

History of the Efficient Market Hypothesis

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August 2008 (amended September 2008)

Table 1: History of the Efficient Market Hypothesis

| Year | Notable Research |
|------|---|
| 1565 | The prominent Italian mathematician, Girolamo Cardano, in <i>Liber de Ludo Aleae</i> (The Book of Games of Chance) wrote: ‘The most fundamental principle of all in gambling is simply equal conditions, e.g. of opponents, of bystanders, of money, of situation, of the dice box, and of the die itself. To the extent to which you depart from that equality, if it is in your opponents favour, you are a fool, and if in your own, you are unjust.’ (Cardano 1564) |
| 1828 | Scottish botanist, Robert Brown, noticed that grains of pollen suspended in water had a rapid oscillatory motion when viewed under a microscope. (Brown 1828) |
| 1863 | A French stockbroker, Jules Regnault, observed that the longer you hold a security, the more you can win or lose on its price variations: the price deviation is directly proportional to the square root of time. (Regnault 1863) |
| 1880 | The British physicist, Lord Rayleigh, (through his work on sound vibrations) is aware of the notion of a random walk. (Rayleigh 1880) |
| 1888 | John Venn, the British logician and philosopher, had a clear concept of both a random walk and Brownian motion. (Venn 1888) |
| 1889 | Efficient markets were clearly mentioned in a book by George Gibson entitled <i>The Stock Markets of London, Paris and New York</i> . Gibson wrote that when ‘shares become publicly known in an open market, the value which they acquire may be regarded as the judgment of the best intelligence concerning them.’ (Gibson 1889) |
| 1890 | Alfred Marshall wrote <i>Principles of Economics</i> . (Marshall 1890) |
| 1900 | A French mathematician, Louis Bachelier, published his PhD thesis, <i>Théorie de la Spéculation</i> . He developed the mathematics and statistics of Brownian motion five years before Einstein (1905). He also deduced that ‘The mathematical expectation of the speculator is zero’ 65 years before Samuelson (1965) explained efficient markets in terms of a martingale. Bachelier’s work was way ahead of his time and was ignored until it was rediscovered by Savage in 1955. (Bachelier 1900) |

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| Year | Notable Research |
|------|---|
| 1901 | |
| 1902 | |
| 1903 | |
| 1904 | |
| 1905 | Karl Pearson, a professor and Fellow of the Royal Society, introduced the term <i>random walk</i> in the letters pages of Nature. (Pearson 1905) Unaware of Bachelier's work in 1900, Albert Einstein developed the equations for Brownian motion. (Einstein 1905) |
| 1906 | A Polish scientist, Marian Smoluchowski, described Brownian motion. (von Smoluchowski 1906) |
| 1907 | |
| 1908 | Bachelier's arguments can also be found in André Barriol's book on financial transactions. (Barriol 1908) De Montessus published a book on probability and its applications, which contains a chapter on finance based on Bachelier's thesis. (de Montessus 1908) Langevin authors the stochastic differential equation of Brownian motion. (Langevin 1908) |
| 1909 | |
| 1910 | |
| 1911 | |
| 1912 | George Binney Dibblee published <i>The Laws of Supply and Demand</i> . (Dibblee 1912) |
| 1913 | |
| 1914 | Bachelier published the book, <i>Le Jeu, la Chance et le Hasard</i> (The Game, the Chance and the Hazard), which sold over six thousand copies. (Bachelier 1914) |
| 1915 | According to Mandelbrot (1963) the first to note that distributions of price changes are too 'peaked' to be relative to samples from Gaussian populations was Wesley C. Mitchell. (Mitchell 1915) |
| 1916 | |
| 1917 | |
| 1918 | |
| 1919 | |
| 1920 | |
| 1921 | F. W. Taussig published a paper under the title, 'Is market price determinate?' (Taussig 1921) |
| 1922 | |
| 1923 | Keynes clearly stated that investors on financial markets are rewarded not for knowing better than the market what the future has in store, but rather for risk baring, this is a consequence of the EMH. (Keynes 1923) |

