

Cassandra Goes to the Market:

How economists make good and bad predictions

Montclair State University Humanities in the Schools Program:
“From Alpha to Omega: Imagining Beginnings, Foreseeing Ends”

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10:30 session



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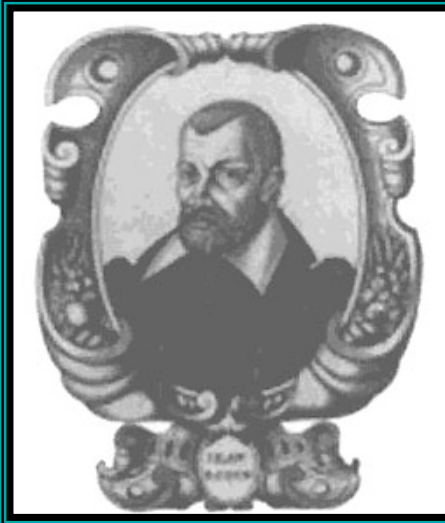
Is Prediction a Matter of Fate or Science?



Predictions are central to all decisions

- The ancients had a very limited sense of the scientific method as we know it today. Not surprisingly, they viewed many events as the product of fate, or even random forces in the universe. It is thus not surprising that the Greeks worshipped many gods, and that they were masters in the development of tragic and heroic literature, for this is how so much of the physical world appeared to them.
- The question is whether the accuracy of one's prediction leads to meaningful action, or whether one is condemned to an uncontrollable fate, as was Cassandra in her time. Her gift of prophecy from Apollo led her to correctly predict the fall of Troy, but to no avail. We thus think of a Cassandra as one who can predict the future but who has little control over events. The question is how accurate economists have been over time, and whether their predictions have produced appropriate responses, or whether they have tended to share the same fate as Cassandra.
- If we use science to make decisions, we rely on assumptions about past observations to construct predictive models of the future. Economic forecasting is, in part, the story of how science applies to understanding and predicting human behavior.

Can We Predict Inflation?

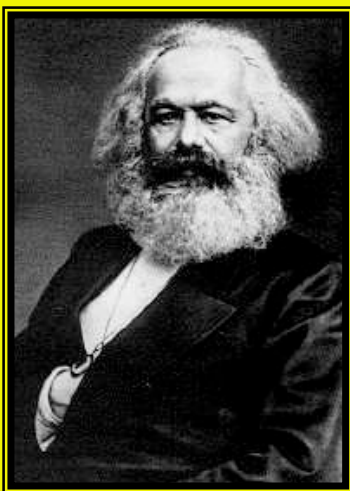


Jean Bodin (1530-1596)

The Quantity Theory of Money and Spanish Inflation in the 16th Century

- French jurist Jean Bodin wrote one of the first tracts on the quantity theory of money. In his “Réponses aux paradoxes de M. Malestroict” in 1568, Bodin argued that inflation can occur in several ways. One, put forth by Malestroict, and reflecting the historical experience of French monarch Philippe LeBel (1265-1314), is that debasement of a currency can cause a general rise in prices. Bodin accepted this argument, but in observing the rapid rise in prices in Spain, argued that a rapid increase in the supply of money, in this case, silver from the Potosi mines in Peru, could produce an equally devastating effect. Bodin’s larger insight was correct, and Spain experienced devastating increases in inflation as larger and larger quantities of silver were imported into Spain from the various conquistadors of the Spanish monarchy, notably, Charles V (1517-1556), and later Philip II (1556-1598). Bodin’s original formulation was kept in mind by later economists, including Irving Fisher (1867-1947) and Milton Friedman (1912-), and whose lessons have been learned well at the U.S. Federal Reserve, notably under the leadership of Alan Greenspan and more recently by Ben Bernanke. As some have argued, however, undue restraint in the supply of money and credit can produce the opposite effect, namely, a great depression, as it now known to be the case with Federal Reserve policy following the stock market crash in October 1929. What is remarkable is that Bodin had none of the econometric modeling skills that later economists were to use in formulating models of monetary policy.

