

# SCIENCE, ART, AND INVESTMENT MANAGEMENT

By Nathan Jaye, CFA

**Are changing opinions about investment theory and practice altering the way hiring firms look at candidates?**

**Two researchers share their findings.**

Is investment management a science or an art? And how have recent events, especially the global financial crisis, changed the consensus about the correct relationship between theory and practice? To answer such questions, three authors teamed up to investigate the state of investment management's body of knowledge, how it should be taught by business schools, and what attributes investment firms are seeking in job candidates. Their analysis and conclusions are reported in the recent book *Investment Management: A Science to Teach or an Art to Learn?* published by the CFA Institute Research Foundation.

In this *CFA Institute Magazine* interview, two of the authors—Sergio Focardi (visiting professor of finance at Stony Brook University) and Caroline Jonas (managing partner with The Intertek Group in Paris)—discuss the implications for the investment profession. Because each addressed different facets of the topic, the interview is presented in two parts.

# Broad Vision and Rigorous Analysis

"Recent crises have made employers more skeptical of persons with sophisticated mathematical skills but no economic or business understanding," says Caroline Jonas, managing partner of The Intertek Group in Paris.

## What are asset management HR managers looking for in candidates?

It's difficult to offer a general answer to this question. Much depends on the style of management—for example, traditional versus quant. But I think it's fair to say that there is a sort of rebalancing going on. Most persons we talked to at asset management firms remarked that they are looking for candidates that combine solid economic reasoning, including an understanding of the global macro and the geopolitical, with the ability to work with statistics and modeling, understanding that a statistic or a modeling result always requires a critical evaluation. Even for quants, firms are looking for people with broad vision, able to formulate judgments on the global macroeconomic environment.



Caroline Jonas

## How is what they are looking for changing?

Again, one big change we noted in doing the study was the emphasis asset managers now put on sound macroeconomic reasoning. Together with that, certainly, the amount of data now available makes it imperative for anyone wanting to work in the industry to be able to work with data, to determine patterns in data and separate signal from noise. Even fundamental managers now run their data through models and screening and are trying to learn how to read the data using analytics.

## Are engineers, mathematicians, and physicists as sought after as previously?

I would say yes, with a caveat: Candidates must also show economic understanding. Certainly, such areas as multi-asset or systemic fund management, market and credit risk measurement, or derivatives pricing will always require persons with a high level of mathematical skills. And note that these areas are those that are growing in the industry. However, recent crises have made employers more skeptical of persons with sophisticated mathematical skills but no economic or business understanding.

## Is there a tradeoff between business school training and out-of-the-box thinking?

I think it's fair to say that in an industry dominated by the need to outperform one's competitors, out-of-the-box thinking is appreciated only if it helps identify profit opportunities that others have not found. The teaching in finance programs tries to give students the classical intellectual tools to find sources of profit.

## Is macroeconomic theory (and historical perspectives on it) undervalued by job seekers? How sought after is this knowledge by employers?

It's not so much a question of macroeconomic theory as of macroeconomic understanding, reasoning. The theory doesn't really bring much to the job. What matters is that the future investment professional have the ability to reason on how changes in the geopolitical environment, the economy, trade patterns, trends in specific industry sectors, and so on might impact a given portfolio. Such an understanding is essential to protecting the client's investments—and his or her [the investment professional's] job and the firm's business.

## What qualities in job applicants are in shortest supply?

Persons we talked to said that the skill most difficult to find in a candidate was the ability to combine reasoning on the "big picture," the global macroeconomic outlook, with the ability to make a rigorous analysis, including the ability to use, or at least understand, model results and their eventual shortcomings.

## Which attributes are overabundant in the industry?

None! Perhaps what are overabundant are applicants for jobs in the industry. Like finance in general, there are more applicants than job openings in investment management. A job in asset management is attractive—it is intellectually challenging and financially rewarding. But while schools continue to form students for jobs in finance, jobs in asset management are still not back to their pre-crisis levels.

## What's a description of the ideal candidate—if there is one?

It's difficult to describe an ideal candidate given the variety of jobs, for example, in client relations, marketing and sales, fundamental analysis, systemic management, or risk management. I think it's fair to say that all would need a good macro understanding, some statistical and mathematical skills, and the ability to use technology, but the balance will depend on the specific job, which is great because that leaves the door open to many profiles.

