An Examination Of Historical Linkages In The Evolution Of Finance Theory

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SCIENTIFIC RESEARCH IN FINANCE THEORY

"The whole of science is nothing more than the refinement of everyday thinking"-Albert Einstein

"If I have seen further, it is by standing on the shoulders of Giants"- Isaac Newton in a letter to Robert Hook in 1676.

Every field of study has its own language and its own way of thinking. Mathematicians talk about axioms, integrals, and vector spaces .Psychologists talk about ego, id, and cognitive dissonance. Lawyers talk about venue, torts, and promissory estoppels. Finance is no different - financial futures, equity swaps, exchange traded options, mortgage based securities, junk bonds, electronic funds transfer, internet-based security trading, asset-based financing, derivatives, securitization, international finance, LBO, and EVA- these terms are part of the finance language. Researchers in finance try to address their subject with a scientist's objectivity. They approach the study of finance in much the same way a physicist approaches the study of matter and a biologist approaches the study of life. They devise theories, collect data, and then analyse these data in an attempt to verify or refute their theories. For them, finance is science. The essence of science, however, is the scientific method- the dispassionate development and testing of theories about how the world works. This method of inquiry is as applicable to studying currency swaps as it is to studying earth's gravity or a species' evolution.

Theories in finance are seldom born fully clothed, but are rather dressed by a slow and arduous process of accretion. In the study of evolution of finance theory, to achieve deep knowledge of the current state-of-the-art, it is necessary to appreciate how its ideas have evolved - What are their origins? By what paths of thought are they elaborated? How does one idea lead to others? Why was there once confusion about ideas that now seem obvious?

One of the delightful by- products of historical research is the connections that one often uncovers between apparently disparate and unrelated work- connections which may not have been consciously at work, but no doubt, though undocumented byways, must surely have exercised an influence.

In this spirit, this article provides a history of aspects of the theory of finance, emphasizing on the foundation-setting contributions over the last four centuries. Out of necessity, the author has selected only a small, but the most inter-connected contributions out of the large number of research that is available on finance theory. The author's aim has been to provide the reader with the insight into the interlinkage between key theorists and their theories.

This article is divided into two parts. In the first part, the author provides over 28 most influential finance theorists in perspective, their key works and contributions to finance theory, who influenced their work and whom they influenced. In the second part, the author discusses the linkages between the contributions in the evolution of three most-important finance theories; **(1)** Portfolio Theory **(2)** Efficient Market Hypotheses and **(3)** International Finance.

DISCUSSION

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

The first important series of inter-connected research work on finance theory was the **portfolio theory**. **Irving Fisher (1906, 1907, and 1930)** had 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 his theories of money, **John Maynard Keynes (1930, 1936)** had conceived of portfolio selection theory in which uncertainty

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Table 1 : Key Theorists And Their Foundation- Setting Contributions

Key theorist in perspective	Best Known as	Key works and contributions, influences & influenced
Joseph de la Vega (ca.1650, Espejo, Spain - November 13, 1692, Amsterdam, Netherlands) - *Confusion of Confusions* was one of the first analytical attempts to describe the different kind of financial operations taking place at that time. It explores the impact of crowd behavior, and the trading trickery on the financial markets. de la Vega presents **four rules of speculation** that are still relevant today: never advice anyone to buy or sell shares; accept both your profits and losses; profit from share trading never lasts; you need both money and patience. He shows that, even then, there were bulls, bears, panics, bubbles, short selling, margin trading, most of the other features of modern exchanges.	**Author of *Confusion of Confusions*, the oldest book ever written on stock exchange business**	**Key Works** *Confusion of Confusions (1688)* **Key Contributions** bulls, bears, bubbles, short selling, margin trading **Influenced Entire** body of efficient market hypothesis research **Theoretical Strand** Portfolio Theory, Efficient Market Hypothesis
Adam Smith (16 June 1723 - 17 July 1790) - One of the key figures of Scottish enlightenment in the 18th century. In *The Wealth of Nations*, he argued that all human powers are subject to natural, moral, and physical laws, and proposed that governments should manage economic matters alone, to work naturally, which he argued would benefit individuals and state. In *The Theory of Moral Sentiments*, he explored moral judgments within the context of people being motivated by self-interest, while acknowledging that individuals have *"social propensities"* for sympathy, justice and benevolence. He found the free market ensured the best balance in goods and services through a so-called *"invisible hand"*-that society and commerce benefits from people behaving in their own interests. He believed that while human motives were often driven by selfishness and greed, the competition in the free market would tend to benefit society as a whole by keeping the prices low, while still building in an incentive for the production of a wide variety of goods and services. Shortly before his death, Smith had nearly all his manuscripts destroyed. In his last years, he seemed to have been planning two major treatises, one on the theory and history of law and one on the sciences and arts. The posthumously published *Essays on Philosophical Subjects (1795)*, a history of astronomy down to Smith's own era, plus some thoughts on ancient physics and metaphysics, probably contain parts of what would have been the latter treatise. *Lectures on Jurisprudence* were notes taken from Smith's early lectures, plus an early draft of *The Wealth of Nations*, published as part of the 1976 Glasgow Edition of the works and correspondence of Smith. Other works, including some published posthumously, include *Lectures on Justice, Police, Revenue, and Arms (1763)* (first published in *1896*); *A Treatise on Public Opulence (1764)* (first published in *1937*).	**The Father Of Modern Economics**	**Key Works** *The Theory of Moral Sentiments (1763), Lectures on Justice, Police, Revenue, and Arms (1763), The Wealth of Nations (1776)* **Key Contributions** Classical economics, modern free market, division of labour , the *"invisible hand"* **Influences** Aristotle, Butler, Chydenius , Hobbes, Hume , Hutcheson , Locke ,Mandeville ,Petty, Quesnay **Influenced** Belgrano, Chomsky, Comte, Darwin, Engels, Friedman, Hayek , Keynes , Marx, Malthus, Mill, Montesquieu, Rand, Ricardo **Theoretical Strand** International Finance
Jean-Baptiste Say (5 January 1767 - 15 November 1832)- His most celebrated work was *A Treatise on Political Economy*, which expounded laissez-faire economic principles, and a combination of the utility theory of	**He is best known as the author of *The Law Of Markets*, known as Say's Law of Markets, and as**	**Key Works** *A Treatise on Political Economy, or the Production, Distribution And Consumption Of Wealth* (1828). *Letters to Thomas Robert*

