Finance and Theory of Knowledge

Jose Rigoberto Parada Daza

Professor Universidad de Concepcion-Chile, Victoria 471-Concepción, Chile
E-mail: rparada@udec.cl
Tel: 56-41-2204172

Abstract

Different areas of Finance are analyzed (Finance Theory and Applied Finance) through the lens of the Theory of Knowledge. The method used to study Finance is explored, focusing on aspects of Dogmatism and Skepticism, Rationalism and Empiricism, and the intermediate versions of the latter two, Apriorism and Intellectualism. These perspectives are used to orient the methodology of analysis used in Finance, its probable projections, and the definition of its theoretical and applied areas of study, expressed in three propositions that outline the field of study of Finance Theory and Applied Finance. This article considers a little-explored vision of Finance, revealing the development of new knowledge that can be generated in this area.

Keywords: Dogmatism, Skepticism, Rationalism, Empiricism, Finance Theory, Theory of Knowledge.
JEL Classification Codes: Goo

1. Introduction

A variety of areas are developed within the concept of Finance including Finance Theory, Applied Finance, Public Finance, International Finance, and Financial Management, amongst others. Applied Finance and Public Finance were already being developed as specific areas of knowledge prior to the 1950s, when the theoretical body known as Finance Theory began to form. Although more recent than the other areas of economic knowledge, the development of this new theory changed the way Finance is taught and researched.

This article offers a general overview of the relationship between Finance Theory and Applied Finance for private and public businesses. First, however, the paper presents some of the philosophical aspects of the Theory of Knowledge that form the basis for the generation of knowledge in this new area, Finance Theory. Later, three propositions are presented regarding the theoretical background of Finance.

2. Finance Theory and Applied Finance

Finance Theory must be defined in order to focus the analysis. The following are some definitions provided by classical authors.

W. Sharpe (1976) defines Finance Theory as a fairly abstract but rigorous theory, of special interest to portfolio investors. E. Fama (1976) does not provide an explicit definition, but indicates that the objective of his text is to introduce Finance Theory and its empirical verification; Fama considered Finance Theory to be a unique field of economics due to the correspondence between theory and

practice. Huang and Litzenberg (1988) state that Finance Theory deals with individual consumption and portfolio decisions under uncertainty and their implications for financial assets. R. Jarrow (1988) understands Finance Theory to be a theory of portfolios, CAPM, option prices, APT, and models associated with financial economy. T. Copeland and F. Weston (1988) argue that it is a theory that explains how and why individuals and their agents make decisions and choose between different flows, concentrating on assets, portfolio administration, and finance policies. R. Merton (1992) indicates that Finance Theory is a neoclassical theory that covers perfectly defined areas.

Other authors question Finance Theory. W. Buffet (1994) is cited in Hagstrom (1995) as indicating that unlike academics, risk is too complex to be evaluated solely by statistical measurements, as Finance Theory suggests, adding that diversification is a solid principle for average investors, but can be an obstacle. Because this intellectually provocative position comes from a person whose graduate studies are in the area of finance and who has made a fortune in stock investments, it should be considered. Buffet is a true representative of the fundamental analysis approach, which deals with stock prices.

B. G. Malkiel (1996), on the other hand, indicates that when taken to a logical extreme, this would mean that a blindfolded chimpanzee throwing darts at the stock market pages of a newspaper could choose a portfolio with values as good as those chosen with the greatest expert care. The author further notes his personal and professional predisposition against "chartists". He indicates that Technical Analysis (the academic name for "chartist") is an anathema in the academic world; frequent criticism is driven by two considerations: 1) the method is clearly false and 2) it is easy to criticize, and, Malkiel reminds his readers, although it seems a little unfair to criticize such a pitiful objective, remember: the goal is to save your money. This is a direct, intellectually provocative position with respect to other approaches that are not included in Finance Theory, in this case, technical analysis, which also deals with the price of the financial assets and, specifically, the price of stocks. Technical analysis is very old, both in theoretical approaches and its application to stock prices.

Edwards and Magee (2001), on the other hand, indicate that "Technical analysis is the science of recording, usually in graphic form, the actual history of trading (price change, volume of transactions, etc.) in a certain stock or in "the Average" and then deducting from that pictured history the probable future trend".

A closer examination of the bibliography cited reveals the following:

a) Finance Theory is made up of a set of normative models, which are contrasted with reality to analyze their validity. The theory's fundamental concern is explaining the formation of financial assets prices, investment in these assets, and how to protect one's self from risk, using a financial asset portfolio in a competitive capital market as a reference.

b) The underlying methodological base is mathematics in is different forms. This confirms the idea that Finance Theory deals with rigorous models that are the product of arbitrage in the prices of the financial assets in a competitive capital market.

c) The main variable studied consists of the prices of financial assets on competitive capital markets.

d) The theory is relatively young with respect to other areas of knowledge. Variables related to self-esteem needs, social needs, and emotional treatment are considered to be neutral in Finance Theory.

e) The conceptual definition of Finance Theory does not include financial assets investment models developed before its inception in the 1950s, nor does it include models that refer to technical or fundamental analysis.

f) Its underlying economic methodology is the application and extension of the microeconomic concepts of equilibrium and the research methodology of neoclassical economics.

g) Although no clear definition of Finance Theory exists, the theory clearly refers to equilibrium models with respect to the financial assets prices, models that contain aspects of rationality and empiricism, which are the bases of the Theory of Knowledge.