## How much added value are top schools and MBA programs delivering to job applicants?

That's a difficult question. I suppose it varies from one country to another, one firm to another, and among jobs. Clearly, in the United States, those holding an MBA are sought after for jobs in marketing and sales while engineers, mathematicians, and physicists are more sought after for the quant-oriented jobs. In Europe, with perhaps the exception of subsidiaries of US asset management firms, the MBA is not so important. The economics and finance departments of universities form students for jobs in finance—typically with a sound grounding in macroeconomics.

Certainly, firms do not want to pay for value that is not

delivered, any more than they want to overpay for the assets they invest in. While we didn't get much feedback on specific evaluation programs, it's clear that HR tracks the performance of recent graduates, the schools they come from, and their pay relative to their performance. One comment often heard is that recent hires that come from MBA programs have high expectations in terms of salary and a fast career path, which means that to deliver added value, they have to outperform candidates without an MBA. Some persons we talked to reported that this is not necessarily the case. Another remark with a bearing on the return on investment is that MBA candidates tend to be more ideological, arrogant, and unlikely to change their minds when confronted with others' opinions or new information.

### **What are some "untaught" skills that companies are looking for?**

Certainly, the ability to think out of the box is not a skill typically taught to students of finance! Finance tends to be taught dogmatically in terms of theories—often nonvalidated theories—such as efficient markets and the capital asset pricing model. This does not encourage students to be open minded, to examine alternative ways of thinking about a problem. Of course, being too open minded might not always be an advantage in an organization!

### **How impressed are HR managers with the CFA designation?**

What we heard for this study—and, by the way, for past studies—is that the CFA designation is an important indication of a commitment to the profession and the willingness to continue to learn. The latter is particularly important in an industry where nothing stands still. Financial innovation is high, and the global macro environment and technology are continually changing.

### **What surprised you about responses from HR managers?**

HR managers—and indeed the whole industry—seem to put much more emphasis on the need for global macroeconomic reasoning, while this seems to be the poor stepchild of most academic programs.

## **Market Noise and Complex Reasoning**

**"To gain a better understanding of markets, we would need a more robust theory based on a different type of mathematics," says Sergio Focardi, visiting professor of finance at Stony Brook University.**

### **Should finance professors teach market efficiency as a timeless truth, an idea found to be deeply flawed, or something in between?**

It really depends on how market pricing efficiency is taught. In my opinion, the classical, mainstream concept of market

efficiency is flawed. Let me explain why. According to the original definition of efficiency introduced by Eugene Fama, markets are efficient if prices reflect all available information. Translated into the language of mainstream finance theory, market efficiency means that actual prices are equal to theoretical prices. But there is no agreement on theoretical prices, so we can't really teach market efficiency as the timeless truth that actual prices equal theoretical prices. It is an idealization.

More recently, market efficiency has been recast as the unforecastability of returns. Now, if markets were efficient in the sense that actual prices always equal theoretical prices, then returns would indeed be unforecastable. But the contrary is not true. Returns can be unforecastable without implying that prices reflect a theoretical value. So, if we teach that market efficiency means the unforecastability of returns, we have to be careful not to confuse this concept with the classical concept of market efficiency.

The notion of market efficiency as unforecastability of returns might create some confusion. The classical argument in favor of the unforecastability of returns dates back to Paul Samuelson's 1965 paper "Proof That Properly Anticipated Prices Fluctuate Randomly [*Industrial Management Review*, Spring 1965]." Samuelson's argument does not rely on the notion of theoretical prices but runs like this: If returns were forecastable, then investors would immediately try to exploit their forecasts to make a profit or avoid a loss and, in so doing, would invalidate the forecast. This argument is very general; it applies to any forecast made by an intelligent processor of information whose action can change the course of events. For example, if I can forecast that tomorrow a car will hit me when crossing a given street, I will not cross that street, thereby invalidating my forecast.

Students of investment management should understand the difference between forecasting stock prices, which leads to the unforecastability of returns but does not imply theoretical prices, and forecasting future cash flows, which leads to theoretical prices and implies the unforecastability of returns.

Forecasting is a fundamental concept in finance. Basically, every task in finance depends on the ability to forecast the future. In a broad sense, forecasting is the basic task of science. The objective is to determine what will happen in the future or what is happening in other places, having knowledge of events here and now. Students should grasp the central role of forecastability and its limitations, including the fact that any notion of perfect forecastability, even in a probabilistic sense, is subject to potential contradictions.

As with many other concepts in finance, the forecastability of returns is a purely intellectual concept. In practice, no investor can make perfect forecasts of returns as we cannot make perfect forecasts of future cash flows on which returns depend.