demand, Adam Smith's cost theory of supply. Say championed classically liberal principles and argued in favor of competition and free trade, and the lifting of restraints on business. Say's Law of Markets states that total demand in an economy cannot exceed or fall below total supply in that economy, so that there can be no demand without supply, and that recession does not occur because of failure in demand , or lack of money. Studied the role of entrepreneurs and their unique importance to the economy as risk-takers and contributors to production, as compared with the manager or the capitalist.	**The First To Coin The Term "Entrepreneur"**	*Malthus on Political Economy and Stagnation of Commerce (1821), Definitions in Political Economy (1827)* **Key Contributions** Say's Law - supply creates its own demand **Theoretical Strand** Efficient Market Hypothesis, International Finance
David Ricardo (19 April 1772 - 11 September 1823) - Ricardo laid down the foundations for the principles of a market economy. He also described the guiding concepts behind economic theories such as the law of diminishing returns, and economic rent. He integrated his theory of value with his theory of distribution. The law of comparative advantage that Ricardo formulated made a significant contribution to political economics and has since become a central tenet of free trade, open markets, and anti-protectionism. He contended that profits depend on high or low wages; wages on the price of necessaries; and the price of necessaries chiefly depend on the price of food. Ricardo was admired for his ability to arrive at complex conclusions without the use of mathematics. His views have been influential in the work of many more recent economists, including Friedrich Hayek, who discussed the Ricardo Effect based on his theories on the interrelationships between capital, labor, output and investment.	**Founder Of The Classical School Of Economics**	**Key Works** *The High Price of Bullion, A Proof of the Depreciation of Bank Notes (1810), An Essay on the Influence of a Low price of Corn on the Profits of Stock (1815), Essay on Profits (1815), The Principles of Political Economy and Taxation (1817)* **Key Contributions** Ricardian equivalence,labour theory of value, comparative advantage, law of diminishing returns **Influenced** Ricardian Socialists, John Stuart Mill, Marx, Sraffa, Barro **Theoretical Strand** International Finance
Louis Bachelier (March 11, 1870 - April 28, 1946) - Bachelier`s successful defense of his theses in 1900 marked the birth of mathematical finance and it was later published in the influential French Journal, *Annales Scientifiques de l'Ecole Normale Superieure*.He analyzed Brownian motion so that it could be applied to the mathematical modeling of price movements. His evaluation of contingent claims in financial markets is often thought of as one of the most important mathematical discoveries of the 20th century. His analysis of stock and option markets included several key ideas of both finance and probability. Between 1900 and 1914, he developed the mathematical theory of diffusion process in a series of papers published in reputed French journals. He introduced many of the concepts like the systematic use of the concepts continuity in probabilistic modeling and stochastic analysis. Public acknowledgment of his work richly deserved for the innovations he bought to financial theory, did not really arrive until after his death, when he was rediscovered by those founding modern financial theory in the 1950s.	**The Father Of Financial Mathematics**	**Key Works** *The Theory of Speculation (1900)* **Key Contributions** - Mathematical Finance. He discovered that stock price changes are random and unpredictable (which was popularized 60 years later as the "random walk" approach). In addition, he discovered an effective method for valuing financial options. **Influenced** Harry Markowitz, Burton Malkiel, Peter L.Bernstein, Willam F. Sharpe, Eugene Francis "Gene" Fama, Myron Samuel Scholes, Fisher Black, Paul Samuelson **Theoretical Strand** Efficient Market Hypothesis
Irving Fisher (February 27, 1867 - April 29, 1947) - He was the first to earn a PhD in Economics from Yale University. He has several concepts named after him, including the Fisher Equation, the Fisher Hypothesis, and the Fisher separation theorem. The International Fisher	**Renowned Neoclassical Economist of the early 20th century. He is best known for his research on the theory of interest,**	**Key Works** *The Nature of Capital and Income (1906) , The Rate of Interest (1907), Introduction to Economic Science (1910), Money Illusion (1928)*