Applied Finance, also known as Corporate Finance, concentrates on three main aspects of management: how much and in which assets to invest, how to finance those investments and, finally, how much of the dividends should be distributed among the owners of the stocks. Classical authors such as Brealey and Myers (2002); Weston and Brigham (1993); and Ross, Westerfiel, and Jaffe (1995) include this outlook in their works. Although these authors use the value of the financial assets and their prices indistinctly, on markets with incomplete information, value and price are not necessarily the same.

3. Finance Theory and Methodological Approaches
3.1. Theoretical aspects and compliance in Finance Theory

The analysis of a theory's validity and its degree of rigorousness are done according to Hernández et al. (1994), with respect to the functions that a theory should fulfill, these being: a) to explain the phenomenon: why, how, and when it occurs, b) to systematize and organize knowledge regarding a phenomenon, especially when this knowledge is disperse, and c) to predict the future of the phenomenon, which is the objective of any theory.

The concepts detailed above show that the Finance Theory models attempt to **explain** the price of the financial assets, adjustments for changes in supply and demand, and profitability. Thus, the so-called utility functions, which assume maximizing human behavior, are used to explain an investor's behavior. The theory attempts to explain how the prices of financial assets are determined.

In terms of its **systematization**, knowledge existed prior to 1950 as to the prices and models of stocks and interest rates. Fisher (1930), Keynes (1936), Williams (1938), and Schneider (1994) are some of the authors who were working in this area at the same time that technical and fundamental analyses were being developed. As of the end of the 1950s, the study of the prices of financial assets was systematized and reoriented with a global approach, generating models with new unknowns and new hypotheses.

Prediction is clearly the objective of Finance Theory. Sharpe (1976) indicates that the utility of a normative model rests on its predictive capacity. Whether or not these prognoses coincide with reality is another matter. There are reasonable doubts as to the real predictive capacity, whether because of the normative or underlying suppositions that the analysis method implicitly brings, such as the very definitions of the different mathematical methods.

Thus, Finance Theory clearly complies with the requirements for being considered a theory. The evaluation of a theory, the other stage of analysis, should involve the following criteria: a) the description and explanation of the phenomenon, b) logical consistency, c) perspective, d) fructification, and e) parsimony.

According to the criteria above, Finance Theory provides a description and explanation of the phenomenon of financial asset prices, allowing for greater understanding, the formulation of empirical tests, and prediction. Finance Theory is also logically consistent, as its propositions are interrelated and not contradictory. It offers a greater perspective through more explanatory phenomena and fructification as new questions are generated. Parsimony is a bit more complicated, as this attribute means that the theory should be plain and simple. In this respect, Finance Theory has become more sophisticated and is now a methodology that can only be understood by experts in the area, which could make it inoperational, useless theory, at risk of falling into mere beliefs, suppositions, or intellectual speculations.

3.2. Finance Theory and Theory of Knowledge: Rationalism and Empiricism

Finance Theory is characterized by the use of models with a high degree of abstraction and idealism. In this approach the use of mathematics in its different forms predominates; thus, each model of Finance Theory has its own mathematical method. Differential and Integral Calculus, Stochastic Differential Calculus, Multivariate Analysis, Econometric Analysis, Optimization, and Dynamic Programming are

some of the materials behind these models. With this logic, one could expect new models using other mathematical techniques as yet unexplored in Finance Theory.

From a more general perspective, the reason for this type of approach should be analyzed in order to understand the real meaning of Finance Theory as well as its projection. For this, we will first focus on the aspects of Theory of Knowledge as detailed by Hessen (1925). This author established that knowledge originates between two opposite approaches: Rationalism or Idealism and Empiricism.

Rationalism maintains that the cause of knowledge is **reason** and this has a **logical need** and **universal validity**. In other words, a phenomenon is what it is and is not any other way and it should be so always and everywhere. Thus, all knowledge originates exclusively in thought, that is, an idea, giving rise to Idealism, which at times is confused with Rationalism, with Plato being one of the first Rationalists. In support of this idea, it is indicated that the world of experiences is in a constant state of change and, as a consequence, cannot provide real knowledge. In this context, Hessen holds that the Rationalists come from mathematics and the empiricists (the opposition position) from the natural sciences, in which experience is a determinant element for the generation of new knowledge.

According to the above approach, Finance Theory follows the search for this logical need and universal validity. That is, e.g. the CAPM model would have universal validity, that is how it is, and it should always be so everywhere. It is also Idealistic, in the sense that it gives more importance to intelligence than does Empiricism.

On the other hand, Empiricism holds that the only cause of knowledge is **experience**, for which there is no *a priori* influence of reason. That is, experience predominates over reason in the generation of knowledge. Thus, in this approach, all the concepts, general as well as abstract, originate in experience and not reason. This implies that the people do not have knowledge before birth, but that all knowledge is the product of observation of experience. Some authors adhering to this approach throughout the history of economic thought are J. Locke (1632-1704), D. Hume (1711-1776), and John Stuart Mill (1806-1873). The latter indicated that mathematical knowledge comes from experience, which is the only source of knowledge, since no *a priori* propositions exist that are valid without experience. In this context, Finance Theory also has incorporated knowledge through experience, which is very common through the "contrast hypothesis" using statistical techniques, mainly Econometrics.

There are two intermediate approaches that fall between Rationalism (or Idealism) and Empiricism: Apriorism and Intellectualism.

With Intellectualism, it is understood that knowledge is originated by reason (Rationalism) as well as by experience (Empiricism), with reason generating images of conscience and experience generating concepts. Thus, Intellectualism deduces that the conscience "reads" experience and from this extracts its concepts. The central emphasis is more on Rationalism than on Empiricism in the sense that it accepts the existence of logical judgments with universal validity but also accepts that such judgments arise from experience. Aristotle is a representative of intellectualism.

