

Evolution of Stock Pricing

The need to determine a value in exchange or price began with the earliest trade in ancient times. There were informal markets for livestock over 3,000 years BCE as evidenced by tablets in Sumer for counting sheep in cuneiform. Prices gained in usefulness and importance with the monetization of an economy and the development of organized markets with standardized products, weights and measures. Informal markets include the markets for privately owned companies, in contrast with the stock exchanges and other organized markets for shares of stock in publicly traded corporations.

Commodity prices are expressed as unit prices to enable quick and easy comparisons. The numerator of a unit price is a currency or other measure of value, such as US dollars, and the denominator is a unit of the item being priced. Examples include price per piece, price per pound, price per yard, price per square foot, price per gallon, and price per bushel. Financial assets or claims on physical assets have similar unit prices.

In the first stage of the evolution of the pricing of a company as a going concern, the prices for private companies were expressed in the same way that prices for commodities were expressed, but the units were different. As a result of the invention of double-entry bookkeeping in the 14th century and subsequent improvements, there are three major units and resulting price ratios: price per unit of earnings based on the income statement, price per unit of net worth or book value based on the balance sheet, and price per unit of cash flow based on the funds flow statement. This was not scientific pricing, but it was an advance.

In the second stage, the emphasis shifted from pricing whole companies to pricing shares of business ventures and companies. Stock exchanges for shares in joint stock companies were established, such as the Amsterdam Stock Exchange in the 16th century. Stock market investors followed the unit-pricing practices in the private markets for closely held companies when they expressed share prices in terms of price/earnings ratio, price/book value ratio, and price/cash flow ratio. Because of the greater importance of cash dividends paid to investors in publicly traded companies, price/dividends ratio was included. This was not scientific pricing, but it was a further advance.

In the third stage, the emphasis shifted from heuristics for pricing to scientific measures of prices. Discounted cash flow (DCF) techniques based on the theory of interest and the time value of money led to the Dividend Discount Model (DDM). These DCF techniques are used by John Burr Williams in his 1938 book entitled *The Theory of Investment Value*. Strictly speaking, the DCF techniques are used to determine, not price, but rather the intrinsic value of one investment asset or one individual company at a time. The firm valuation process is different from the stock pricing process, but DCF values can be used as estimates of fair prices. Scientific valuation is more rational and uses the relevant information more efficiently than is the case with non-scientific procedures. DCF techniques for valuation are scientific, and they were a further advance.

In the fourth stage, the emphasis shifted from price ratios for pricing to scientific models for pricing, and from pricing shares of stock in one company to pricing portfolios of stocks in a number of companies, usually publicly traded corporations. This led to Modern Portfolio Theory (MPT) by Harry Markowitz in 1952 (*Journal of Finance*) and to the related Capital Asset Pricing Model (CAPM) by William Sharpe in 1964 (*Journal of Finance*) with its sole explanatory variable, market-Beta. MPT and CAPM are scientific, but they apply only to portfolios of stocks instead of individual companies.

In the fifth stage, the emphasis shifted from scientific models of return for stock portfolio pricing to pseudo-scientific return models for stock portfolio pricing. Similar to the second stage, these models for stock portfolio pricing followed the pricing practices in the private markets for closely held companies, but with a change from unit prices to price yields. Unit prices have company price as the numerator. Price yields or yields on price have share price as the denominator. Price yields are the inverse of unit prices. Some of these return models include risk factors that are price yields, such as book-to-market equity ratio (equal to book-to-price ratio), earnings/price ratio, and dividend/price ratio.

Price-related risk factors in a return model are not scientifically valid, and this is because of the fallacy of circular reasoning. The effect of this logical circularity in a stock pricing model is large, significant, irremediable and thus fatal. These price-related risk factors are claimed to be scientific by their authors, but they are pseudo-scientific. An example is the Three-Factor Model of return for stock portfolio pricing (FF3F) with a market-related risk factor, a fallacious size-related (market capitalization) risk factor, and a fallacious value-related (book-to-market equity ratio) risk factor. The FF3F model was designed by Eugene Fama and Kenneth French in 1992 (*Journal of Finance*). The FF3F model is neither scientific nor rational. The FF3F model is not efficient. The FF3F model is harmful and costly to investors.

Stock investment strategies, stock mutual funds, and other financial products and services based on the size factor, the book-to-market value factor, other price-related factors, and the FF3F model are variations of market timing. They are not rational and not efficient. This is not scientific pricing, and it is a retrograde movement or devolution rather than an advance.

Unlike the stages in biological evolution, these five stages in stock pricing are not sequential and progressive. Once each stage begins, it continues to exist in parallel with the prior stages without extinction and can be regressive.

Technical Note: DDM and CAPM

A DDM is used to estimate the intrinsic value of a single investment asset. A CAPM is used to estimate the average market prices of the risk factors for a portfolio of stocks or other group of financial assets.

A DDM is a mathematical formula or algebraic equation to calculate certain value from correctly identified variables with correctly identified relationships among the variables. It is not a model in the strict sense of causal explanation. In contrast, a CAPM is an econometric, statistical, probabilistic model that is designed to explain expected return and to calculate the average of the parameter associated with each of the necessarily incorrectly specified variables with necessarily incorrectly specified relationships among the variables in the model. If the true identity of the variables and the true relationships among the variables were correctly known, then there would be no need for a non-deterministic model.

A DDM is deterministic. It determines intrinsic value, but does not attempt to explain intrinsic value. A CAPM is stochastic. It attempts to explain expected return, but does not determine expected return. Expected return is not certain return.

A DDM is defined in terms of ordinary variables with known relationships among these variables. A CAPM specifies random variables with an unknown relationship among these random variables. A random variable is represented by a probability distribution, such as Gaussian or Stable Law Paretian, with specific moments (mean, variance, skewness, kurtosis, fifth, sixth, etc.).

A sophisticated form of DDM can include a randomized variable, but this variable is not connected by any causal relationship to the other variables in the algebraic equation. Inclusion of a randomized variable enables the determination of a single expected value instead of a single certain value.

A DDM application begins with a forecast of future cash flows from the investment asset. A CAPM application begins with a sample of historical returns and data observations for each of the explanatory variables or risk factors for each of the individual stocks in a portfolio or for the individual financial assets in a group of such assets for each time period.

A DDM application ends with a single intrinsic value. A CAPM application ends with a set of average parameters with associated standard errors and t-statistics that measure their degree of probability or likelihood.