Effect, which predicts international exchange-drift independent of inflation, was also named after him. His theories of capital and investment were first presented in *The Nature of Capital and Income* and *The Rate of Interest*, and more fully analyzed in his groundbreaking, *The Theory of Interest*. His treatment of the *Money Illusion* anticipated later research on the psychology of decision-making by Daniel Kahneman and Amos Tversky; discuss the impact of investors and savers of the tendency to think of currency in nominal, rather than in real terms. In *The Making of Index Numbers*, he looked at the critical role of Index Numbers in monetary theory, statistical theory, econometrics, and index number theory. Gained mainstream recognition through his work as a health campaigner and eugenicist.	**and capital theory.**	*The Stock Market Crash and After (1930), The Theory of Interest (1930)* **Key Contributions** Fisher equation, equation of exchange, price index, Philip curve, money illusion, fisher separation theorem **Influenced** Milton Friedman, Harry Markowitz **Theoretical Strand** Portfolio Theory
John Maynard Keynes (5 June 1883 - 21 April 1946) - The effect of Keynesian economics and theory still reverberates; his work on economic policy, and social progress was hugely influential in forming modern economic thinking. He strongly advocated interventionist policies, and government use of fiscal and monetary measures to mitigate the adverse effects of recessions and booms. He believed that government borrowing was necessary for undertaking large scale public works that would stimulate the economy during a recession. His *Treatise on Probability* explored the foundation of knowledge regarding the meaning and measurement of probability, depicting probability as a logical relation, and ,therefore, objective. In *Tract on Monetary Reform*, he called for an end to the gold standard, on the basis that devaluation was preferable to deflation, and that sterling was overvalued. In *Treatise on Money*, he distinguished between investments and saving, proposing that if investments exceeded saving, it led to inflation, but if saving exceeded investment, there would be recession. In *The General Theory of Employment, Interest and Money*, he argued, that unemployment occurs if people do not spend enough money.	**Key economic thinker of the 20th century. He was particularly central for the creation of the IMF and the World Bank.**	**Key Works** *Economic Consequences of the Peace (1919), Treatise on Probability (1921), Tract on Monetary Reform (1923), Treatise on Money (1930), The General Theory of Employment, Interest and Money (1936), How to pay for the war (1940)* **Key Contributions** Macroeconomics, Keynesian economics, liquidity preference, spending multiplier, aggregate demand - aggregate supply model **Influences** Adam Smith, David Ricardo, Hume, Mill, Malthus, Gesell, Moore, Marshall, wicksell, Robertson **Influenced** Whitaker, Lynch, Kuznets, Samuelson, Hicks, Shackle, Vickrey, Galbraith, Schiller, Stiglitz, Krugman, Roubini, Harry Markowitz **Theoretical Strand** Portfolio Theory , International Finance
Benjamin Graham (May 8, 1894 - September 21, 1976) - He was a strong advocate of financial analysis training, and helped found the Chartered Financial Analyst (CFA) program in USA. Warren Buffett studied under him at Columbia University Business School. Graham revolutionized investment thinking by introducing the concepts of security analysis, fundamental analysis and value investing. Two of his books, *Security Analysis* and *The Intelligent Investor,* are considered the bibles for both individual investors and financial professionals. He presented his principles of value-oriented investment, using fundamentals in guiding the valuation of securities. He criticized corporations that produced unhelpful financial reports, advocated dividend payments for shareholders, and popularized the examination of price-to-earnings ratio, debt-to-equity ratios, dividend records, net current assets, book values, and earnings growth.	**The Father Of Modern Security Analysis**	**Key Works** *Storage and Stability: A Modern Ever-normal Granary (1937), The Interpretation of Financial Statements (1937) , World Commodities and World Currency (1944), The Intelligent Investor (1949)* **Key Contributions** Popularized the value style of investing, security analysis, fundamental analysis **Influenced** Jean-Maril Eveillard, Warren Buffett, William J. Ruane, Irving Kahn, Hani M. Anklis, Walter J. Schloss **Theoretical Strand** Portfolio Theory

Joseph Schumpeter (8 February 1883 - 8 January 1950) - Schumpeter's relationships with the ideas of other economists were quite complex. Schumpeter believed that continuous change in the economy meant most businesses fail, becoming victim of innovation by their competitors. In *The Theory of Economic Development*, he argued that entrepreneurs innovate, not just figuring out how to use inventions, but also by introducing new means of production, new products and new forms of organization. Schumpeter's most popular book in English is probably, *Capitalism, Socialism and Democracy*. This book opens with a treatment of Karl Marx. While he is sympathetic to Marx's theory that capitalism will collapse and will be replaced by socialism, Schumpeter concludes that this will not come about in the way Marx predicted. To describe it, he borrowed the phrase *"creative destruction"* and made it famous by using it to describe a process in which the old ways of doing things are endogenously destroyed and replaced by new ways. Schumpeter has a following outside of standard textbook economics, in areas such as in economic policy, management studies, industrial policy, and the study of innovation. On 17 September 2009, *The Economist* magazine inaugurated a column on business and management named *"Schumpeter"* .The initial Schumpeter column praised him as a *"champion of innovation and entrepreneurship"* whose writing showed an understanding of the benefits and dangers of business that proved to be far ahead of its time.	**Economist And Political Scientist. He was the first to study and theorize on the concept of entrepreneurship, and based his research on an attempt to integrate and unite the different social sciences.**	**Key Works** *Theory of Economic Development (1934), Business Cycles (1939), Capitalism, Socialism and Democracy (1942)* **Key Contributions** Business cycles, economic development, entrepreneurship, evolutionary economics **Influences** Bohm- Bawerk, Wieser, Menger, Walras, Juglar **Influenced** Friedman, Samuelson, Tobin, Nouriel Roubini **Theoretical Strand** International Finance
Ronald Harry Coase (born 29 December 1910) - Coase is best known for two articles in particular: *The Nature of the Firm (1937)*, which introduces the concept of transaction costs to explain the nature and limits of firms, and *The Problem of Social Cost (1960)*, which suggests that well-defined property rights could overcome the problems of externalities. His transactions costs approach is influential in modern organizational theory. Coase is also often referred to as the *"father"* of reform in the policy for allocation of the electromagnetic spectrum, based on his article *The Federal Communications Commission (1959)*, where he criticizes spectrum licensing, suggesting property rights as a more efficient method of allocating spectrum to users. He won the Nobel Prize in Economics for discovering and explaining the significance of transactions costs and property rights for the institutional structure and functioning of the economy.	**Father Of Transaction Costs Economics**	**Key Works** *The Nature Of The Firm (1937) Birth Broadcasting: A Study In Monopoly (1950) The Problem Of Social Cost (1961)* **Key Contributions** Coase Theorem, Analysis Of Transaction Costs, Coase Conjecture **Influenced** Entire contributions in Finance Theory where transactions costs are involved. **Theoretical Strand** Portfolio Theory, Efficient Market Hypothesis, International Finance
Friedrich Hayek (8th May 1899 - 23rd March 1992) - Hayek was one of the most influential members of the Austrian School of Economics, and in 1974, shared the Nobel Memorial Prize in Economics for his *"pioneering work in the theory of money and economic fluctuations and his penetrating analysis of the interdependence of economic, social and institutional phenomena."* . Hayek was a prolific researcher and writer over nearly seven decades, and was seen as a central figure in the move from interventionism and Keynesian policies towards classical liberalism. Hayek's account of how changing	**Influential Social Theorist And Advocate Of Free Markets**	**Key Works** *The Road to Serfdom (1944), The Constitution of Liberty (1960) ,The Fatal Conceit (1988)* **Key Contributions** Economic calculation problem catallaxy, extended order, dispersed knowledge, price signal, spontaneous order, hebbian theory **Influences** Wieser, Menger, Mach, Mises, Mandeville, Huma, Fwerguson, Wittgenstein, Locke, Burke