Market efficiency is an approximate quantitative concept that implies that markets are difficult to forecast and



Sergio Focardi

that, generally speaking, prices are equal to a valuation on which there is substantial agreement. In some conditions, it's very difficult to make forecasts and markets are said to be efficient. In other conditions, markets are easier to forecast and there are profit opportunities, which is to say that markets are less efficient. But these are pragmatic concepts, difficult to formalize.

### **Is finance theory an empirical science or more of a social science?**

I think it's fair to say that it's a mix of both. Finance theory is the theory of the behavior of a human artifact—financial markets—but the laws of financial markets and financial markets themselves are subject to change. A number of facts related to financial markets are pretty general and can be handled with the methods of empirical science. For example, we can empirically ascertain with some degree of accuracy the probability distribution of returns and other facts, such as cointegration or regime shifting of financial time series. These facts are not the universal laws that we have in the hard sciences but can be modeled as empirical regularities, albeit with uncertainty. Tick-by-tick data (frequently referred to as ultra-high-frequency data) provide a database with strong empirical regularities. We have a reasonably good idea of the behavior of high-frequency data, including the distribution of the time between successive market orders and many other facts.

But political or social changes with a bearing on financial markets are not so easy to model. In many instances, we need complex reasoning, which is very difficult to formalize. It's in such circumstances that finance becomes more of a social science, requiring broader knowledge (such as the history of economic thought or the history of economics and finance) and, incidentally, more creative thinking.

It's interesting to note that while most today would agree that a scientific theory requires empirical validation, there is a strain in economic thought going back to the Austrian economist [Ludwig] von Mises (and shared by some contemporary mainstream economists) that the study of the economy can be done with idealized models and thought experiments and that our theory does not need empirical validation.

### **Does finance theory have "physics envy"?**

Well, that has been suggested, hasn't it? Finance theory has created huge mathematical frameworks, similar to those of physics, especially in the realm of derivatives. Macroeconomics has done the same. But by the standards of modern physics, the validation of our finance theory is very weak. As remarked by the late Fischer Black in his famous paper "Noise," by the very nature of financial markets, little information is available; noise, which is the term we use for unpredictable disturbances, prevails.

It's difficult to believe that the motivation for building this huge conceptual edifice, which has such a weak empirical basis, was "physics envy." Actually, the mathematization of, for example, derivatives pricing, although scientifically weak, has opened the door to a very profitable business for some financial firms. Another example is the CDO

(collateralized debt obligation) and other more complex contracts behind the subprime mortgage crisis that brought on the recent financial crisis. Thomas Kuhn's classical analysis of scientific revolutions made clear that behind the adoption of scientific theories there are political and economic considerations as well as purely intellectual ones. Physics envy is only one, but perhaps not the strongest, motivation behind the adoption of the framework of classical physics in finance.

### **How problematic is it that many economic and financial terms are not observable?**

Any empirical science is based on observables. In physics, many terms are not directly observable but are linked to observables through the theory itself. Temperature is one such term. What we observe is not the temperature itself but the readings of an instrument, in this case, of a thermometer. These readings are connected by the theory. Any meaningful physical theory must be observationally complete.

In finance, there are terms that are neither observable nor able to be linked to observables through the theory itself. Any formulation of a theory based on terms that are intrinsically not observable is intrinsically weak. Consider, for example, a notion such as the "infinite stream of future cash flows" originated by an asset. Well, as you might imagine, an infinite stream of cash flows is not observable, nor are the utility functions of market participants.

In practice, "proxies" are used. But a proxy is not a theoretically well-defined term. To use a proxy would require a theory of the proxy—clearly an oxymoron. Again, we encounter another weakness of our mathematical theory: a theory that relies on a proxy for key terms is a weak theory.

### **Is there an overreliance on mathematics in the teaching of finance?**

That's a difficult question. The problem is not with the teaching of finance but with the theory itself. For example, the mathematization based on the representative agent is problematic because, as demonstrated by a famous theorem of Sonnenschein, Debreu, and Mantel, we cannot consistently aggregate utility functions. Or consider the so-called volatility smile—it's clearly an indication of the uncertainties in derivatives pricing.

Despite the lack of true scientific validation of our theory, mathematization has created significant profit opportunities—at least for some players. The incentive to abandon a scientific paradigm that supports a profitable business is understandably low. But from the scientific point of view, if we want to gain a better *understanding* of markets, we would need a more robust theory based on a different type of mathematics, likely more in line with the theory of complex systems or even biomathematics. But personally, I don't think we're anywhere near achieving this.

