency regarding the expected financial result

The main lines of the BPIH functioning are highlighted by Figure 5.

Figure 5. The general abstract functioning of the BPIH



Source: author

6. Main findings

The paper examined the relationships between information and behaviour on the financial market, in order to put new bricks in rebuilding process regarding the financial theory and methodology. The main results of the research are the followings:

- (a) There are three categories of information on the financial market: formal (codified norms), implicit, and bound, which the economic agent faces with;
- (b) If the formal, and bound information appear to economic agents *qua* information, the implicit information is „ciphered” inside behaviour of the other players on financial market; so, the implicit information must be produced by the economic agent him/herself, by observing the behaviour and by inferring that information from the behaviour. This means that behaviour has a logical and chronological primacy over information;
- (c) Prices on financial market change rather under the pression of behaviour, than under the pression of information, as EMH and AMH claim;

- (d) Regarding the empirical testing, the focus should be moved from informational testing (for example, by analysing the correlations in informational time series) to behavioural testing.

7. Conclusions

- (1) Based on the hypothesis of primacy of behaviour over information, we can easier derive an evolutionary model of financial market functioning;
- (2) The biological suggestions come now to economic theory (especially to financial theory) not only through entropy vehicle (e.g. Bioeconomics) but through evolutionary process (combined, of course, with the older insights from psychology);
- (3) Taking into account that the human being informational (and computational) black-box will persist on long time, it remains that the (observed and translated) behaviour can constitute the best option for both explanations and prediction on the financial market, therefore our hypothesis of the primacy of behaviour over information can be proved as a productive way.

8. Directions for future research

Some issues could (or should) be deeper examined further in order to add grounds to the proposed hypothesis regarding the primacy of behaviour over information on the financial market:

- (i) the mechanism, both logical and psychological, through which the observed behaviour on financial market is „translated” into implicit information;
- (ii) the way in which EMH (and, maybe, even AMH) could integrate the hypothesis of primacy of behaviour over information and, in this case, could be (perhaps, easier) empirically tested in Popper’s framework of falsifiability;
- (iii) how could the hypothesis of primacy of behaviour over information be put on the basis of new developments of evolutive financial market theory and methodology.

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