prices communicate signals which enable individuals to coordinate their plans is widely regarded as an important achievement in economics. He was also instrumental in the founding of the *Institute of Economic Affairs*, the free-market think-tank and inspired Reaganomics and Thatcherism. He opposed government intervention in the marketplace, and was a fierce critic of Keynesian welfare economics. His writings also strongly criticized collectivism, as being dependent on a central authority; he argued that the central role of the state should be to maintain the rule of law, and avoid arbitrary intervention as much as possible. His early works on industrial fluctuations, and prices as signals, were influential, as were his contributions to jurisprudence and cognitive science.		**Opposed** John Maynard Keynes **Influenced** Friedman, Stigler, Richard H. Thaler,Paul Samuelson, Nouriel Roubini **Theoretical Strand** Efficient Market Hypothesis, International Finance
Paul Samuelson (May 15, 1915 - December 13, 2009) - Paul Samuelson was a leading light of the Harvard Generation of 1930s, where he studied under Schumpeter and Leontief. He was one of the first economists to generalize and apply mathematical methods developed for the study of thermodynamics to a diverse range of economic issues. He helped create the neoclassical synthesis, incorporating Keynesian and neo-classical principles, which now dominates mainstream economics. His *Foundations of Economic Analysis* is typical of his perspective, as it considers the universal nature of consumer behavior as the key to economic theory, underpinned by mathematical rigor and it launched the era of mathematization of economics. He was one of the first economists to generalize and apply mathematical methods developed from the study of thermodynamics-optimizing behavior of agents, and stability of equilibrium as to economics systems, which was based on classical thermodynamics. This innovation established comparative statics in economics, the method of calculating how a change in any parameter affects an economic system. Both the multiplier-accelerator macro-dynamic model and his presentation of the Phillips Curve helped make his name. In microeconomics, he is responsible for the theory of revealed preference, and also developed the Bergson-Samuelson social welfare functions. His work on speculative prices anticipated the efficient markets hypothesis in finance theory, while his research on diversification and the concept of *"lifetime portfolio"* are also respected innovations. In international trade theory, he is responsible for the Stopler-Samuelson theorem, and the Factor Prize Equalization theorem. He was the first American to win the Nobel Prize in Economics for his contribution of neoclassical economic theory. Samuelson was instrumental in the initial development of *Indian Institute of Management, Calcutta, the first Indian Institute of Management.*	**Father of Modern Neoclassical Economics**	**Key Works** *Foundations of Economic Analysis (1947), Publication Of His Collected Scientific Papers (1966)* **Key Contributions** Neoclassical synthesis, mathematical economics, economic methodology, revealed preference theory, internationa trade theory, economic growth theory, public goods theory. **Influences** John Maynard Keynes, Joseph Schumpeter, Ricardo **Influenced** Fischer Black, Merton Miller, Eugene Fama **Theoretical Strand** Efficient Market Hypothesis, International Finance
Gary Becker (born December 2, 1930) - His research considered the overlap between economics and area of sociology such as racial discrimination, crime, family organization and drug addiction. He analyzed criminal behavior based on rational decision making, and how	**Nobel Prize-Winning Economist**	**Key works** *The Economics of Discrimination (1957), Human Capital (1964), A Treatise on the Family (1991), Accounting for Tastes (1996)*

criminals weigh the benefits of their crimes against risks of appreciation, conviction and punishment. He originated the *"rotten kid theorem"*, which states that children in a family, even if they normally act selfishly, will help one another, if sufficiently incentivized. He analyzed the working a democracy, especially with regard to interest groups exploiting other groups, based on the concept of deadweight loss. He received the Nobel Prize in Economic Science in 1992 for his work in extending economic theory to new areas of human behavior, including sociology, demography and criminology. He has taught economics at Colombia University for nearly 50 years, written a monthly column for Business Week for 20 years, and now coproduces an economic internet blog with Richard Posner.		**Key Contributions** Analysis of human capital, rotten kid theorem **Influences** Milton Friedman **Influenced** Casey Mulligan, Steven Levitt, Richard H.Thaler, James Tobin, Joseph Stiglitz **Theoretical Strand** Efficient Market Hypothesis
Merton Miller (May 16, 1923 - June 3, 2000) - Merton Miller made pioneering contribution to financial economics through the theory of corporate finance, and the evaluation of firms on markets. He built on the work of Harry Markowitz on portfolio theory and William Sharpe in the development of Capital Asset Pricing Model (CAPM) and received the Nobel Prize for his research. He collaborated with Franco Modigliani in a seminal article on the cost of capital, and investment theory. The Miller-Modigliani Theorem ran against the traditional view that a company should reduce its cost of capital by finding the right debt-to-equity ratio, but argued that there is no right ratio, but that corporate managers are better off reducing their tax liability, and increasing corporate wealth. The theorem changed the focus from how investors choose which securities to buy to how companies decide what securities they should sell. Merton Miller helped to interpret the complexities of the futures markets to academia, business and regulators during 1987 stock market crash.	**Nobel Prize-Winning Economist, And Activist Supporter Of Free-Market Solutions**	**Key Works** *The Cost of Capital, Corporate Finance and the Theory of Investment (1958), The Theory of Finance (1972),* *Financial Innovations and Market Volatility (1991), Merton Miller on Derivatives (1997)* **Key Contributions** Modigliani-Miller theorem **Influences** Fritz Machlup, Harry Markowitz, Irving Fisher **Influenced** Eugene Fama, Myron Scholes **Theoretical Strand** Efficient Market Hypothesis, Portfolio Theory
Harry Markowitz (born August 24, 1927) - He was the first to place a number on risk relative to investing, defying the traditional view that risk should only be assessed in general terms ; he quantified what an investor wants to avoid by using a range of possible return outcomes based on the past variability of returns. His research emphasized the importance of measuring the risk of an entire portfolio, rather than the risk on an individual security level. His theory of portfolio selection under uncertainty was published in 1952 by the *Journal of Finance*. He researched optimization techniques, developing critical line algorithm for the identification of the optimal mean-variance portfolios. This was found to be lying on what was later named the Markowitz Frontier. He was awarded Nobel Memorial prize in Economics for his work in portfolio theory, sparse matrix techniques, and SIMSCRIPT.	**The Grandfather Of Modern Portfolio Theory**	**Key works** *Portfolio Selection (1959) SIMSCRIPT: A Simulation Programming Language (1962)* **Key Contributions** Efficient frontier, Modern Portfolio theory, Sparse Matrix Methods, Simscript **Influences** Milton Friedman, Jacob Marschak, Oskar, Irving Fisher,John Maynard Keynes, Morgenstern, Leonard Savage, John Von Neumann **Influenced** James Tobin, Willam F.Sharpe **Theoretical Strand** Portfolio Theory
Burton Malkiel (born August 28, 1932) - *In A Random Walk Down Wall Street*, an investment classic that is now in its ninth edition , Malkiel explains why diversification is critical in a portfolio and argues that asset allocation should always be done appropriately. He has revised his	**American Economist, and Author of classic finance book, *A Random Walk Down Wall Street*.**	**Key Works** *The Term Structure of Interest Rates (1966), A Random Walk Down Wall Street (1973),* *The Inflation Beater`s Investment Guide (1980), Winning Investment Strategies (1982),*