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| Year | Notable Research |
|------|---|
| 1924 | |
| 1925 | Frederick MacCauley, an economist, observed that there was a striking similarity between the fluctuations of the stock market and those of a chance curve which may be obtained by throwing a dice. (MacCauley 1925) |
| 1926 | Unquestionable proof of the leptokurtic nature of the distribution of returns was given by Maurice Olivier in his Paris doctoral dissertation. (Olivier 1926) |
| 1927 | Frederick C. Mills, in <i>The Behavior of Prices</i> , proved the leptokurtosis of returns. (Mills 1927) |
| 1928 | |
| 1929 | Wall Street Crash of 1929 in late October. |
| 1930 | Alfred Cowles, 3rd, the American economist and businessman, founded and funded both the Econometric Society and its journal, <i>Econometrica</i> . |
| 1931 | |
| 1932 | Cowles set up the Cowles Commission for Economic Research. |
| 1933 | Cowles analysed the performance of investment professionals and concluded that stock market forecasters cannot forecast. (Cowles 1933) |
| 1934 | Holbrook Working concludes that stock returns behave like numbers from a lottery. (Working 1934) |
| 1935 | |
| 1936 | English economist John Maynard Keynes has <i>General Theory of Employment, Interest, and Money</i> published. He famously compares the stock market with a beauty contest, and also claims that most investors' decisions can only be as a result of 'animal spirits'. (Keynes 1936) |
| 1937 | Eugen Slutsky shows that sums of independent random variables may be the source of cyclic processes. (Slutsky 1937) In the only paper published before 1960 which found significant inefficiencies, Cowles and Jones found significant evidence of serial correlation in averaged time series indices of stock prices. (Cowles and Jones 1937) |
| 1938 | |
| 1939 | |
| 1940 | |
| 1941 | |
| 1942 | |
| 1943 | |
| 1944 | In a continuation of his 1933 publication, Cowles again reported that investment professionals do not beat the market. (Cowles 1944) |
| 1945 | |
| 1946 | |
| 1947 | |
| 1948 | |

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| Year | Notable Research |
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| 1949 | Holbrook Working showed that in an ideal futures market it would be impossible for any professional forecaster to predict price changes successfully. (Working 1949) |
| 1950 | |
| 1951 | |
| 1952 | |
| 1953 | Milton Friedman points out that, due to arbitrage, the case for the EMH can be made even in situations where the trading strategies of investors are correlated. (Friedman 1953) Kendall analysed 22 price-series at weekly intervals and found to his surprise that they were essentially random. Also, he was the first to note the time dependence of the empirical variance (nonstationarity). (Kendall 1953) |
| 1954 | |
| 1955 | Around this time, Leonard Jimmie Savage, who had discovered Bachelier's 1914 publication in the Chicago or Yale library sent half a dozen 'blue ditto' postcards to colleagues, asking 'does any one of you know him?' Paul Samuelson was one of the recipients. He couldn't find the book in the MIT library, but he did discover a copy of Bachelier's PhD thesis. (Bernstein 1992; Taqqu 2001) |
| 1956 | Bachelier's name reappeared in economics, this time, as an acknowledged forerunner, in a thesis on options-like pricing by a student of MIT, economist Paul A. Samuelson. (Mandelbrot and Hudson 2004) |
| 1957 | |
| 1958 | Working builds an anticipatory market model. (Working 1958) |
| 1959 | Harry Roberts demonstrates that a random walk will look very much like an actual stock series. (Harry 1959) M. F. M. Osborne shows that the logarithm of common-stock prices follows Brownian motion; and also found evidence of the square root of time rule. Regarding the distribution of returns, he finds 'a larger "tangential dispersion" in the data at these limits.' (Osborne 1959) |
| 1960 | Larson presents the results of an application of a new method of time series analysis. He notes that the distribution of price changes is 'very nearly normally distributed for the central 80 per cent of the data, but there is an excessive number of extreme values.' (Larson 1960) Cowles revisits the results in Cowles and Jones (1937), correcting an error introduced by averaging, and still finds mixed temporal dependence results. (Cowles 1960) Working showed that the use of averages can introduce autocorrelations not present in the original series. (Working 1960) |
| 1961 | Houthakker uses stop-loss sell orders and finds patterns. He also finds leptokurtosis, nonstationarity and suspects non-linearity. (Houthakker 1961) Independently of Working (1960), Alexander realised that spurious autocorrelation could be introduced by averaging; or if the probability of a rise is not 0.5. He concluded that the random walk model best fits the data, but found leptokurtosis in the distribution of returns. Also, this paper was the first to test for non-linear dependence. (Alexander 1961) |