Apriorism also considers that knowledge comes from reason and experience, but it is closer to Rationalism than Empiricism, holding that knowledge contains elements *a priori* that are independent of experience.

Economic Theory and Finance Theory, a continuation of the former, are mixtures between Apriorism and Intellectualism, since the implicit consideration of both approaches is simultaneous. Thus, the models are first mathematical and abstract (Rationalism and Apriorism) and then contrasted with reality (Empiricism and Intellectualism). Dagum (1995) affirmed that Plato's cave allegory inspired various widely accepted economic myths in the field due to authority, ideology, mathematical convenience, or all of these combined, including: i) the invisible hand of A. Smith, ii) the rehiring of Edgeworth, and iii) the neoclassical version of the rational expectations of Muth (1961). In terms of Finance Theory, models like the Efficient Market and Black-Sholes Options, amongst others, should also be included here.

Both approaches exist simultaneously in different models since Finance Theory is a social science as opposed to a mathematical or natural science. This hybrid mix of approaches stems from the

end goal, the explanation of human behavior. The only difference is that this case looks at economic actions and, more specifically, behavior in terms of the supply and demand of financial assets. All this is assumed in Finance Theory, with the dependent variable being the behavior of the agent-investor and the independent variable the price.

The hybrid situation indicated leads to the conclusion that the mere use of mathematics (rationalist) does not necessarily result in rigorousness; often the simple inclusion of mathematical methodology results in something being described as a model. Sometimes the idea of "rigorous" seems to indicate precision in prediction and at the same time the indisputability of a given model. Here "rigorous" should be understood in a wider sense, since aprioristic thought does not necessarily justify everything; intellectual thought should also be "rigorous". This misunderstanding has led to thinking that, by relating the term "rigorous" with mathematics, then Finance Theory must necessarily be mathematical. Nor should empiricism be considered the only really interesting thing, as it is also based on mathematical sciences (normally used to prove it). The use of methodologies such as Multivariate Analysis and Econometrics do not necessarily indicate rigorousness, since they do not generate new knowledge themselves but only act to refute and not validate due to the hybrid character of Finance Theory. Therefore, it is best to carefully observe each model and not fall into the temptation of assuming that something is "rigorous" and therefore irrefutable simply because it uses mathematical techniques.

3.3. Finance models, Apriorism, and Intellectualism

The mixture of Apriorism and Intellectualism in the classical finance models is very notorious. Here, classical models are understood to be those that are most cited in the finance literature and that have been the motivation for greater attention and investigation.

All the models are based on the supposition of behavior equivalent to that of a "homo oeconomicus". From an Apriorism perspective, it is understood that one's actions are always guided by a principle of more rather than less; that is, a naturally maximizing being. All the models start with this subject of study, which is why knowledge is found in reason and therefore has universal validity. The models suppose that this "homo oeconomicus" "simply behaves like that" and can behave no other way and that, because this is always and everywhere so, s/he is rational. This is the dominant part of Rationalism; it is in consequence an idea. The presence of Rationalism in this supposition acquires greater presence when one considers that the "homo oeconomicus" can be represented in a logarithmic or squared utility function, as indicated initially by Bernoulli in 1730; this unites Rationalism (the mathematical function) with economics (maximizing being). Empiricism is also understood to influence this type of utility function, as it is a good representation of the behavior of a person that offers and demands financial goods on the market; that is "conscience reads experience", as held by Hessen.

Thus, the utility function of a "homo oeconomicus" is the best expression of the existence of this mix between Apriorism and Intellectualism. This aspect must remain with each new attempt to explain and apply Finance Theory models, since these do not lead to an automaticity and mechanization of them. Instead of generating new models, one runs the risk of falling in the Rationalism-Dogmatism relationship, defending the position of a model with "but keep in mind who is proposing it". That is, the existence of the model is defended by considering who is promoting it and not the object of the research, which is the relevant item.

The other extreme can result in an excess of Skepticism, which occurs when greater importance is assigned the object than the subject. The latter can acquire different dimensions: Subjectivism, Relativism, and Pragmatism; Criticism falls between these two extremes as a generator of knowledge. This is necessary in the utility function, as economic acts clearly exist that cannot be explained by this type of logarithmic or squared function. Nevertheless, these acts are economic, carried out by a rational "homo oeconomicus" that also considers what has herein been called "rigor", understanding this to be only the rationalist-aprioristic part of the models. This should not be interpreted as an explanation of the phenomenon, but rather as a sort of description of the problem using a determined language

(mathematics, in the present case). The most used mathematical methods in Finance Theory are Algebra, Differential and Integral Calculus, Stochastic Differential Calculus, Optimization, Econometrics, and Multivariate Analysis (Factor Analysis and Discriminant Analysis). The use of mathematics has advantages for deduction and communication, but at the same time requires care since mathematical rationality, being a language, has definitions and conventions that imply "implicit" suppositions that are carried over to the models of Finance Theory affecting them and also distancing them from reality. This aspect has been criticized by, amongst others, Hayek (1942), Allais (1971), and Koopmnas (1975), the latter two Nobel Prize winners for Economics.

