Finance Theory

Finance theory has a surprisingly short history in economics. Economists have long been aware of the basic economic function of credit markets but they were not keen on analyzing it much further than that. As such, early ideas about financial markets were largely intuitive, mostly formulated by practitioners. Pioneering theoretical work on financial markets, notably that of Louis Bachelier (1900), tended to be basically ignored by theoreticians and practitioners alike.

Portfolio Theory

This does not mean that the early economists ignored financial markets. Irving Fisher (1906, 1907, 1930) had already outlined the basic functions of credit markets for economic activity, specifically as a way of allocating resources over time -- and had recognized the importance of risk in the process. In developing their theories of money, John Maynard Keynes (1930, 1936), John Hicks (1934, 1935, 1939), Nicholas Kaldor (1939) and Jacob Marschak (1938) had already conceived of portfolio selection theory in which uncertainty played an important role.

However, for many economists during this early period, financial markets were still regarded as mere "casinos" rather than "markets" properly speaking. In their view, asset prices were determined largely by expectations and counter-expectations of capital gains and thus they were "held up by their own bootstraps" as it were. John Maynard Keynes's "beauty contest" analogy is representative of this attitude.

As such, a good amount of ink was spent on the topic of speculative activity (i.e. the purchase/temporary sale of goods or assets for later resale). For instance, in their pioneering work on futures markets, John Maynard Keynes (1923, 1930) and John Hicks (1939) argued that the price of a futures contract for delivery of a commodity will be generally below the expected spot price of that commodity (what Keynes called "normal backwardation"). This, Keynes and Hicks argued, was largely because hedgers shifted their price risk onto speculators in return for a risk premium. Nicholas Kaldor (1939) went on to analyze the question of whether speculation was successful in stabilizing prices and, in so doing, expanded Keynes's theory of liquidity preference considerably.

(In later years, Holbrook Working (1953, 1962) would dispute this, arguing that there was, in fact, no difference between the motivations of hedgers and speculators. This led to an early empirical race -- Hendrik Houthakker (1957, 1961, 1968, 1969) finding evidence in favor of normal backwardation and Lester Telser (1958, 1981) finding evidence against it.)

John Burr Williams (1938) was among the first to challenge the "casino" view economists held of financial markets and questions of asset pricing. He argued that asset prices of financial assets reflected the "intrinsic value" of an asset, which can be measured by the discounted stream of future expected dividends from the asset. This "fundamentalist" notion fit well with Irving Fisher's (1907, 1930) theory, and the "value-investing" approach of practitioners such as Benjamin Graham.

Harry Markowitz (1952, 1959) realized that as the "fundamentalist" notion relied on expectations of the future, then the element of risk must come into play and thus profitable use could be made of the newly developed expected utility theory of John von Neumann and Oskar Morgenstern (1944). Markowitz formulated the theory of optimal portfolio selection in the context of trade-offs between risk and return, focusing on the idea of portfolio diversification as a method of reducing risk -- and thus began what has become known as "Modern Portfolio Theory" or simply MPT.

As noted, the idea of an optimal portfolio allocation had already been considered by Keynes, Hicks and Kaldor in their theories of money, and thus it was a logical step for James Tobin (1958) to add money to Markowitz's story and thus obtain the famous "two-fund separation theorem". Effectively, Tobin argued that agents would diversify their savings between a risk-free asset (money) and a *single* portfolio of risky assets (which would be the same for everyone). Different attitudes towards risk, Tobin contended, would merely result in different combinations of money and that unique portfolio of risky assets.

The Markowitz-Tobin theory was not very practical. Specifically, to estimate the benefits of diversification would require that practitioners calculate the covariance of returns between every pair of assets. In their Capital Asset Pricing Model (CAPM), William Sharpe (1961, 1964) and John Lintner (1965) solved this practical difficulty by demonstrating that one could achieve the same result merely by calculating the covariance of every asset with respect to a general market index. With the necessary calculating power reduced to computing these far fewer terms ("betas"), optimal portfolio selection became computationally feasible. It was not long before practitioners embraced the CAPM.

The CAPM would be eventually challenged empirically in a series of papers by Richard Roll (1977, 1978). One of the alternatives offered up was the "intertemporal CAPM" (ICAPM) of Robert Merton (1973). Merton's approach and the assumption of rational expectations led the way to the Cox, Ingersoll and Ross (1985) partial differential equation for asset prices and, perhaps only a step away, Robert E. Lucas's (1978) theory of asset pricing.