Can We Predict the Future of Capitalism?



Karl Marx (1818-1883)



Joseph A. Schumpeter (1883-1950)

Marx vs. Schumpeter on the Future of Capitalism

- With the upheaval and growth of the industrial revolution, several observers saw in the emerging economies of Europe both opportunity and disaster. One Cassandra on England's prospects was Karl Marx (1818-1848), co-author of the *Communist Manifesto* (1848), *Das Kapital* (1867), and numerous other works. Marx predicted the collapse of capitalism and its replacement by a socialist system, based on his labor theory of value, a classical notion that he used to characterize as economic exploitation. Marx then went on to predict that the rate of exploitation was highest in the most advanced economy of the time, England, and that it would be the first to undergo a socialist revolution. Marx was wrong - the first Communist state was the Soviet Union, and it lasted but 70 years, as the inconsistencies of the the labor theory of value were laid bare. Despite Marx's wrong prediction, he still has his followers, even after the collapse of the Soviet Union in 1990.
- As with Marx, Austrian economist Joseph Schumpeter predicted the replacement of capitalism by a socialist economic system. In his 1942 study, *Capitalism, Socialism, and Democracy*, Schumpeter predicted that this change would take place not because of the labor theory of value, or of the exploitation of labor, but through the success of capitalism in achieving material success. Schumpeter also was wrong in his prediction, which suggests that grand predictions on the future of capitalism may still be produced, but capitalism has shown itself to be remarkably flexible and resilient. What it does embody is Schumpeter's famous declaration about "creative destruction", in which new industries are constantly being invented, thereby rendering obsolete old ones. In this sense, capitalism has no known diminishing returns to human creativity.

Are We Running Out of Energy - part 1?



William Stanley Jevons (1835-1882)

The Coal Question (1865)

- At the time of the Crystal Palace Exhibition in London in 1851, England was enjoying the benefits of free trade and industrialization
- Queen Victoria knew that much of England's growth depended on the consumption of coal, and commissioned a young economist, William Stanley Jevons, to undertake a study of how long England's coal reserves would last
- Jevons studied available data and published his findings in an 1865 monograph, *The Coal Question*. He predicted that at current rates of consumption, England could enjoy continued growth for up to 100 years, but not more

England's Coal Balances in Perspective

Coal Production and Consumption in the United Kingdom, 1993-2003

(in millions of short tons)

| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 |
|--------------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Production | | | | | | | | | | | |
| Anthracite | 75.2 | 53.9 | 52.5 | 53.5 | 51.8 | 44.1 | 39.9 | 33.7 | 34.7 | 32.6 | 30.6 |
| Bituminous | 1.1 | 1.1 | 1.2 | 1.8 | 2.0 | 2.4 | 2.4 | 2.9 | 2.8 | 2.9 | 3.2 |
| Lignite | 74.1 | 52.9 | 51.3 | 51.7 | 49.8 | 41.7 | 37.4 | 30.8 | 32.0 | 29.7 | 27.5 |
| Total | 150.4 | 107.8 | 105.0 | 107.0 | 103.6 | 88.3 | 79.7 | 67.5 | 69.5 | 65.1 | 61.2 |
| Consumption | 96.1 | 90.8 | 79.0 | 77.1 | 68.8 | 68.3 | 60.7 | 63.9 | 70.1 | 64.2 | 68.8 |
| Balance | 54.2 | 17.1 | 26.0 | 30.0 | 34.8 | 20.0 | 19.1 | 3.6 | -0.6 | 1.0 | -7.6 |

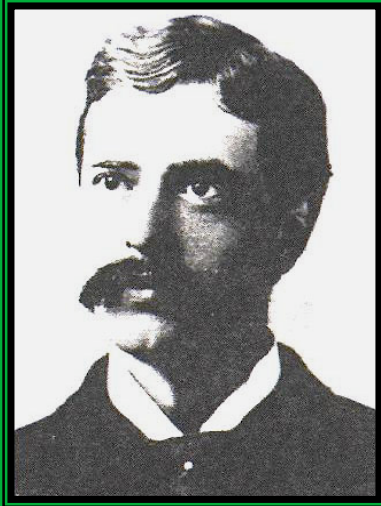
Note: components may not add to total due to rounding

