History Versus Science

There is a history of science, but there is no science of history. There is data of history, but there is no meaningful scientific theory of history. A theorem is a generally accepted statement about reality that has been verified by rigorous empirical testing, and it may be supplanted by a better theory or rejected by newer data. History does not repeat itself, but the laws of science describe and explain predictable, replicable phenomena.

An Introductory Analogy

A comparison can be made between temperature measurements in degrees Fahrenheit and the same temperature measurements in degrees Centigrade. A statistical correlation analysis can be made between the same temperature measurements in Fahrenheit and Centigrade degrees. An econometric regression analysis can be made of temperature measurements in degrees Centigrade regressed on the same temperature measurements in degrees Fahrenheit. Any of these three studies can be called historical analysis. Yet none of these studies is scientific, and none of them are logical. This conclusion about the relationship between temperature measurements in Fahrenheit and in Centigrade degrees is also true about relationship between temperature and degree-days.

Likewise, a comparison, statistical correlation or econometric regression analysis can be made between stock returns on one hand and capital gains and dividends on the other. The same three types of analyses can be made between stock returns on one hand and size (measured by market equity), value (measured by book-to-market equity), price-to-earnings ratio, or dividend yield (dividends-to-price ratio). Likewise, any of these three types of studies can be called historical analysis. And likewise, none of these studies is scientific, and none of them is logical.

The reason is the same in the case of temperature measurements and in the case of stock returns: the alleged relationship being studied is a tautology of vicious, inferential, circular reasoning, in contrast to virtuous, non-inferential, circular reasoning.

Historical Analysis

Some finance authors claim that their academic studies are historical analyses. The phrase "historical analysis" is ambiguous. It can refer to an analysis of history using the tools and techniques of the historian, or it can refer to the analysis of past data in any other discipline using techniques specific to that other discipline. Such techniques include descriptive statistics, inferential statistics and econometrics. There is no place in history, statistics or econometrics for vicious, inferential, circular reasoning.

Productive histories, whether in the vision of Herodotus or the vision of Thucydides, have intellectual substance beyond mere chronological ordering. A professor of finance or financial economics generally does not have the specialized expertise of a professor of history or economic history. A bona fide historian could observe that academic finance has become too much like a religion and not a science.

Finance and financial economics are secondary fields in the primary field of economic sciences. Published empirical scientific studies in finance and financial economics academic journals use econometrics and financial econometrics as part of their analyses to test their hypotheses. Such analyses are historical only in the chronological sense of the past in contrast to the present and the future.

Econometrics is a method of causal inference applied to economics. A large part of econometrics is diagnostic testing of models. Diagnostics can be used to detect and reject fallacies and biases. Fallacies can be identified and removed. Biases can be identified, but

not all biases are avoidable. Avoidable biases can be removed. Unavoidable biases must be reported as part of the research findings in the discussion of diagnostics. In advance of model testing, diagnostics can be used to identify and reject fatal fallacies such as vicious circular reasoning. There is no scientifically valid way to econometrically test models containing vicious circular reasoning, and such models can be diagnosed and rejected before testing.

In both history and science, historical returns can be described using factors alleged to determine returns. There is no logical way to describe historical returns using viciously logically circular factors, and there is no scientific way to describe or explain expected future returns using viciously logically circular factors.

Every field of study has its history and its historical data. Historical data in a scientific field of study can be either historically analyzed or scientifically analyzed. History and historical analysis can be instructive, but only science is reliably predictive.

History and Science Channels

Each scholar of the stock market can choose between two approaches to his or her studies. They can be called the history channel and the science channel. The history channel is for historians. Historians are story-tellers. Historians provide entertainment and subjective interpretations of recorded information about the past. The emphasis of history and historians is data rather than the application of theories. In the history of ideas, the data are the ideas or theories, and there is no application of so-called theories of history. All historical information, necessarily, is past information. The important point about history is that every selection of historical facts is arbitrary in the sense that any other selection of facts can be chosen. What does this imply? It implies that with biased

selection of a sample of data, one can justify any answer to any question, including the question of superior stock returns. And with the history of finance, an author must provide the caveat: Past performance in the stock market is no indication of future results.