A more interesting alternative was the "Arbitrage Pricing Theory" (APT) of Stephen A. Ross (1976). Stephen Ross's APT approach moved away from the risk vs. return logic of the CAPM, and exploited the notion of "pricing by arbitrage" to its fullest possible extent. As Ross himself has noted, arbitrage-theoretic reasoning is not unique to his particular theory but is in fact *the* underlying logic and methodology of virtually *all* of finance theory. The following famous financial theorems illustrate Ross's point.

The famous theory of option pricing by Fisher Black and Myron Scholes (1973) and Robert Merton (1973) relies heavily on the use of arbitrage reasoning. Intuitively, if the returns from an option can be replicated by a portfolio of other assets, then the value of the option must be equal to the value of that portfolio, or else there will be arbitrage opportunities. Arbitrage logic was also used by M. Harrison and David M. Kreps (1979) and Darrell J. Duffie and Chi-Fu Huang (1985) to value multi-period (i.e. "long-lived") securities. All this spills over into the Neo-Walrasian theories of general equilibrium with asset markets (complete and incomplete) developed by Roy Radner (1967, 1968, 1972), Oliver D. Hart (1975) and many others since.

The famous Modigliani-Miller theorem (or "MM") on the irrelevance of corporate financial structure for the value of the firm also employs arbitrage logic. This famous theorem Franco Modigliani and Merton H. Miller (1958, 1963) can actually be thought of as an extension of the "Separation Theorem" originally developed by Irving Fisher (1930). Effectively, Fisher had argued that with full and efficient capital markets, the production decision of an entrepreneur-owned firm ought to be independent of the intertemporal consumption decision of the entrepreneur himself. This translates itself into saying that the profit-maximizing production plan of the firm will *not* be affected by the borrowing/lending decisions of its owners, i.e. the production plan is independent of the financing decision.

Modigliani-Miller extended this proposition via arbitrage logic. Viewing firms as assets, if the underlying production plans of differently-financed firms are the same, then the market value of the firms will be the same for, if not, there is an arbitrage opportunity there for the taking. Consequently, arbitrage enforces that the value of the firms to be identical, *whatever* the composition of the firm's financial structure.

Efficient Markets Hypothesis

The second important strand of work on finance was the empirical analysis of asset prices. A particularly disturbing finding was that it seemed that prices tended to follow a *random walk*. More specifically, as documented already by Louis Bachelier (1900) (for commodity prices) and later confirmed in further studies by Holbrook Working (1934) (for a variety of price series), Alfred Cowles (1933, 1937) (for American stock prices) and Maurice G. Kendall (1953) (for British stock and commodity prices), it seemed as there was *no* correlation between successive price changes on asset markets.

The Working-Cowles-Kendall empirical findings were greeted with horror and disbelief by economists. If prices are determined by the "forces of supply and demand", then price changes should move in particular direction towards market clearing and not randomly. Not everyone was displeased with these results, however. Many viewed them as proof that the "fundamentalist" theory was incorrect, i.e. that financial markets *really* were wild casinos and that finance was thus not a legitimate object of economic concern. Yet others crowed that it proved the failure of traditional "statistical" methods to illuminate much of anything. High-powered time series methods were used by Clive Granger and Oskar Morgenstern (1963) and Eugene F. Fama (1965, 1970), but they came up with the same randomness result.

The great breakthrough was due to Paul A. Samuelson (1965) and Benoit Mandelbrot (1966). Far from proving that financial markets did not work according to the laws of economics, Samuelson interpreted the Working-Cowles-Kendall findings as saying that they worked all too well! The basic notion was simple: if price changes were not random (and thus forecastable), then any profit-hungry arbitrageur can easily make appropriate purchases and sales of assets to exploit this. Samuelson and Mandelbrot thus posited the celebrated "Efficient Market Hypothesis" (EMH): namely, if markets are working properly, then all public (and, in some versions, private) information regarding an asset will be channelled immediately into its price. (note that the term "efficient", as it is used here, merely means that agents are making full use of the *information* available to them; it says nothing about other types of "economic efficiency", e.g. efficiency in the allocation of resources in production, etc.). If price changes seem random and thus unforecastable it is because investors are doing their jobs: all arbitrage opportunities have *already* been exploited to the extent to which they can be.

The "Efficient Markets Hypothesis" was made famous by Eugene Fama (1970) and later connected to the rational expectations hypothesis of New Classical macroeconomics. It did not please many practioners. "Technical" traders or "chartists" who believed they could forecast asset prices by examining the patterns of price movements were confounded: the EMH told them that they could not "beat the market" because any available information would already be incorporated in the price. It also had the potential to annoy some fundamentalist practioners: the idea of efficient markets rests on "information" and "beliefs", and thus does not, at least in principle, rule out the possibility of speculative bubbles based on rumor, wrong information and the "madness of crowds".