Source: DOE/EIA

Resolving the Coal Question

- When Jevons wrote his monograph, *The Coal Question*, he used simple extrapolations from limited historical data to project how long reserves would last. Today, economists use more sophisticated econometric models.
- Interestingly, Jevons' approach did not take into account the impact of relative prices on production and consumption. The fact that England still produces coal today reflects the impact of relative prices on all forms of energy, including the quality of these fuels to end users.
- If we accept the notion of resource substitution, then England, and the rest of the world for that matter, is not likely to run out of coal anytime soon. Fortunately, England's leaders did not take the prediction of Jevons' dire prediction too seriously at the time. As to Jevons himself, his reputation stands taller as a contributor to the marginalist economic revolution of the 1870s, in which marginal changes are more determining of economic choices than average ones. And that is just as true for coal as it is for other resources.

Can We Predict Economic Booms and Busts?



Irving Fisher (1867-1947)

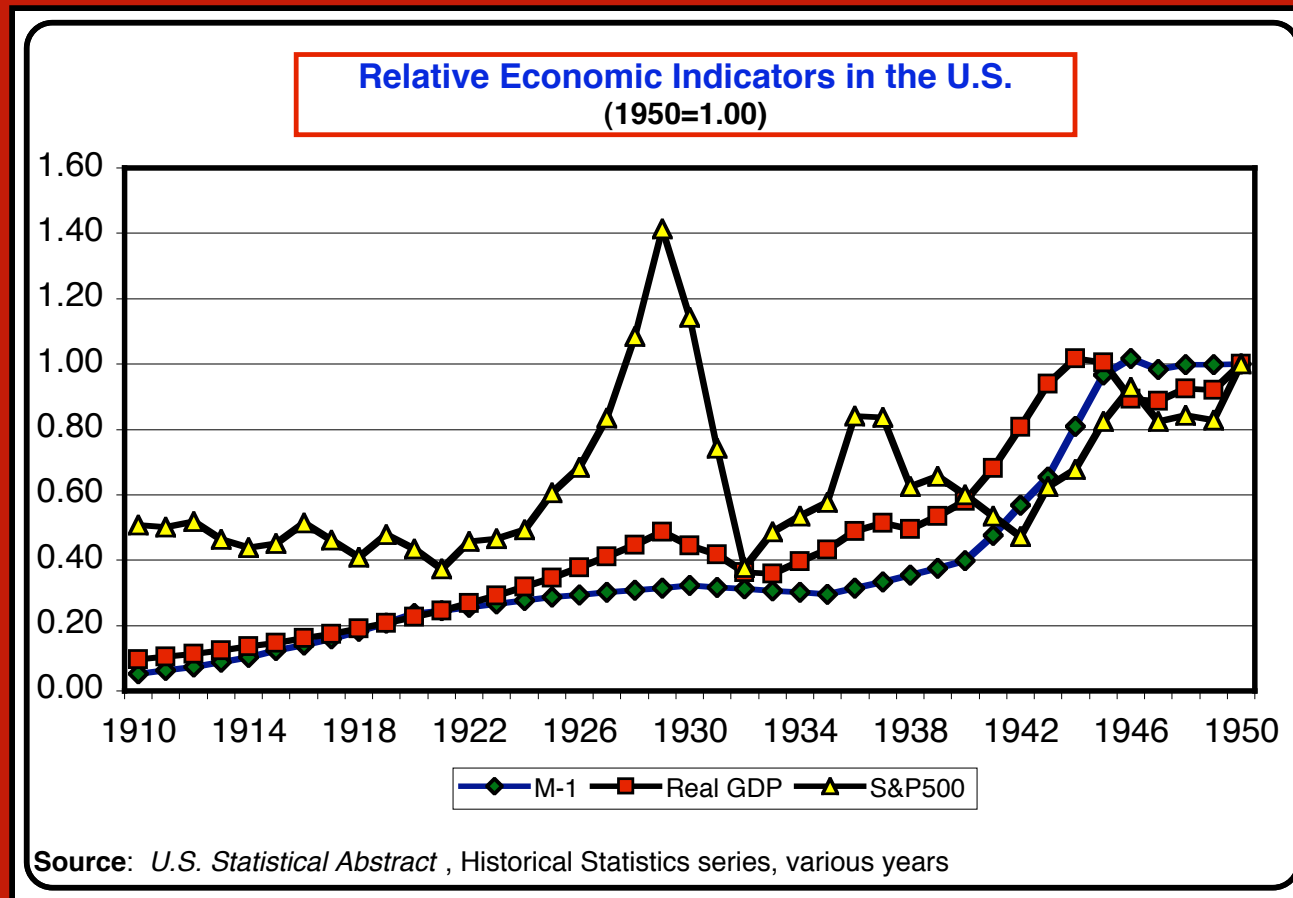


Roger Babson (1875-1967)

Two Views of the Stock Market in 1929

- Was anyone able to predict the stock market crash of 1929? One who did so was investor Roger Babson (1875-1967), from whom we offer these historical quotes: "Sooner or later a crash is coming that will take in the leading stocks and cause a decline of from 60 to 80 points on the Dow Jones barometer." (Sept. 5, 1929) [It dropped from 381 on Sept. 3, 1929 to 41 on July 8, 1932.] "In a big way, 1931 can be described as a year of opportunity." (Dec. 26, 1930). Babson's estimates were based on his own judgmental formulations. He gained by withdrawing from the market, and the Babson School of Business began not long thereafter in his honor. And Cassandra would have recognized him.