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| Year | Notable Research |
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| | John F. Muth introduces the rational expectations hypothesis in economics. (Muth 1961) |
| 1962 | Mandelbrot first proposes that the tails follow a power law, in IBM Research Note NC-87. (Mandelbrot 1962) Paul H. Cootner concludes that the stock market is not a random walk. (Cootner 1962) Osborne investigates deviations of stock prices from a simple random walk, and his results include the fact that stocks tend to be traded in concentrated bursts. (Osborne 1962) Arnold B. Moore found insignificant negative serial correlation of the returns of individual stocks, but a slight positive serial correlation for the index. (Moore 1962) Jack Treynor wrote his unpublished manuscript ‘Toward a theory of market value of risky assets’, the first paper on the Capital Asset Pricing Model (CAPM), yet rarely cited and often incorrectly referred to as ‘Treynor (1961)’. (Treynor 1962) |
| 1963 | Berger and Mandelbrot propose a new model for error clustering in telephone circuits, and if their argument is applicable to stock trading, it might afford justification for the Pareto-Levy distribution of stock price changes claimed by Mandelbrot. (Berger and Mandelbrot 1963) Granger and Morgenstern perform spectral analysis on market prices and found that short-run movements of the series obey the simple random walk hypothesis, but that long-run movements do not, and that ‘business cycles’ were of little or no importance. (Granger and Morgenstern 1963) Benoit Mandelbrot presents and tests a new model of price behaviour. Unlike Bachelier, he uses natural logarithms of prices and also replaces the Gaussian distributions with the more general stable Paretian. (Mandelbrot 1963) Fama discusses Mandelbrot’s ‘stable Paretian hypothesis’ and concludes that the tested market data conforms to the distribution. (Fama 1963) |
| 1964 | Alexander answers the critics of his 1961 paper and concludes that the S&P industrials does not follow a random walk. (Alexander 1964) Cootner edited his classic book, <i>The Random Character of Stock Market Prices</i> , a collection of papers by Roberts, Bachelier, Cootner, Kendall, Osborne, Working, Cowles, Moore, Granger and Morgenstern, Alexander, Larson, Steiger, Fama, Mandelbrot and others. (Cootner 1964) Godfrey, Granger and Morgenstern publish ‘The random walk hypothesis of stock market behavior’. (Godfrey, Granger and Morgenstern 1964) Steiger tests for nonrandomness and concludes that stock prices do not follow a random walk. (Steiger 1964) Sharpe published his Nobel prize-winning work on the CAPM. (Sharpe 1964) |
| 1965 | Fama defines an “efficient” market for the first time, in his landmark empirical analysis of stock market prices that concluded that they follow a random walk. (Fama 1965b) |