book over the years, re-examining his views on market manias in terms of the internet bubble, and strongly defends efficient markets and index fund investing. He is the leading proponent of efficient market hypothesis. This contends that prices of publicly traded assets reflect all publicly available information. His influential article, *The Valuation of Closed-End Investment Company Shares* , in the *Journal of Finance (1977)* , discussed why closed-end fund companies trade at market valuations lower than the net value of their assets.		*The Random walk Guide to Investing (2003), From Wall Street to the Great Wall (2007)* **Key Contributions** Efficient market hypothesis , non-random walk **Influenced** Eugene Fama **Theoretical Strand** Efficient Market Hypothesis
Peter L. Bernstein (January 22, 1919 - June 5, 2009) - was an American financial historian, economist and educator whose development and refinement of the efficient-market hypothesis made him one of the country's best known authorities in popularizing and presenting investment economics to the general public. Bernstein has the ability to combine historical ideas with economics, and the theory and practice of investment management. *Capital Ideas* explores the development of new theories in risk, valuation and investment returns and focuses on the implementation of these theories in the world of investment management. It shows how these theories explain the link between risk and reward and the advantages of diversification and provides a clear framework for valuing financial options. Bernstein produced a sequel to *Capital Ideas* in 2007, called *Capital Ideas Evolving*, which defended the theories of the first book, and extended the examination of key ideas that derive modern financial practice. In *Against the Gods*, Bernstein analyzes probability and its applications, using a readable blend of biography, history and science to examine the role played by famous thinkers in helping the evolution from a superstitious outlook to modern risk management. *Against the Gods* shows how the concept of risk originated and traces its progression through history up to our modern understanding of how it affects us all. It examined Pascal's Wager in detail, a concept that was ahead of time in terms of both probability theory and decision theory; it is based on consequences being more important than probabilities.	**The Foremost Chronicler Of Risk**	**Key Works** *Economist on Wall Street (1970),* *Streetwise: The Best of the Journal of Portfolio Management (1977),* *Capital Ideas: The Improbable Origins of Modern Wall Street (1992),* *Portable MBA in Investment (1995),* *Against the Gods: The Remarkable Story of Risk (1996),* *Investment Management (1998),* *The Power of Gold: The History of an Obsession (2004),* *Capital Ideas Evolving (2007),* *Wedding of the Waters (2007).* **Key Contributions** Risk, insurance , investment theories **Influenced** Entire research on financial risk **Influences** Efficient market hypothesis research **Theoretical Strand** Efficient Market Hypothesis
William F. Sharpe (born 16th June 1934) - Sharpe, Harry Markowitz and Merton Miller all shared the Nobel Prize for their contribution to financial economics, which helped establish it as a separate field of study. Sharpe showed how capital asset pricing model (CAPM) implies a single mix of risky assets fits in every investor's portfolio - those who want a high return should hold a portfolio heavily weighted with the risky asset, while those who want a low return hold a portfolio heavily weighted with a riskless asset. He produced a number of innovations in investment analysis, including the Sharpe Ratio for risk-adjusted investment performance analysis- the ratio evaluates the level of risk a fund accepts against the return it delivers. He contributed to the development of binomial method for the valuation of options, as well as the gradient method of optimizing asset allocation, and returns- based analysis for evaluating the style and performance of investment funds. He developed a	**Leading Economist, And Co- Author Of The Black-Scholes Equation**	**Key Works** *Portfolio Theory and Capital Markets (1970),* *Investment (1978),* *Asset Allocation Tools (1987),* *Investors and Markets (2007)* **Key Contributions** Beta, CAPM, Sharpe Ratio **Influences** Armen Alchain, Harry Markowitz, James Tobin **Influenced** Howard Sosin, Richard Roll **Theoretical Strand** Portfolio Theory