The formulation of a hypothesis and of suppositions in models, a valid method for any science, requires researchers to rely on their memory, knowledge, and evidence of the external environment. Researchers are also influenced by their emotional state, their incentives for the research itself, and obviously the matters unique to the researcher's human nature. Russell (1975) states that memory and evidence of others are necessary for science, understanding memory as the remembrance of past events, which is considered to be fallible, mostly due to aspects such as: the definition of when it begins and ends, what is memory, and the possibility of falsifying the facts. Schumpeter (1954) holds that in everyday words and academic jargon, especially in franco- and anglo-phone countries, the word (science) is often used to mean physical-mathematical clearly excluding all the social sciences and, by extension, economics.

These two observations highlight the need to look at Finance Theory models, which cannot be considered exempt of such observations. Thus, matters such as emotions, the need for self-esteem and power, the underlying suppositions of Rationalism, and others, should be analyzed for each model and not necessarily accepted as what "should always be so, with universal validity", which is a characteristic that Hessen (op. cit.) attributed to Rationalism.

A central aspect of the classical models is that they try to explain the supply and demand behavior of financial assets as a dependant variable, assuming that these being behave rationally. This has a very relevant implication regarding the possible existence of other parallel objectives when only being considered as a maximizing being; this idea coincides with the concept of mathematical maximization. There are also economic beings that act at suboptimal levels although they are as rational as any being. These mathematically suboptimal beings are restricted in their behavior because they are too complex to be considered exclusively economic beings. Such is the case of investor-mangers, people who acquire financial assets known as common stocks in order to reap benefits not limited to economic utility. Said benefits are more related to the investor's behavior as a social being motivated by a variety of needs (e.g. self-esteem, political power, and social control) whereas others are motivated by psychiatric reasons (e.g. compulsive shopping due to endogenous depression, or excessive gambling due to ludopathy). These actions appear to be solely economic, but are anomalies that are defined as pathologies. These aspects should be analyzed since, obviously, they are not considered in the models and they deserve a closer look when being considered as universal laws. Focardi (1996) indicates that Finance Theories are not laws of nature, but rather mathematical descriptions of the financial markets.

Another consideration in Finance Theory is the determination of the dependent and independent variables. Finance Theory, in line with economic methodology, considers investors to be subjects that take, but do not make, prices. This approach is relevant since price data are a consequence of supply and demand, implying that someone supplying or demanding financial assets would act according to their perception of price behavior. The methodological principle is what has helped create models and it is a very useful frame of reference that is coherent with economic postulates. The opposite idea, that the real independent variable is the subject, is more complex to apply since it would lead to taking each individual as a separate case, with a model for each person.

3.4. Use of models and suppositions in Finance Theory

The use of models is necessary in any science since reality is too complex to be described exactly. Models are standards with certain logic that attempt to describe the phenomenon under study as best as

possible. If reality were simple, models would be unnecessary. Finance Theory is not exempt from this situation.

Finance Theory models are guidelines or ideals that describe how prices behave given a balanced situation on the financial asset markets. Descriptions of these models are based largely on mathematical language. More than representing laws of nature, the models represent and describe the phenomenon of financial asset prices.

Finance Theory has two central models. The first is Perfect Competition, which explains how prices are formed in equilibrium if the system has all the incentives to allow the competition; that is, frictionless total competition. This is an intellectual frame of reference with elements of Apriorism since, within the theoretical world, it is a universal law; it is a frame of reference for researchers as well as public and social policy managers. In order to comprehend its importance, it is necessary to think about how the world would be if this model did not exist and given the lack of an alternative intellectual device. Without another intellectual and aprioristic model, it would be very difficult to formulate new theories and efficiently assign resources. The Perfect Competition model is difficult to replace, has been in place for centuries, and will continue to be so in Finance Theory for a long time to come.

Another relevant model in Finance Theory is the Efficient Capitals Market, which deals with a special niche of the perfect market such as information, Fama (1970). In order for competition to exist as "fair or clean play" there should be, ideally, information – public and private, historical and current – for all participants, expressed in the price. The lack of such information but with equality for all is known as asymmetrical information and results in the unfair movement of wealth from those without information to those with advantageous confidential information. Thus, in Efficient Capitals Market, those offering and those demanding financial assets as takers of prices must have all the information – past, present, and any other information that affects a company emitting financial assets – completely incorporated into the price. The development of this model, which also combines Intellectualism and Apriorism, has allowed increased knowledge of investors and their behavior.

Suppositions are another required aspect for all sciences. Suppositions often arise because reality is very complex and cannot be understood. During a first stage, some simplifying suppositions are formulated that allow the phenomenon to be understood in general. These suppositions are reviewed during a second stage to determine whether the models are altered when the initial suppositions regarding the problem are changed; this is a consequence of the research method itself. Finance Theory is not exempt from the use of this type of norm and two types of suppositions should be pointed out. The first are mathematical-type suppositions that come from the Aprioristic method, implicit in Finance Theory, that condition the development of the models. It is necessary to pay attention to their influence; these were called underlying suppositions in previous paragraphs because they normally are not given much importance. Examples of this kind of supposition are continuous functions and those two and three times differentiable, Brownian geometric processes and Wiener processes, the normal distribution of variables, closed solutions to simple and differential equations, very small variations in Differential Calculus, etc. Each of these mathematical definitions conditions the model's solution.

The second type of supposition deals with the behavior of rational beings, a consequence of Intellectualism. These suppositions are necessary to adjust the models towards the type of person involved, in this case, individuals participating in economic acts. To name a few, these include the existence of rational economic beings, fair and complete competition, and neutrality in ethics as well as emotions.