More disturbingly, the EMH has not pleased economists. EMH is probably one of the more resiliant empirical propositions around (albeit, see Robert Shiller's (1981) critique), yet it does not seem to have a clearly sound theoretical standing. It all seems to collapse on one particular objection: namely, that if all information is *already* contained in prices and investors are fully rational, then not only can one not profit from using one's information, indeed, there might not be any trade at all! These peculiar, contradictory implications of rational expectations were demonstrated by Sanford J. Grossman and Joseph E. Stiglitz (1980) and Paul Milgrom and Nancy Stokey (1982). Intuitively, the objection can be put this way (and here we are oversimplifying a bit). The efficient markets hypothesis effectively implies that there is "no free lunch", i.e. there are no $100 bills lying on the pavement because, if there were, someone would have picked them up already. *Consequently*, there is no point in looking down at the pavement (especially if there is a cost to looking down). But if everyone reasons this way, no one looks down at the pavement, then any $100 bills that might be lying there will *not* be picked up by anyone. But then there *are* $100 bills lying on the pavement and one *should* look down. But then if everyone realizes *that*, they *will* look down and pick up the $100 bills, and thus we return to the first stage and argue that there are not any $100 bills (and therefore no point in looking down, etc.) This circularity of reasoning is what makes the theoretical foundations of the efficient markets hypothesis somewhat shaky.

Pioneers of Finance Theory

- Irving Fisher, 1867-1947.
- John Maynard Keynes, 1883-1946.
- Sir John R. Hicks, 1904-1989.
- Nicholas Kaldor, 1908-1986.
- Jacob Marschak, 1898-1977.
- John Burr Williams, 1902-1989.
  - *Theory of Investment Value*, 1938.
  - *International trade under flexible exchange rates*, 1954.
  - Founder and developer of "fundamentalist" theory of asset valuation.
- Benjamin Graham, 1894-1976.
- Samuel Eliot Gould
  - *Stock Growth and Discount Tables*, 1931.
  - Often credited as the founder of the "intrinsic value" or "fundamentalist" theory of stock markets.

Modern Portfolio Theory (MPT)

- Harry M. Markowitz, 1923-
- James Tobin, 1918-
- William J. Baumol, 1922-
- William F.Sharpe, 1934-
- John Lintner, 1916-
- Richard Roll

Arbitrage and Equilibrium Theory

- Roy Radner, 1927-
- Stephen A. Ross, 1944-
- Fisher Black, 1938-
- Myron S. Scholes, 1941-
- Robert C. Merton, 1944-
- Oliver D. Hart, 1948-
- David M. Kreps, 1950-
- Darrell J. Duffie
- John Cox
- Mark Rubinstein

Chi-Fu Huang

- Jonathan E. Ingersoll, Jr.

Finance and the Firm

- Merton H. Miller, 1927-
- Franco Modigliani, 1918-
- Michael C. Jensen, 1939-
- Jacques H. Dr�ze, 1929-
- Sanford J. Grossman
- Joseph E. Stiglitz, 1943-
- Paul R. Milgrom, 1948-
- Douglas Gale, 1950-

Empiricists and the Efficient Markets Hypothesis

- Louis Bachelier, 1870-1946.
- Holbrook Working, 1895- 1985.
- Alfred Cowles, 3rd., 1891-1984 - (1), image
  - "Can Stock Market Forecasters Forecast?", 1933, *Econometrica*.
  - "Some Posteriori Probabilities in Stock market Action" with H. Jones, 1937, *Econometrica*.
  - *Common Stock Indexes, 1871-1937*, 1938.
  - "Stock Market Forecasting", 1944, *Econometrica*
  - "A Revision of Previous Conclusions Regarding Stock Price Behavior", 1960, *Econometrica*
  - A prominent Colorado businessman and investment counselor, Alfred Cowles became convinced of the importance of the quantitative aspects of economics after the numerous forecasting failures of the 1929 crash. His own studies of stock market data, (esp. 1933), provide an early demonstration of the "random walk" in stock price movements and the beginning of the "Efficient Market Hypothesis". In 1930, Cowles founded and funded both the Econometric Society and its journal, *Econometrica* and, in 1932, set up the Cowles Commission for Economic Research. One of the first Cowles Commission projects was Cowles's own on the development and analysis of monthly and annual stock market indices (1938).
- Oskar Morgenstern, 1902-1976.
- Paul A. Samuelson, 1915-
- Benoit B. Mandelbrot, 1924-
- Hendrick S. Houthakker, 1924-
- Eugene F. Fama, 1939-
- Robert E. Lucas , Jr., 1937-
- Burton G. Malkiel
- Robert Shiller

Resources on Finance Theory

- HET Pages: General Equilibrium under Uncertainty

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