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| Year | Notable Research |
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| | Samuelson provided the first formal economic argument for ‘efficient markets’. His contribution is neatly summarized by the title of his article: ‘Proof that properly anticipated prices fluctuate randomly’. He (correctly) focussed on the concept of a martingale, rather than a random walk (as in Fama (1965b)). (Samuelson 1965) Fama explains how the theory of random walks in stock market prices presents important challenges to both the chartist and the proponent of fundamental analysis. (Fama 1965a) |
| 1966 | Fama and Blume concluded that for measuring the direction and degree of dependence in price changes, serial correlation is probably as powerful as the Alexandrian filter rules. (Fama and Blume 1966) Mandelbrot proved some of the first theorems showing how, in competitive markets with rational risk-neutral investors, returns are unpredictable—security values and prices follow a martingale. (Mandelbrot 1966) |
| 1967 | Harry Roberts coined the term <i>efficient markets hypothesis</i> and made the distinction between weak and strong form tests, which became the classic taxonomy in Fama (1970). (Roberts 1967) |
| 1968 | Michael C. Jensen evaluates the performance of mutual funds and concludes that ‘on average the funds apparently were not quite successful enough in their trading activities to recoup even their brokerage expenses.’ (Jensen 1968) Ball and Brown were the first to publish an ‘event study’. (Ball and Brown 1968) |
| 1969 | Fama, Fisher, Jensen and Roll undertook the first ever event study (although they were not the first to publish), and their results lend considerable support to the conclusion that the stock market is efficient. (Fama, <i>et al.</i> 1969) |
| 1970 | The definitive paper on the efficient markets hypothesis is Eugene F. Fama’s first of three review papers: ‘Efficient capital markets: A review of theory and empirical work’. He defines an efficient market thus: ‘A market in which prices always “fully reflect” available information is called “efficient.”’. He was also the first to consider the ‘joint hypothesis problem’. (Fama 1970) Granger and Morgenstern publish the book <i>Predictability of Stock Market Prices</i> . (Granger and Morgenstern 1970) |
| 1971 | Kemp and Reid concluded that share price movements were ‘conspicuously non-random’. (Kemp and Reid 1971) Jack L. Treynor published ‘The only game in town’ under the pseudonym ‘Walter Bagehot’. (Bagehot 1971) Hirshleifer first noted that the expected revelation of information can prevent risk sharing. (Hirshleifer 1971) |
| 1972 | Scholes studies the price effects of secondary offerings and finds that the market is efficient except for some indication of post-event price drift. (Scholes 1972) |
| 1973 | Samuelson wrote his survey paper, ‘Mathematics of speculative price’. (Samuelson 1973a) |

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| Year | Notable Research |
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| | <p>LeRoy showed that under risk-aversion, there is no theoretical justification for the martingale property. (LeRoy 1973)</p> <p>Lorie and Hamilton publish the book <i>The Stock Market: Theories and Evidence</i>. (Lorie and Hamilton 1973)</p> <p>Burton G. Malkiel first publishes the classic <i>A Random Walk Down Wall Street</i>. As of August 2008, there have been 25 editions. (Malkiel 1973)</p> <p>Samuelson generalized his earlier (1965) work to include stocks that pay dividends. (Samuelson 1973b)</p> |
| 1974 | |
| 1975 | |
| 1976 | <p>Cox and Ross author ‘The valuation of options for alternative stochastic processes’. (Cox and Ross 1976)</p> <p>Sanford Grossman describes a model which shows that ‘informationally efficient price systems aggregate diverse information perfectly, but in doing this the price system eliminates the private incentive for collecting the information.’ (Grossman 1976)</p> <p>Fama publishes the book <i>Foundations of Finance</i>. (Fama 1976)</p> |
| 1977 | <p>M. F. M. Osborne published <i>The Stock Market and Finance From a Physicist’s Viewpoint</i>, a collection of lecture notes, in which he discusses market-making, random walks, statistical methods and sequential analysis of stock market data. (Osborne 1977)</p> <p>Beja showed that the efficiency of a real market is impossible. (Beja 1977)</p> |
| 1978 | <p>Ball wrote a survey paper which revealed consistent excess returns after public announcements of firms’ earnings. (Ball 1978)</p> <p>Jensen famously wrote, ‘I believe there is no other proposition in economics which has more solid empirical evidence supporting it than the Efficient Market Hypothesis.’ He defines efficiency thus: ‘A market is efficient with respect to information set θ_t if it is impossible to make economic profits by trading on the basis of information set θ_t.’ (Jensen 1978)</p> <p>Robert E. Lucas, Jr. builds a theoretical model of rational agents which shows that the martingale property need not hold under risk aversion. (Lucas 1978)</p> |
| 1979 | <p>With a theoretical model, Radner shows when rational expectations equilibria exist that reveal to all traders all of their initial information. (Radner 1979)</p> <p>Dimson reviews the problems of risk measurement (estimating beta) when shares are subject to infrequent trading. (Dimson 1979)</p> <p>Harrison and Kreps publish ‘Martingales and arbitrage in multiperiod securities markets’. (Harrison and Kreps 1979)</p> <p>Robert J. Shiller shows that the volatility of long-term interest rates is greater than predicted. (Shiller 1979)</p> |
| 1980 | <p>Sanford J. Grossman and Joseph E. Stiglitz show that it is impossible for a market to be perfectly informationally efficient. Because information is costly, prices cannot perfectly reflect the information which is available, since if it did, investors who spent resources on obtaining and analysing it would receive no compensation. Thus, a sensible model of market equilibrium must leave some incentive for information-gathering (security analysis). (Grossman and Stiglitz 1980)</p> |