4. A General Analysis Model of Finance Theory

4.1. The relationship between Finance Theory, Applied Finance, and Public Finance

The previous paragraphs have shown that Finance Theory deals with investments in financial assets and their financing. Nevertheless, other areas of Finance also give rise to study and analysis, with the corresponding conceptual bodies, models, and descriptions. These areas are Applied Finance and Public Finance.

Applied Finance deals with a private or public company's investment in assets (either financial or productive) as well as the financing and distribution of the utilities generated by the corporation. In Applied Finance, the concept of an intrinsic value of a financial asset coexists simultaneously with its price. One of its main topics of Applied Finance is the determination of the business's value, sometimes with the same relevance as the market price of the business. In fact, some investment and financing operations may not be carried out on a market with completely competitive values (a perfect competition model), which means that the exchanges should be valued at the intrinsic value, which may or may not come close to the price. On the other hand, companies act within a regulatory and legal framework that cannot be obviated, making the concept of value even more relevant than price for the company. In extreme cases, price should be the same as value, as in Modigliani-Miller (1963). However, this sameness is a particular situation that is not always obtained in inefficient markets, as it could be an inequality, indicating an over- or under-estimation.

Just as relevant as legal aspects are the political systems, cultural traditions, ethical values, and others that are normally considered to be neutral in market theory. However, their consideration in Applied Finance when making decisions could lead to new distances between the company's value and market price. If the consumer product and financial asset markets are developed within the perfect competition model, the value of the business would be the same as its market price, as represented by the price of its stocks. Companies that are not private limited corporations do not have a clearly determined market price determined by the interaction of a group engaging in the supply and demand of its stocks. In this case, the company's value plays a fundamental role; examples of this situation are small and medium-sized family businesses and legally organized partnerships such as collective partnerships with limited responsibility or cooperatives. In this type of organization, Applied Finance does not always respond to the theoretical models generated by Finance Theory, since the latter is based on the market prices of the financial assets, which are clearly determined, theoretically, on a competitive value market.

The discipline known as Public Finance, on the other hand, deals with investments in assets and their financing by public entities. This type of Finance is more associated with public policies and conceptually combines an asset's intrinsic value with its price for those assets traded on a competitive market. Normally, Public Finance refers to services and not tangible products. The relevance of public actors to Public Finance and the occasional lack of competitive markets for their services explain the greater difference between the intrinsic values and prices of the assets. This also causes the occasional lack of coincidence between Finance Theory and Public Finance. As with Applied Finance, Public Finance cannot consider variables that are determined by the regulatory and legal systems or by the cultural and political systems to be constants. In this sense, Public Finance clearly differs from Finance Theory, which does not consider these last variables mentioned or the environment in which they are developed, but rather assumes that they are included in the price of the financial assets.

4.2. Towards an integrated explicative Finance model

The Applied Finance approach is defined as a set of topics that includes Applied Finance, Public Finance, and Finance Theory. Thus, we can conclude that these three branches coexist simultaneously and that the role of each one is differentiated essentially by the concept of a financial asset's intrinsic value and respective price, that latter being freely determined on the stock market. In a particular case of perfect competition, price equals intrinsic value so the approach should be coincident. Nonetheless, a set of variables that explain the real markets does not necessarily coincide with the aprioristic concept

of perfect competition. Because this set of variables or real facts that affect the formation of prices is not considered, the models do not always totally explain the economic phenomenon at hand, a situation that can occur for the two following reasons:

    a) these facts are incorporated into the models if they can be measured and turned into parameters.

    b) these are qualitative facts or difficult to measure objectively, so that their inclusion in Finance Theory models is not viable. In this case, the study of these facts cannot be ignored and an appropriate methodology that allows their inclusion must be found.

Parada (2000) developed a set of elements that make up the values market. They are:

$$SI = \{F, E, G, RW\} \tag{1}$$

where:

SI = The set of savings and investment units;
F = the set of families and person;
E = The set of public and private enterprises;
G = the central government and parliament; and
RW = the institutions of the rest of the world.

$$T = \{FE, I, MI, SR, RIU\} \tag{2}$$

where:

T = The set of economic technology;
I = the set of informational methods;
FE= the set of financial engineering;
MI = management of investments and financing;
SR = scientific research methods, and
RIU = research centers and universities.

$$IS = \{L, IR, TX, RP, ECV, IN, CS, SS\} \tag{3}$$

where:

IS = The set of institutions and institutional structure;
L = legal system of the country;
IR = the set of internal regulations of the stock market;
TX = the legal tax system;
RP = relationships of political power (corporate control);
ECV = ethical, cultural, and historical values;
IN = intermediaries (stock brokers and banks);
CS = country size (measured in economic variables); and
SS = stock market size (transaction levels, number of traded assets, and number of investments).

The elements of these sets (savings and investment, technology, and institutions and institutional structure) are part of a country's economic system. Their components are directly involved in the development of the economy, both private as well as public. Therefore, any governmental business policy, private or public, takes the elements of these three sets into consideration.

The three sets could generate financial assets but they can only be traded on a market where the investors have all the information.

The following definitions were used to formulate the Propositions:

$\{SI \cup T \cup IS\}$= set that represents the socioeconomic system of a country.

$\{SI \cap IS\} = U_1$= set of valid financial assets in a political and economic system.

$\{SI \cap T\} = U_2$= set of financial assets with possibilities for stock trading.

$\{IS \cap T\} = U_3$= set of valid financial assets in the economic and institutional system.

$\{U_1 \cap U_2 \cap U_3\} = U_4$= set of financial assets traded on the stock market, considering explicit and simultaneous political, legal, economic, and social organization variables that are incorporated in the price of the assets.