Also, don't lose sight of the fact that finance departments at business schools and universities prepare students for jobs in the industry, so it's important for them to ensure that their graduates have the skillset the industry requires, even if the validity of the theory taught and the appropriateness of the math are questionable. Certainly, for those students

wanting to go into a job that requires a lot of math, such as derivatives pricing, systemic or multi-asset fund management, or risk management, one cannot say that there is an over-emphasis on teaching mathematics.

That being said, professors of finance and investment management should make students aware of the limits of methods currently used and perhaps progressively introduce students to a different type of mathematics that might better capture the complexity of financial markets and investment decision making.

### **Are we seeing a sea change in finance theory—or just the onset of a newer generation of theorists (because as physicist Max Planck once said, "Science advances one funeral at a time")?**

Actually, we're seeing surprisingly little change if you consider that over a period of 20 years, we have had at least three significant stock market crashes, that of 1987, the collapse of the dot-com bubble between 1999 and 2001, and the more recent crisis originating with subprime mortgages. Market crashes are not taken into consideration by neoclassical finance theory, which is deeply rooted in the notions of rational expectations, optimization, and equilibrium. Finance departments are staffed with professors versed in neoclassical finance theory; business schools and universities are reluctant to make radical changes in their finance programs; and innovative theories and mathematical approaches have difficulty getting published in mainstream journals. We've seen a lot of *technical* innovation with, for example, derivatives pricing, high-frequency trading, and CDOs but little innovation as regards the fundamental theory. For example, despite the most recent financial crisis, the role of the banking system or liquidity in determining asset prices is generally neglected in standard courses and in research papers.

### **Are we seeing a reexamination of the "dominant thinking?" What does that mean?**

I think it's fair to say that most of the reexamination of the dominant thinking is coming from the domain of economics, where a number of leading academics are questioning the foundation of the prevailing economic theory. Perhaps the most radical innovation is to consider any economy as a complex system made of many interacting agents. Ironically, this idea is not new. It comes from Adam Smith! Smith conceptualized markets as complex systems governed by an invisible hand. Later, the liberal Austrian economist Friedrich Hayek advanced the idea of the economy as a system made up of independent units. These ideas, however, were lost in mainstream economics.

In finance theory, some attempts are being made to "complete" the theory (for example, adding liquidity and the banking system). But as far as I know, there is little questioning of the fundamentals.

### **How much have closed-end publication policies affected finance theory?**

Unfortunately, closed-end publication policies have put a damper on what many consider to be the necessary reexamination of some of the fundamentals in our finance theory. Academic careers depend on publication in a number of "select" journals. These journals are typically edited by mainstream economists or finance theorists. Referees are chosen from among mainstream theorists. As a result, innovative papers that poke holes in mainstream theory tend to get rejected. Even papers that report empirical facts—if the findings cannot be explained by or are in disagreement with mainstream theory—get rejected. As a result, many researchers have to publish their work in journals such as *Physica A*, but these publications have little impact on the dominant thinking and are typically not read by the profession.

The result is that young economists and finance theorists who want to make a career in these disciplines tend to research subjects and publish papers that are not controversial. We see many papers that are technically brilliant but that lack the fundamental spirit of research by accepting the usual long list of what I would call false assumptions.

### **Is diversification still considered universally beneficial?**

Generally speaking, a well-diversified portfolio is better than a poorly diversified one. In this sense, diversification certainly is not dead. However, blind reliance on diversification is by now an obsolete thing of the past. Perhaps what was lacking earlier in the practice of diversification was the notion of changing market conditions. A dynamic view of the markets calls for reviewing the allocation of assets as market conditions change. The dominant paradigm now is dynamic asset allocation, which we might simply call dynamic diversification. Of course, dynamic asset allocation does not have the simple robust character of naive diversification. It implies dynamic forecasting of returns over different time scales and complex optimization methods.

### **What is trend diversification? How is it implemented?**

Asset prices follow what we call local trends; that is, the average value of returns remains constant or nearly constant for a while and then changes to a different value, positive or negative. This is what gives the central direction of prices. But generally speaking, all asset classes do not trend in the same direction (that is, up or down). Just like with classical diversification, where you do not want to put all your eggs in one basket, so with trend diversification, you do not want to put all your assets in classes that trend in the same direction. There might well be extended periods where most return trends are negative, but there must be some asset classes where the return trend is positive. The objective, of course, is to diversify on asset classes that do not trend in the same direction. Trend diversification can be implemented, for example, by clustering time series of prices around common trends.

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