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| Year | Notable Research |
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| 1981 | <p>LeRoy and Porter showed that stock markets exhibit ‘excess volatility’ and they reject market efficiency. (LeRoy and Porter 1981)</p> <p>Stiglitz shows that even with apparently competitive and ‘efficient’ markets, resource allocations may not be Pareto efficient. (Stiglitz 1981)</p> <p>Shiller shows that stock prices move too much to be justified by subsequent changes in dividends, i.e. excess volatility. (Shiller 1981)</p> |
| 1982 | <p>Milgrom and Stokey show that under certain conditions, the receipt of private information cannot create any incentives to trade. (Milgrom and Stokey 1982)</p> <p>Tirole shows that unless traders have different priors or are able to obtain insurance in the market, speculation relies on inconsistent plans, and thus is ruled out by rational expectations. (Tirole 1982)</p> |
| 1983 | |
| 1984 | <p>Osborne and Murphy find evidence of the square root of time rule in earnings. (Osborne and Murphy 1984)</p> <p>Roll examined US orange juice futures prices and the effect of the weather. He found excess volatility. (Roll 1984)</p> |
| 1985 | <p>Werner F. M. De Bondt and Richard Thaler discovered that stock prices overreact; evidencing substantial weak form market inefficiencies. This paper marked the start of behavioural finance. (De Bondt and Thaler 1985)</p> |
| 1986 | <p>Marsh and Merton analyse the variance-bound methodology used by Shiller and conclude that this approach cannot be used to test the hypothesis of stock market rationality. They also highlight the practical consequences of rejecting the EMH. (Marsh and Merton 1986)</p> <p>Fischer Black introduces the concept of ‘noise traders’, those who trade on anything other than information, and shows that noise trading is essential to the existence of liquid markets. (Black 1986)</p> <p>Lawrence H. Summers argues that many statistical tests of market efficiency have very low power in discriminating against plausible forms of inefficiency. (Summers 1986)</p> <p>French and Roll found that asset prices are much more volatile during exchange trading hours than during non-trading hours; and they deduced that this is due to trading on private information—the market generates its own news. (French and Roll 1986)</p> |
| 1987 | |
| 1988 | <p>Fama and French found large negative autocorrelations for stock portfolio return horizons beyond a year. (Fama and French 1988)</p> <p>Lo and MacKinlay strongly rejected the random walk hypothesis for weekly stock market returns using the variance-ratio test. (Lo and MacKinlay 1988)</p> <p>Poterba and Summers show that stock returns show positive autocorrelation over short periods and negative autocorrelation over longer horizons. (Poterba and Summers 1988)</p> |