method for finding approximate solutions to a class of portfolio analysis problems, which has been widely implemented.		
James Tobin (March 5, 1918-March 11, 2002) - He developed the ideas of Keynesian economics, and advocated government intervention to stabilize output and avoid recessions. His academic work included pioneering contributions to the study of investment, monetary and fiscal policies and financial markets. He proposed an econometric model for censored endogenous variables, the well known *"Tobit model"*. Tobin received Nobel Prize in Economic Sciences in 1981. Tobin was widely known for his suggestion of a tax on foreign exchange transactions, now known as the *"Tobin Tax"*. This was designed to reduce speculation in the international currency markets, which he saw as dangerous and unproductive. He suggested that the proceeds of tax could be used to fund projects for the benefit of Third World countries, or to support the United Nations.	**Nobel Prize- Winning Financial Economist**	**Key Works** *Essay in Economics (1971),* *Is Growth Obsolete? (1972),* *A Note On The Monetary Wage Problem, Quarterly Journal of Economics, 55 (3) :508-516 (1941),* *A Dynamic Aggregative Model, Journal of Political Economy, 63 (2) : 103-115, (1955),* *Liquidity Preference as Behavior Towards Risk, Review of Economic Studies,25(1):65-86(1958),* *A General Equilibrium Approach to Monetary Theory, Journal of Money, Credit, and Banking, 1.1 (1):15-29 (1969)* **Key Contributions** Tobin's q, Tobit model, Tobin tax, Capital Market Line (CML). **Influences** John Maynard Keynes, Schumpeter,Harry Markowitz **Influenced** Paul Samuelson **Theoretical Strand** Portfolio Theory , International Finance
Eugene Francis "Gene" Fama (born February 14, 1939) is an American economist, known for his work on portfolio theory and asset pricing, both theoretical and empirical. His Ph.D. thesis, which concluded that stock price movements are unpredictable and follow a random walk, was published in January, 1965 issue of the Journal of Business, entitled *"The Behavior of Stock Market Prices"*. That work was subsequently rewritten into a less technical article, *"Random Walks In Stock Market Prices"*, which was published in the *Financial Analysts Journal* in *1965* and *Institutional Investor in 1968*.His article *"The Adjustment of Stock Prices to New Information"* in the *International Economic Review, 1969* (with several co-authors) was the first event study that sought to analyze how stock prices respond to an event, using price data from the newly available CRSP database. Fama helped popularize efficient market hypothesis and the random walk theory. In a ground-breaking article in the May, 1970 issue of the *Journal of Finance*, entitled *"Efficient Capital Markets: A Review of Theory and Empirical Work"*, Fama proposed two crucial concepts that have defined the conversation on efficient markets ever since. In recent years, he has co-written a series of papers with Kenneth French, that cast doubt on the validity of the Capital Asset Pricing Model (CAPM), which posits that a stock's beta alone should explain its average return. These papers describe two factors above and beyond a stock's market beta which can explain differences in stock returns: *"Market Capitalization" and "value"*. They also offer evidence that a variety of patterns in average returns, often labeled as *"anomalies"* in past work, can be explained with their 3 factor model.	**American Economist, Proponent of Keynesian Economics**	**Key Works** *The Theory of Finance (1972),* *Small Is Beautiful (1973),* *A Guide for the Perplexed (1977),* *Good Work (1979)* **Key Contributions** Fama-French three-factor model, efficient Market Hypothesis, event study **Influences** Merton Miller, Harry Markowitz **Influenced** Peter L. Bernstein **Theoretical Strand** Efficient Market Hypothesis

Additionally, Fama co-authored the textbook *The Theory of Finance* with Nobel Memorial Prize in Economics winner Merton H. Miller.		
Myron Samuel Scholes (born July 1, 1941) is an American financial economist who is best known as one of the authors of the Black-Scholes equation. In 1997, he shared the Nobel Prize in Economics with Robert C. Merton *"for a new method to determine the value of derivatives"*. Fischer Black, who co-authored with them the work that was awarded, had died in 1995 and thus was not eligible for the prize. The model provides the fundamental conceptual framework for valuing options, such as calls or puts, and is referred to as the Black-Scholes model, which has become the standard in financial markets globally. Trillions of dollars of options trades are executed each year using this model and derivations thereof. All binomial option models have evolved from this original concept.	**Author Of The Efficient Markets Hypothesis, Internationally Renowned Economist, And Environmentalist**	**Key Works** Published seminal paper,*"The Pricing of Options and Corporate Liabilities"*, with Fischer Black (1973), Taxes and Business Strategy: A Planning Approach (1992) **Key Contributions** Black-scholes model **Influenced** Stephen A. Ross **Theoretical Strand** Portfolio Theory
Fischer Black (January 11, 1938 - August 30, 1995) - He played a critical part in applying Quantitative Strategies to investment practice for the first time. Black`s work on option valuation marked the emergence of continuous time finance. Derivatives traded in trillions of dollars each year, are mostly valued using the mathematical methods Black helped develop in the early 1970s.This research produced the celebrated Black Scholes formula, based on his 1973 paper with Myron Schools, *The Pricing Of Options And Corporate Liabilities*. Black-Scholes -Merton derived the Black Scholes-Merton deferential equation, thereby solving the stock option pricing problem. In addition to his work with Scholes and Merton, he also made other important contributions, including his work on portfolio insurance, commodity futures pricing, bond swaps and interest rate futures global asset allocation models, dividend policy, international trade, business cycle, and labor economics. He was also the co-developers of the Black-Derman-Toy interest-rate derivatives model. He analyzed the capital asset pricing model (CAPM) in terms of monetary policy and Keynesian economics and discussed the most effective way it could be used.	**The High Priest Of Modern Finance**	**Key works** *The Capital-Asset Pricing Model: Some Empirical Tests(1972)* *The Pricing of Options and Corporate Liabilities(1973)* *The Effects of Dividend Yield and Dividend Policy On Common Stock Prices And Returns(1974)* *Fact And Fantasy In The Use Of Options(1975)* *The Pricing of Commodity Contracts (1976)* *Noise(1986)* *A One-factor Model Of Interest Rates And Its Application To Treasury Bond Options(1990)* *Global Portfolio Optimization(1992)* *Interest Rates as Options(1995)* **Key Contributions** Black-Scholes equation, Black-76 model Black-Derman-Toy model Black-Karasinski model Black-Litterman model Black's approximation Treynor-Black model **Influenced** Stephen A. Ross **Theoretical Strand** Portfolio Theory
John C. Cox (born in 1943) - The Cox-Ross-Rubinstein model became popular due to its relative simplicity and flexibility in that it uses a *"discrete-time"* model of the varying price over time of the underlying financial instrument , and can be applied to the pricing of American as well as European options. In the mid-1970s, Cox, Stephen Ross of MIT and John Ingersoll of Yale University published a number of papers that led to the Cox-Ingersoll-Ross term-structure model, which provided a consistent approach to the valuation of interest-rate derivatives. In a paper co-authored with Fischer Black in 1976, he examined how bond provisions can bring about a firm's bankruptcy or reorganization, one of the first to	**One of the vanguards of options modeling. He is known as one of the developers of the influential Cox-Ross-Rubinstein binomial model for the pricing of options.**	**Key Works** *Developed The Cox-Ross-Rubinstein Binomial Model For Options Pricing (1976), Published The Cox-Ingersoll-Ross Term- Structure Model (1985)* **Key Contributions** Binomial options pricing model Cox-Ingersoll-Ross-model **Influences** Robert Merton, William F.Sharpe **Theoretical Strand** Portfolio Theory