The science channel is for scientists in all fields of science including the economic sciences. Scientists provide theories, related theorems, and independently verifiable information. Scientists are logical, causal, inferential experimenters. The proper emphasis of science and scientists is theory, even in empirical studies. Atheoretic studies are suspect. It has been argued that all scientific studies are guided by some theory, even if the theory is not explicitly stated by the investigator who may be unaware of unconscious motives. For quantitative analysis, an economic model is represented by an econometric model. Every econometric model is tested using a sample of data. All such data is past data, and past data, necessarily, is historical data.

To insure that a scientific sample is representative and not biased, the sample can be drawn randomly from a well-defined population that is relevant to the research question. If a convenience sample is used instead of a randomly drawn sample, then at least the sample data can be randomly ordered in contrast to grouped before testing an econometric model.

Harry Markowitz won a Nobel Prize in economic sciences for his Modern Portfolio Theory. William Sharpe won a Nobel Prize in economic sciences for his Capital Asset Pricing Model, an econometric model of expected total return for stock-portfolio pricing. A financial asset pricing model is a model of expected (future) return. It is not a model of historical returns. An econometric model is properly estimated using representative, ungrouped sample data. In addition, to insure that valid inferences can be drawn from the

econometric tests and estimates, there must be no data snooping, factor snooping or model snooping, and all conducted tests must be reported along with their results.

Of all the popular books on stock market investing written by finance and economic professors, very few are known to meet these criteria. The rest are confused and confusing mixtures of fact and fiction. They are false and misleading. They succeed by flattering their intended audiences and thereby ensnaring them in an invisible trap, i.e., without a Ph.D. in economics or equivalent expertise, few investors have the requisite specialized knowledge and ability to detect, discern and diagnose the fatal fallacies in the arguments of these books. *Caveat lector*.

Anecdotal Evidence and Probability

Anecdotes or stories often reveal a lack of understanding about probability. Data mining circumvents probability, and pretends to find something new and surprising that was already known. What is probability? What is a probability distribution? How is a random variable different form an ordinary variable? What is a stochastic equation? What is a random sample? Why is a random sample important? What is a randomly order sampled? Why is a randomly-ordered sample important? It is necessary to understand these and related basic concepts in order to understand econometric models, and in particular, to understand the Fama-French Three-Factor Model of return.

Probability. In math, probability refers to the number of times something is likely to occur over a range of possible occurrences. Probability can be represented by a frequency distribution of outcomes.

An example may help. In one scenario, first you write down a random vehicle license tag number, say USA2005, and second you travel to a large shopping center. What are

the odds of finding a vehicle in the parking lot of the shopping center at the time you arrive with the exact same license tag number? In another scenario, first you travel to the large shopping center and observe at the time you arrive a vehicle with the license tag number USA2005, and second you express surprise that this particular vehicle license tag number out of all possible vehicle license tag numbers was observed by you at that time. What are the odds of that particular vehicle license tag number being there at the time you saw it? Assume there are more than one million vehicles within a one-hour driving time from the shopping center.

The probability in the former scenario is extremely small, less than one in a million. There is no uncertainty in the latter scenario, and thus it is not appropriate to think in terms of probability in that case. It is 20/20 hindsight. A historical datum or anecdotal evidence is certain, and thus it is not a subject of expected future outcomes. The license tag example is analogous to data snooping and data manipulation. Misrepresenting or not disclosing the research methodology and its implications compounds the serious mistake.

Example. The evidence in support of small-cap stocks is often anecdotal in nature. Small-cap stocks, however defined, are asserted to experience greater volatility, however defined, and to earn higher return, however defined, than do large-cap stocks, however defined, during selected historical time intervals, however selected and however defined.

The average-return relationship between small-cap and large-cap stocks reverses when you change one or more of the following elements of the operational definitions of return, size and value:

1. The arbitrary number of categories of market capitalization.
2. The arbitrary choice of breakpoints for small-cap or market capitalization.

3. The arbitrary definition of average volatility, from 1-year to 10-year.

4. The arbitrary beginning date of the historical time period selected.

5. The arbitrary ending date of the historical time period selected.

6. The arbitrary length of each measurement interval from months to years.

7. The arbitrary definition of average expected return, from 1-year to 10-year.

One way to reduce the ambiguity of arbitrary definitions and non-random data selection is to impose in advance some conditions on historical data for making subsequent comparisons and assessments. The following are one set of conditions.

First: Use audited fund data reported in prospectuses or other documents filed with government regulatory agencies such as the U.S. SEC. Do not use database time series.

Second: Use inception-to-date returns, because there is only one inception and there is only one current date.