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| Year | Notable Research |
|------|---|
| | Conrad and Kaul characterize the stochastic behaviour of expected returns on common stock. (Conrad and Kaul 1988) |
| 1989 | <p>Cutler, Poterba and Summers found that news does not adequately explain market movement. (Cutler, Poterba and Summers 1989)</p> <p>Eun and Shim found that a substantial amount of interdependence exists among national stock markets, and the results are consistent with informationally efficient international stock markets. (Eun and Shim 1989)</p> <p>Ball discusses the specification of stock market efficiency. (Ball 1989)</p> <p>Guimaraes, Kingsman and Taylor edit the book <i>A Reappraisal of the Efficiency of Financial Markets</i>. (Guimaraes, Kingsman and Taylor 1989)</p> <p>Shiller publishes <i>Market Volatility</i>, a book about the sources of volatility which challenges the EMH. (Shiller 1989)</p> <p>LeRoy publishes his survey paper, 'Efficient capital markets and martingales'. He makes it clear that the transition between the intuitive idea of market efficiency and the martingale is far from direct. (LeRoy 1989)</p> |
| 1990 | <p>Laffont and Maskin show that the efficient market hypothesis may well fail if there is imperfect competition. (Laffont and Maskin 1990)</p> <p>Lehmann finds reversals in weekly security returns and rejects the efficient market hypothesis. (Lehmann 1990)</p> <p>Jegadeesh documents strong evidence of predictable behaviour of security returns and rejects the random walk hypothesis. (Jegadeesh 1990)</p> |
| 1991 | <p>Kim, Nelson and Startz re-examine the empirical evidence for mean-reverting behaviour in stock prices and find that mean reversion is entirely a pre-World War II phenomenon. (Kim, Nelson and Startz 1991)</p> <p>Matthew Jackson explicitly models the price formation process and shows that if agents are not price-takers, then it is possible to have an equilibrium with fully revealing prices and costly information acquisition. (Jackson 1991)</p> <p>Andrew W. Lo developed a test for long-run memory that is robust to short-range dependence, and concludes that there is no evidence of long-range dependence in any of the stock returns indices tested. (Lo 1991)</p> <p>Fama wrote the second of his three review papers. Instead of weak-form tests, the first category now covers the more general area of tests for return predictability. (Fama 1991)</p> |
| 1992 | <p>Chopra, Lakonishok and Ritter find that stocks overreact. (Chopra, Lakonishok and Ritter 1992)</p> <p>Bekaert and Hodrick characterize predictable components in excess returns on equity and foreign exchange markets. (Bekaert and Hodrick 1992)</p> <p>Peter L. Bernstein publishes the book <i>Capital Ideas</i>, an engaging account of the history of the ideas that shaped modern finance and laced with anecdotes. (Bernstein 1992)</p> |

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| Year | Notable Research |
|-------------|--|
| | Malkiel contributed an essay 'Efficient market hypothesis' in the <i>New Palgrave Dictionary of Money and Finance</i> . (Malkiel 1992) |
| 1993 | Jegadeesh and Titman found that trading strategies that bought past winners and sold past losers realized significant abnormal returns. (Jegadeesh and Titman 1993) Richardson shows that the patterns in serial-correlation estimates and their magnitude observed in previous studies should be expected under the null hypothesis of serial independence. (Richardson 1993) |
| 1994 | Roll observes that in practice it is hard to profit from even the strongest market inefficiencies. (Roll 1994) Huang and Stoll provide new evidence concerning market microstructure and stock return predictions. (Huang and Stoll 1994) Metcalf and Malkiel find that portfolios of stocks chosen by experts do not consistently beat the market. (Metcalf and Malkiel 1994) Lakonishok, Shleifer and Vishny provide evidence that value strategies yield higher returns because these strategies exploit the suboptimal behaviour of the typical investor and not because these strategies are fundamentally riskier. (Lakonishok, Shleifer and Vishny 1994) |
| 1995 | Robert Haugen publishes the book <i>The New Finance: The Case Against Efficient Markets</i> . He emphasizes that short-run overreaction (which causes momentum in prices) may lead to long-term reversals (when the market recognizes its past error). (Haugen 1995) |
| 1996 | W. Brian Arthur, <i>et al.</i> propose a theory of asset pricing by creating an artificial stock market with heterogeneous agents with endogenous expectations. (Arthur, <i>et al.</i> 1997) Campbell, Lo and MacKinlay publish their seminal book on empirical finance, <i>The Econometrics of Financial Markets</i> . (Campbell, Lo and Mackinlay 1996) Chan, Jegadeesh and Lakonishok look at momentum strategies and their results suggest a market that responds only gradually to new information. (Chan, Jegadeesh and Lakonishok 1996) |
| 1997 | Andrew Lo edits two volumes that bring together the most influential articles on the EMH. (Lo 1997) Chan, Gup and Pan conclude that the world equity markets are weak-form efficient. (Chan, Gup and Pan 1997) Dow and Gorton investigate the connection between stock market efficiency and economic efficiency. (Dow and Gorton 1997) |
| 1998 | Elroy Dimson and Massoud Mussavian give a brief history of market efficiency. (Dimson and Mussavian 1998) In his third of three reviews, Fama concludes that, '[m]arket efficiency survives the challenge from the literature on long-term return anomalies.' (Fama 1998) |
| 1999 | Lo and MacKinlay publish <i>A Non-Random Walk Down Wall Street</i> . (Lo and MacKinlay 1999) |