The sets U_1, U_2, and U_3 are defined so that, when considered individually, they do not exist in an efficient market because each omits the information of the other sets, causing investors to make imperfect decisions. The information in set U_4, the intersection of the three previous sets, is complete, as it includes the common elements of all the sets considered.

Figure 1: Venn Diagram. Finance Set.
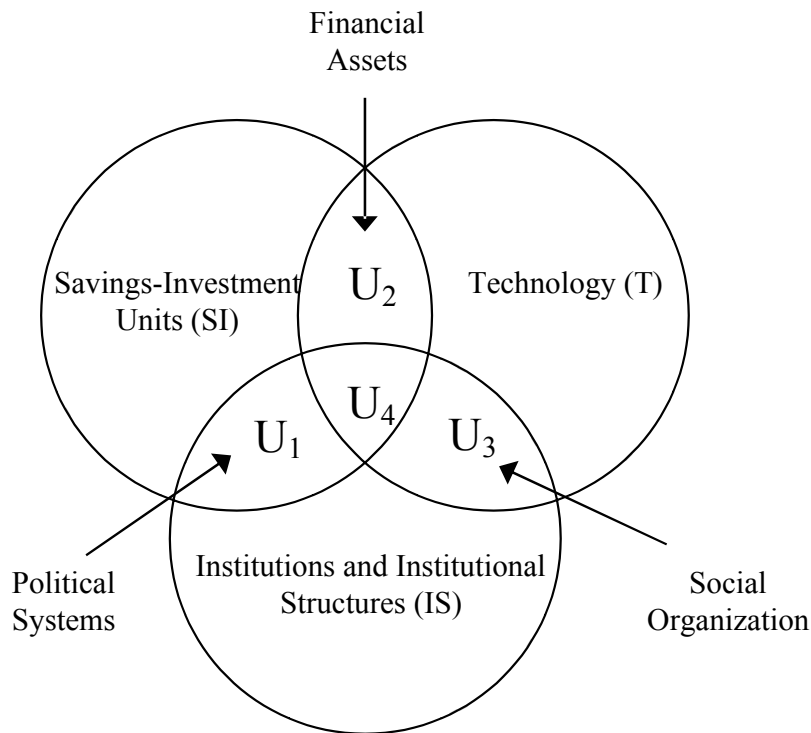
The definitions used require that it be determined whether the intersections indicated contain common elements or whether they form an empty set. The following shows that elements do exist in the intersections, using the following conjecture:

$\exists$ (SI $\cap$ IS), so that: (SI $\cap$ IS)$\neq\varnothing$?

Proof:

Through algebra, we know that: (A$\cap$B) $=\varnothing$ $\Leftrightarrow$ (A$\cap\varnothing$) $=\varnothing$ for any A and B.

So if (SI$\cap$IS)$\neq\varnothing$, then "x" is defined as any financial asset, so that x$\in$(SI $\cap$ IS) => x$\in$SI and x$\in$IS, but this exists by the definition of SI, so that if IS$\neq\varnothing$, then $\exists$ un x$\in$IS => (SI $\cap$ IS) $\neq \varnothing$, for which the intersection between the two sets exists. Likewise, it can be shown that (SI $\cap$ T) and (IS $\cap$ T) exist, showing that they intersections are valid.

When analyzed individually, the sets $\{U_1 - U_4\}$, $\{U_2 - U_4\}$, and $\{U_3 - U_4\}$ do not consider variables from the rest of the stock market. This implies that the investors are influenced by incomplete information, resulting in an intrinsic value for each financial asset in each set that could differ from the respective price. This value depends on the expectations generated by each of the investors with incomplete information. Since the assets have values rather than prices, they fall into the area of Public Finance and Applied Finance, two branches that, when considered theoretically, work conceptually with the intrinsic value of a financial asset. This is an intellectual, as opposed to a rationalist, perspective of complete competition in which the price is a synthesis of value and therefore the two are the same. In Public and Private Applied Finance, the value of a business is a central notion that is determined through the incorporation of different models. Specifically, elements found in the set $\{U_3 - U_4\}$ are simultaneously present in sets T (Technology) and IS (Institutions and Institutional Structure). This field is favorable for topics such as the sociology of investment and psychology of investors.

Proposition I. In the set U_4 there is an efficient stock market.

The following definitions are used for the proof:

$P = \{x_i$: Prices of financial asset i, given $\omega\}$, where ω= set of simultaneous information obtained from the sets SI, IS, and T.

$$V = \{vi:\ v = \int_0^\infty F_i e^{-rt} dt = F/r, \text{ with } \psi \text{ given }\}, \text{ where } v_i = \text{intrinsic value of financial asset i; } r =$$

interest rate; t = capitalization time; and ψ = set of information containing data from SI and T; SI and IS; and IS and T, in U_1, U_2, and U_3 respectively. F_i = expected flow of benefits generated by financial asset i. Therefore:

$v_1 = F_1/r$ = intrinsic value of financial asset i, formed by the information available from the dataset of SI and IS.

$v_2 = F_2/r$ = intrinsic value of financial asset i, formed by the information available from the dataset of SI and T.

$v_3 = F_3/r$ = intrinsic value of financial asset i, formed by the information available from the dataset of IS and T.

With $v_1 \neq v_2 \neq v_3$, the investors are making decisions with incomplete information and therefore each has different information.