Third: Use long-term returns, which Messrs. Fama and French and DFA stress in their claims of enhanced performance for investors who buy and hold for the long term (sticky money for greater stability and more fees for mutual funds), with emphasis on funds with at least five complete calendar years of reported results, and with greatest weight on funds with at least 10 complete calendar years of reported results.

Fourth: Use a broad well-diversified market proxy as a benchmark, say, S&P500 or Wilshire 5000 for the USA equity markets.

Fifth: Use the concept of probability and view the data probabilistically instead of deterministically. The stochastic or probabilistic dimension makes a causal inferential econometric model radically different from an acausal non-inferential algebraic equation.

The Fama-French Three-Factor Model is not a valid hypothesis by the generally accepted standards of logic, economic science and econometric science. Most financial economists know this, and all of them have reason to know it.

There are significant differences between database time series returns and audited mutual fund returns. Database returns are calculated from database prices, dividends, and capital changes. Audited fund returns are the result of actual fund investment decisions, and they reflect the following: (i) transaction costs, (ii) liquidity and transaction speed, (iii) fund management fees, (iv) investment adviser fees, (v) taxes, and (vi) stock and fund survival bias.

How Many Years of Data?

One of the biggest strategic distractions in evaluating the Fama-French Three-Factor Model of return or any allegedly scientific stock pricing model is undue emphasis on the number of years of historic data in the sample used to estimate the econometric model equation. As discussed earlier, regardless of the number of historic years covered, data does not explain the fundamental fatal fallacy of the Three-Factor Model, which concerns its logical validity and scientific validity. A sample of any size, say 200 years, still would be insufficient to address the logically prior issue of model validity as opposed to the logically subsequent issue of fitting a model with the sample data.

Why do Messrs. Fama and French suggest that more years of data, in contrast with more-varied data or more-representative data, result in a better-tested model?

Significance. One reason is based on science. Larger samples result in statistically more-significant estimates of model parameters at conventional levels of probability and thus produce publishable research results. Larger samples are independent of so-called

data mining and data snooping, which are not valid scientific research methodology. Data mining is trying every possible model with the hope that at least one will fit the data well). Data snooping is looking at different data in advance to insure it is well explained by the model. With both data mining and data snooping, tests are not reported that either did not result in significant findings or resulted in significant findings from snooped data. Of course, failure to report any and all tests is contrary to valid scientific research methodology, and theory should be the basis of estimation.

Commerce. Another reason is based on commerce rather than science. The leading applied scientific stock portfolio pricing model was the conventional CAPM, and it has only one explanatory variable, the market-beta. Theoretically, market-beta is constant for each firm, but actually it varies over time. Usually, estimates of market-beta for each firm covered five years of its monthly historic data. Publication of the CAPM began a cottage industry of so-called beta shops that provided pre-calculated market-betas for exchange-traded stocks as a commercial data service to subscribers to their financial database. Anyone could get into this business with low entry costs amounting to the most recent five years of stock market price data.

Messrs. Fama and French, by publishing their Three-Factor Model, created a demand for the decile-portfolio data series of the so-called Fama-French factors, the size-related risk factor (small to large cap) and the value-related risk factor (high to low book-to-market equity ratio). This, in turn, increased demand for the monopolistic proprietary commercial CRSP databases that extend back to the early 1920's for U.S. stocks. The Center for Research in Security Prices (CRSP) is a scientific research center at the Graduate School of Business at the University of Chicago that is headed by Mr. Fama.

The pseudo-scientific Three-Factor Model is a case of the tail (CRSP data) wagging the dog (economic and econometric models), and it has an evident, non-logical, non-scientific agenda.

A Concluding Analogy

A turkey getting a free lunch every day expected the daily meal to continue for the rest of its life. Its expectation turned out to be correct, because its head was axed off once it was fat enough to serve as the main course for a holiday feast. Historic data is no substitute for rational, logical, causal thinking. Data for the past 200 years or more are not a sound basis for rational expectations if they contradict logic. In addition, return distributions are Paretian Stable Law, not Normal (the bell curve), and thus have infinite variance, which means an unlimited element of surprise, as the turkey in the analogy learned too late. The central limit theorem of statistics notwithstanding, the Normal distribution is a simplifying assumption required because there is no adequate system of statistics for the Paretian Stable Law distribution. Non-stochastic past performance is no guarantee of stochastic future results. This turkey may have been a practitioner of historical analysis in the sense of history, but it was not a practitioner of logic and science.