deal with default premiums and credit spreads. In a 1981 article, Cox argued that forward and future prices will not necessarily be identical. In the late 1980s, Cox solved a long standing problem in portfolio theory with Chi-fu-Huang. He has studied the use of options technology to analyze corporate securities and investment portfolio policies. His later research in asset pricing led to a widely used model of term structure of interest rates.		
Stephen A. Ross (born 1940 in Hamtramck, Michigan) - Stephen Alan "Steve" Ross is the inaugural Franco Modigliani Professor of Financial Economics at the MIT Sloan School of Management. He is known for initiating several important theories and models in financial economics. He is a widely published author in finance and economics, and is coauthor of one of the best-selling Corporate Finance texts.Ross is best known for the development of the arbitrage pricing theory (mid-1970s) as well as for his role in developing the Binomial options pricing model (1979; also known as the Cox-Ross-Rubinstein model). He was an initiator of the fundamental financial concept of risk-neutral pricing. In 1985, he contributed to the creation of the Cox-Ingersoll-Ross model for interest rate dynamics. Such theories have become an important part of the paradigm known as neoclassical finance. Ross served as President of the American Finance Association in 1988. He was named International Association of Financial Engineers' Financial Engineer of the Year in 1996.He gave the inaugural lecture of the Princeton Lectures in Finance, sponsored by the Bendheim Center for Finance of Princeton University, in 2001. It became a book in 2004, defending neoclassical finance, and such notions as the efficiency and rationality of markets, against critics, especially those who describe their work as behavioral finance.	**Creator of the arbitrage pricing theory**	**Key Works** Developed the Cox-Ross-Rubinstein Model (1979), Developed the Cox-Ingersoll-Rose Model (1985), *Corporate Finance (1988), Fundamentals of Corporate Finance (1991), Essentials of Corporate Finance (1996), Neoclassical Finance (2005)* **Key Contributions-** Arbitrage pricing theory Binomial options pricing model Cox-Ingersoll-Ross-model Cos-Ingersoll-Rubinstein model **Influences** Robert Merton, Fisher Black, Myron Scholes **Theoretical Strand** Portfolio Theory
Franco Modigliani (June 18, 1918 - September 25, 2003)- was an Italian American economist at the MIT Sloan School of Management and MIT Department of Economics, and winner of the Nobel Memorial Prize in 1985 in Economics for his research in lifecycle theory, an analysis of personal savings that has practical implications. When he was a professor at the Graduate School of Industrial Administration of Carnegie Mellon University in the 1950s and early 1960s, Modigliani made two path-breaking contributions to economic science: Along with Merton Miller, he formulated the important Modigliani-Miller theorem in corporate finance. This theorem demonstrated that under certain assumptions, the value of a firm is not affected by whether it is financed by equity (selling shares) or debt (borrowing money).He was the originator of the life-cycle hypothesis, which attempts to explain the level of saving in the economy. Modigliani proposed that consumers would aim for a stable level of consumption throughout their lifetime, for example by saving during their working years and spending during their retirement. He explored new areas of research, including international finance	**Nobel-Prize Winning Macroeconomist**	**Key Works** *The Collected Papers of Franco Modigliani (1980), Foundation Of Financial Markets And Institutions (1994), Adventures Of An Economist (2001)* **Key Contributions** Modigliani-Miller theorem Life Cycle Hypothesis MPS model **Influences** Stephen A.Ross, Irving Fisher **Influenced** Jacques Dreze, Robert Shiller **Theoretical Strand** Portfolio Theory , International Finance