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| Year | Notable Research |
|------|---|
| | <p>Haugen published the second edition of his book, which makes the case for the inefficient market, positioning the efficient market paradigm at the extreme end of a spectrum of possible states. (Haugen 1999)</p> <p>Bernstein criticizes the EMH and claims that the marginal benefits of investors acting on information exceed the marginal costs. (Bernstein 1999)</p> <p>Zhang presents a theory of marginally efficient markets. (Zhang 1999)</p> <p>Farmer and Lo publish an excellent but brief review article. (Farmer and Lo 1999)</p> |
| 2000 | <p>Shleifer publishes <i>Inefficient Markets: An Introduction to Behavioral Finance</i>, which questions the assumptions of investor rationality and perfect arbitrage. (Shleifer 2000)</p> <p>Lo publishes a selective survey of finance. (Lo 2000)</p> <p>Beechey, Vickery and Gruen published a survey paper on the EMH. (Beechey, Gruen and Vickery 2000)</p> <p>Shiller publishes the first edition of <i>Irrational Exuberance</i>, which challenges the EMH, demonstrating that markets cannot be explained historically by the movement of company earnings or dividends. (Shiller 2000)</p> |
| 2001 | <p>Eugene Fama became the first elected fellow of the American Finance Association.</p> <p>In an excellent historical review paper, Andreou, Pittis and Spanos trace the development of various statistical models proposed since Bachelier (1900) in an attempt to assess how well these models capture the empirical regularities exhibited by data on speculative prices. (Andreou, Pittis and Spanos 2001)</p> <p>Mark Rubinstein re-examines some of the most serious historical evidence against market rationality and concludes that markets are rational. (Rubinstein 2001)</p> <p>Shafer and Vovk publish <i>Probability and Finance: It's Only a Game!</i> which shows how probability can be based on game theory; they then apply the framework to finance. (Shafer and Vovk 2001)</p> |
| 2002 | <p>Lewellen and Shanken conclude that parameter uncertainty can be important for characterizing and testing market efficiency. (Lewellen and Shanken 2002)</p> <p>Chen and Yeh investigate the emergent properties of artificial stock markets and show that the EMH can be satisfied with some portions of the artificial time series. (Chen and Yeh 2002)</p> |
| 2003 | <p>Malkiel examines the attacks on the EHM and concludes that stock markets are far more efficient and far less predictable than some recent academic papers would have us believe. (Malkiel 2003)</p> <p>G. William Schwert shows that when anomalies are published, practitioners implement strategies implied by the papers and the anomalies subsequently weaken or disappear. In other words, research findings cause the market to become more efficient. (Schwert 2003)</p> |

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| Year | Notable Research |
|------|---|
| | In the third edition of his book, Haugen focuses on the evidence, causes and history of overreactive pricing in the stock market. (Haugen 2003) |
| 2004 | Timmermann and Granger discuss the EMH from the perspective of a modern forecasting approach. (Timmermann and Granger 2004) |
| 2005 | Malkiel shows that professional investment managers do not outperform their index benchmarks and provides evidence that by and large market prices do seem to reflect all available information. (Malkiel 2005) |
| 2006 | Blakey looked at some of the causes and consequences of random price behaviour. (Blakey 2006) Tóth and Kertész found evidence of increasing efficiency in the NYSE. (Tóth and Kertész 2006) |
| 2007 | |
| 2008 | McCauley, Bassler and Gunaratne show that martingale stochastic processes generate uncorrelated, generally <i>non-stationary</i> increments; explain why martingales look Markovian at the level of both simple averages <i>and</i> 2-point correlations; and prove that arbitrary martingales are topologically inequivalent to Wiener processes. (McCauley, Bassler and Gunaratne 2008) Andrew Lo wrote the ‘Efficient Markets Hypothesis’ article for the second edition of <i>The New Palgrave Dictionary of Economics</i> . (Lo 2008) |

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