Proof:

By definition we have: $v_1 \in (SI \cap IS) => v_1 \in (U_1 - U_4) \Rightarrow v_1 \in U_1$ and $v_1 \notin U_4$

$v_2 \in (SI \cap T) => v_2 \in (U_2 - U_4) \Rightarrow v_2 \in U_2$ and $v_2 \notin U_4$

$v_3 \in (IS \cap T) => v_3 \in (U_3 - U_4) \Rightarrow v_3 \in U_3$ and $v_3 \notin U_4$

That is: $(v_1, v_2, v_3) \notin U_4$; as $U_4 = (U_1 \cap U_2 \cap U_3) \Rightarrow (v_1, v_2, v_3) \notin (U_1 \cap U_2 \cap U_3)$

On the other hand, so that: $SI = (v_1, v_2)$; $IS = (v_1, v_3)$ and $T = (v_2, v_3)$. However, if $x_i \in U_4 \Rightarrow x_i \in (U_1 \cap U_2 \cap U_3)$. But we know that $(v_1\ v_2, v_3) \notin U_4$. Therefore $(v_1, v_2, v_3) \in U_4 \Leftrightarrow (v_i = x_i)$. If this, then $(v_1 = x_1, v_2 = x_2, v_3 = x_3)$, that is $v_1 = v_2 = v_3 = x_i$.

The last relationship would only be possible on an efficient capital market, where the price simultaneously includes all the information from SI, IS, and T. So $(U_1 \cap U_2 \cap U_3) = U_4$, necessarily represents an efficient market when $\{v_i\} = \{x_i\}$, which is the condition proposed; that is, the price of the financial asset is the same as its intrinsic value, which is determined by the expected flow of benefits (F) capitalized at rate r.

Proposition II. Finance Theory, given perfectly competitive and efficient markets, only occurs in the intersection of the sets U_1, U_2, and U_3 coinciding, in this case, with Applied Finance and Public Finance.

Proof:

Let: $V = \{v_i | \ v \in R, i = 1, n\}$, where v_i is the value of asset i assigned by any investor, with: $v_1 \in U_1$, $v_2 \in U_2$, and $v_3 \in U_3$. $V \subseteq \{j_i$: i = 1, n; j_i = intrinsic value of financial asset i determined according to the methodological approaches of Applied Finance and Public Finance$\}$

If:

$v_1 \in U_1 => v_1 \in (SI \cap IS) => v_1 \in SI$ and $v_1 \in IS$ (4)

$v_2 \in U_2 => v_2 \in (SI \cap T) => v_2 \in SI$ and $v_2 \in T$ (5)

$v_3 \in U_3 => v_3 \in (SI \cap T) => v_3 \in IS$ and $v_3 \in T$ (6)

Of 4, 5, and 6 we know that $SI = \{v_1, v_2\}$; $IS = \{v_1, v_3\}$ and $T = \{v_2, v_3\}$. So we know that: $\{SI \cap IS \cap T\} = \{v_1, v_2, v_3\}$.

From the above, we know that: $(SI \cap IS) \cup (SI \cap T) \cup (IS \cap T) = \{v_1\} \cup \{v_2\} \cup \{v_3\} = \{v_1, v_2, v_3\}$

Let "u" be the value of any other financial asset, determined by different methods of Business and Public Finances, with $u \in (SI \cap IS) \cup (SI \cap T) \cup (IS \cap T)$ (1), then $u \in SI$ and $u \in IS$; or $u \in SI$ and $u \in T$; or $u \in IS$ and $u \in T \Rightarrow u \in (SI$ or $T)$ and $u \in (IS$ or $T)$ and $u \in (SI$ or $IS) \Rightarrow u \in (SI \cup T) \cap (IS \cup T) \cap (SI \cup IS) \Rightarrow u \in (U_1 \cap U_2 \cap U_3) = U_4$. So U_4 contains different values of financial assets, whether

determined by Business and Public Finance methods or not. But we know from Proposition I that for $P = \{p_i: p \in R, i = 1, n; p = \text{the price of a financial asset}\}$ with $P \subseteq \{yi: i = 1, n; y_i = \text{the price of financial asset } i$ according to Finance Theory$\}$, and given that: $p_1 \in (SI \cap IS)$, $p_2 \in (SI \cap T)$, and $p_3 \in (IS \cap T)$ $\Rightarrow SI \cup T = \{p_1, p_2, p_3\}$, $IS \cup T = \{p_1, p_2, p_3\}$ and $SI \cup IS = \{p_1, p_2, p_3\}$, from this, we know that:

$$(SI \cup T) \cap (IS \cup T) \cap (SI \cap IS) = \{p_1, p_2, p_3\} \cap \{p_1, p_2, p_3\} \cap \{p_1, p_2, p_3\} = \{p_1, p_2, p_3\} = U_4$$

So the set formed by the intersection of U_1, U_2, and U_3 is made up of any values "u" that do not necessarily coincide with the prices. Given an efficient and competitive capitals market, then we know that: $P = \{p_i| p \in R, i = 1, n\}$, where p_i = the price of financial asset i. Thus, U_4 contains the sets P and V, and given an efficient and perfectly competitive market so that $P = V$, then Finance Theory (represented by set P) will coincide with Business and Public Finances (represented by set V), which is what we wanted to show.

Therefore, the U_4 intersection is only represented by prices that coincide with the values of the assets; that is, Finance Theory is only valid in the intersection. Otherwise it would not be possible to assure that $V = P$ in the complementary sets, which validates that, when price and value coexist simultaneously, the other sets best represent the other Finance areas. The definition of Applied Finance states that its central concern is the value of the business and that the underlying models normatively impose the condition that the price of the financial asset be the same as its value.