and the international payment system, inflation, credit rationing, the term structure of interest rates, and the valuation of speculative assets.		
Richard H. Thaler (born September 12, 1945) is an American economist. He is perhaps best known as a theorist in behavioral finance, and for his collaboration with Daniel Kahneman and others in further defining that field.Thaler has written a number of books intended for a lay reader on the subject of behavioral finance, including *Quasi-rational Economics* and *The Winner's Curse*, the latter of which contains many of his Anomalies columns revised and adapted for a popular audience. Most recently, Thaler coauthored, with Cass R. Sunstein, *Nudge: Improving Decisions About Health, Wealth, and Happiness (Yale University Press, 2008). Nudge* discusses how public and private organizations can help people make better choices in their daily lives. Thaler and his co-author coined the term *'Choice Architect'*. Thaler gained attention in the field of economics for publishing a regular column in the *Journal of Economic Perspectives* from 1987 to 1990 titled *Anomalies*, in which he documented individual instances of economic behavior that seemed to violate traditional microeconomic theory. In one of his most recent papers, together with three Dutch economists, Thaler has analyzed the choices of contestants appearing in the popular TV game show *Deal or No Deal* and found support for behavioralists' claims of path-dependent risk attitudes.As a columnist for the New York Times news Service, Thaler has begun a series of economic solutions for some of America's financial woes, beginning with "Selling parts of the radio spectrum could help pare US deficit," with references to Thomas Hazlett's ideas for reform of the FCC and making television broadcast frequency available for improving wireless technology, reducing costs, and generating revenue for the US government. Thaler is the founder of an asset management firm, *Fuller & Thaler Asset Management,* that enables a select group of investors to capitalize on cognitive biases such as the endowment effect, loss aversion and status quo bias.	**Influential Thinker On Behavioral Finance**	**Key Works** *Quasi-Rational Economics (1991)* The Winner`s *Curse (1993) Advances in Behavioral Finance (1993) Nudge (2008)* **Key Contributions -** Behavioral finance Influences Daniel Kahneman, James Tobin **Influenced** George Loewenstein, Joseph Stiglitz **Theoretical Strand** Efficient Market Hypothesis
Joseph Eugene Stiglitz (born February 9, 1943) is an American economist and a professor at Columbia University. He is known for his critical view of the management of globalization, free-market economists (whom he calls *"free market fundamentalists"*) and international institutions like the International Monetary Fund and the World Bank. Stiglitz's most famous research was on screening, a technique used by one economic agent to extract otherwise private information from another. It was for this contribution to the theory of information asymmetry that he shared the Nobel Memorial Prize in Economics in 2001 *"for laying the foundations for the theory of markets with asymmetric information"* with George A. Akerlof and A. Michael Spence. Traditional neoclassical economics literature assumes that markets are always efficient except for some limited and well defined market failures. More recent studies by Stiglitz and others reverse that	**American Economist renowned for his critical view on globalization**	**Key Works** *Globalization and Its Discontents (2002),* *The Roaring Nineties (2003),* *Making Globalization Work (2006),* *The Three Trillion Dollar War (2008)* **Key Contributions** Screening, taxation and unemployment Influences John Maynard Keynes,Robert Solow, Eugene Fama **Influenced** Paul Krugman,Jason Furman **Theoretical Strand** International Finance

presumption: It is only under exceptional circumstances that markets are efficient. Stiglitz has shown (together with Bruce Greenwald) that *"whenever markets are incomplete and or information is imperfect (which are true in virtually all economies), even competitive market allocation is not constrained Pareto efficient".*		
Nouriel Roubini ((born 29 March 1959) - is an internationally known expert in international macroeconomics , and a long-time consultant to IMF. He has published numerous policy papers and books on key international macroeconomic issues and is regularly cited as an authority in the media for his views on the future course of the economy. He has been a participant and speaker at G-20 meetings of deputy finance ministers and Central Bank Governors meetings, where he worked on the Asian and global financial crisis of 1997-1998 and the subsequent reform of the international financial architecture. His research focuses on international macroeconomics and finance, fiscal policy, political economy, growth theory and European Monetary issues. He is known for his bearish views. He was the one of the first to forecast a recession in 2006. Although he is ranked only 410th in terms of lifetime academic citations, *Prospect Magazine*, in January 2009, voted him #2 on its *"list of the world's 100 greatest living public intellectuals"*. In 2009, Roubini was ranked #4 on *Foreign Policy* magazine's list of the *"top 100 global thinkers"*, and named one of the 100 most influential people in the world by *Time Magazine*.	**Leading Economic Policy Advisor**	**Key Works** *Bailouts or Ball-ins? Responding to Financial Crises in Emerging Economies (2004), New International Financial Architecture (2006)* **Key Contributions** International macroeconomics, international finance, political economy, growth theory, European monetary issues. **Influences** John Maynard Keynes, Hyman Minsky, Larry Summers, Jeffrey Sachs, Richard H.Thaler, Garry Becker **Theoretical Strand** International Finance

played an important role.

Harry Markowitz (1952, 1959) 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**, in his 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.

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 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 of **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 theory was the empirical analysis of asset prices. A significant 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 a 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)**. **Paul A. Samuelson's** work on speculative prices anticipated the efficient markets hypothesis in finance theory, while his research on diversification and the concept of *"lifetime portfolio"* are also respected innovations. 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, then any profit-hungry arbitrageur can easily make appropriate purchases and sales of assets to exploit this. Samuelson 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.

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 rumour, wrong information and the *"madness of crowds"*.

EMH is probably one of the more resilient empirical propositions around, 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)**.

INTERNATIONAL FINANCE

The third important body of work on finance theory was the international finance. International finance theory makes use of predominantly macroeconomic methods and concepts. Important theories in international finance include the **Mundell-Fleming** model, the optimum currency area (OCA) theory, as well as the purchasing power parity (PPP) theory.

Stainslaw Ulam once challenged **Paul Samuelson** to name one theory in all of the social sciences, which is both true and nontrivial. Several years later, Samuelson responded with **David Ricardo's** theory of comparative advantage: That it is logically true need not be argued before a mathematician; that is not trivial is attested by the thousands of important and intelligent men who have never been able to grasp the doctrine for themselves or to believe it after it was explained to them. The law of comparative advantage that Ricardo formulated made a significant contribution to political economics and has since become a central tenet of free trade, open markets, and anti-protectionism.

In dealing with the issues of general equilibrium, markets under asymmetric information, choice under uncertainty and economic applications of game theory, growth, inflation, and unemployment, economic policies such as changing taxation levels, several inter-connected contributions were made by **Richard H.Thaler (1991),James Tobin (1969), Joseph Stiglitz (2002), Garry Becker (1957).**

Friedrich Hayek (1944,1960,1988) and Paul Samuelson (1966),John Maynard Keynes (1936), Joseph Sumpeter (1939) and Nouriel Roubini (2006) made inter-connected contributions in : the attempt to understand the causes and consequences of short-run fluctuations in national income (the business cycle), and the attempt to understand the determinants of long-run economic growth (increases in national income). The most important factor that links them all is transaction costs. Transaction costs are expected to reduce by the development of finance theory **(Ronald Harry Coase, 1937)**.

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