Proposition III. The area of Applied Finances (AF) is represented by the set:

$$\{(U_1 - U_4) \cup (U_2 - U_4) \cup (U_3 - U_4)\} = \{U_1 \cup U_2 \cup U_3 \cup U_4\}.$$

Proof:

Let x be the value assigned a financial asset by the investor, where $x \in AF \Rightarrow x \in U_1$ and $x \notin U_4$, or $x \in U_2$ and $x \notin U_4$, or $x \in U_3$ and $x \notin U_4$. This $\Rightarrow x \in U_1$, $x \in U_2$, $x \in U_3$, and $x \notin U_4 \Rightarrow x \in (U_1 \cup U_2 \cup U_3)$ and $x \notin U_4$. But from Proposition I, we know that $x = p$, where p = the price of this financial asset, so also $x \in U_4$, for which $x \in \{U_1 \cup U_2 \cup U_3 \cup U_4\}$. So the union of these three sets is made up of financial assets and over these the values that each investor assigns them over their price. On a competitive and efficient market, this value could coincide with the price. When using the value of the asset as a reference, it is understood as the conceptual bodies of Applied Finance and Public Finance.

According to Proposition III, the general Finance body is made up of a set of branches that are considered to be separate: Applied Finance, Public Finance, and Finance Theory. The concept of intrinsic value essentially dominates both Business and Public Finances. This does not mean that prices are absent, but rather gives an indication of the real world; that is the approach is based more on intellectualism than on the rationalist model of perfect competition. Because Finance Theory tends to simultaneously consider the variables from all the sets that make up the stock market (sociocultural, normative, and social organization aspects), it tend to incorporate the price over the value.

5. Conclusions

Although its doctrinal and methodological body is derived from the Theory of Knowledge, Finance cannot be specifically identified with just one area of this theory as can some other sciences. Rather, Finance is a mixture, a hybrid, of Intellectualism and Apriorism. This is a common characteristic of Economics, from which Finance's doctrinal and methodological approaches are derived. This observation clarifies both its meaning and limitations, especially in the interpretation of different authors regarding the use of the term *rigorous* in Finance, specifically in Finance Theory, and the necessary use of models to explain the central phenomenon: stock price behavior.

Thus, all the branches of Finance (Applied Finance, Public Finance, and Finance Theory) coincide only in the Perfect Efficient Market Model. The central aspect of these derivations is that both the price of the stock and its intrinsic value comply with the doctrinal body of Finance.

References

[1]   Black, F. and Scholes, M. (1973), "The Pricing of Options and Corporate Liabilities", Journal of Political Economy 81(3), May-Jun. Pag. 637-654.

[2]   Copeland, T. and Weston, F. (1992), Financial Theory and Corporate Policy. Addison-Wesley Publishing Company, N. York, Third. Edition.

[3]   Dagum, C. (1995), "Alcance y método de Economía como ciencia", El Trimestre Económico, Vol. LXII (3), Jul-Sep, No. 247, Pag. 297-336.

[4]   Edwards, R. and Magge, J. (2001), "Technical Analysis of Stock Trend", Eighth Edition, St. Lucie Press (www.crcpress.com).

[5]   Fama, Eugene (1970), "Efficient Capital Market: A Review of Theory and Empirical Work", Journal of Finance, May, Pag. 383-417.

[6]   Fama, Eugene, (1976), Foundations of Finance, Basic Book, Inc. Publishers. N. York.

[7]   Focardi, S. (1996), "From Equilibrium to Non-Linear Dynamics in Investment Management", The Journal of Portfolio Management, Vol. 22 (4), Summer, Pag. 19-30.

[8]   Hagstrom, R. (1995), The Warren Buffet Way, John Wiley & Sons, Inc.

[9]   Herandez, R., Fernández, C. and Baptista, P. (1994), Metodología de la Investigación, McGraw-Hill. Mexico.

[10] Hessen, J. (1925), Teoría del Conocimiento. 3rd Reprint, Editores Unidos, Mexico, 1993.

[11] Huang, Ch. and Litzenberg, R. (1988), Foundations for Financial Economics, Edit. Prentice-Hall.

[12] Jarrow, R. (1988), Finance Theory, Prentice-Hall International Editions. Y. Yersey.

[13] Koopmans, T. (1980), "Three Essays on the State of Economic Science". McGraw- Hill Book Company, Inc.

[14] Malkiel, B. (1996), A Ramdom Walk Down Wall Street. W.W. Norton and Company, Inc. USA.

[15] Marshall, A. (1920), Principles of Economics, London, MacMillan and Co. Ltd. Bokk III.

[16] Merton, R. (1992), Continuous-Time Finance. Blackwell Publishers Inc.

[17] Parada, J. R. (1989), "Evolución de la Teoría Financiera en las últimas décadas", Economía y Administración, Year XVIII, No. 36, June, Concepción, Chile, Pag. 51-56.

[18] Parada J. R. (1998), "Teoría Financiera y su método", Economía y Administración, Year XXXV, No. 50, June, Concepción, Chile, Pag. 61-78.

[19] Parada J. R. (2000), Teoría Financiera Moderna, Editorial LexisNexis, Santiago, Chile.

[20] Russell, B. (1996), "An Outline of Philosophy", George & Unwin Ltd., (1927), Reprinted by Routledge, 1996.

[21] Sharpe, W. (1976), Portfolio Theory and Capital Market, McGraw-Hill Book C. N. York.

[22] Schumpeter, J. (1954), History of Economic Analysis. Oxford University Press, Inc.