- One who dismissed the stock market crash was well-known Yale economics professor Irving Fisher (1867-1947): Fisher pioneered in quantitative tools for economic analysis and forecasting, and also was the inventor of the rolodex. As to the stock market crash, he said soon after Black Thursday in October, 1929: "Stock prices have reached what looks like a permanently high plateau." While Babson kept a fortune through his prediction of a crash, Fisher lost one for his disbelief in one. As with Voltaire's *Candide*, Fisher thought that all would come out well and that no prolonged Depression was at hand.
- The interesting question is how an economist trained in quantitative modeling could be so wrong. Fisher's prediction gaffe haunted the profession for many years, even if some of his contributions remain valid today. Nobel economist Milton Friedman used Fisher's quantity theory to show why the stock market could crash and why the Great Depression of the 1930's ensued.

Do Stock Markets Predict Future Economic Activity?

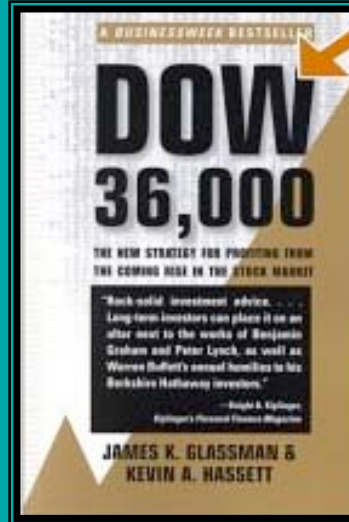


- Stock indexes are considered to be leading economic indicators. Relative to 1950, the S&P in the 1920's suggested a continuing rise in output.
- What was missing was an understanding of a contraction in the supply of money and output to support the predictions of the stock market. The contrast shows clearly here, though few knew at the time how much the supply of money was tending downward. Much of the monetary explanation of the stock market crash of 1929 and the subsequent economic depression of the 1930's has been carefully examined by Milton Friedman, most notably in his 1963 *Monetary History of the United States*. Yet monetary policy alone cannot predict stock market behavior, as the events of 1987 and 2000 have shown.

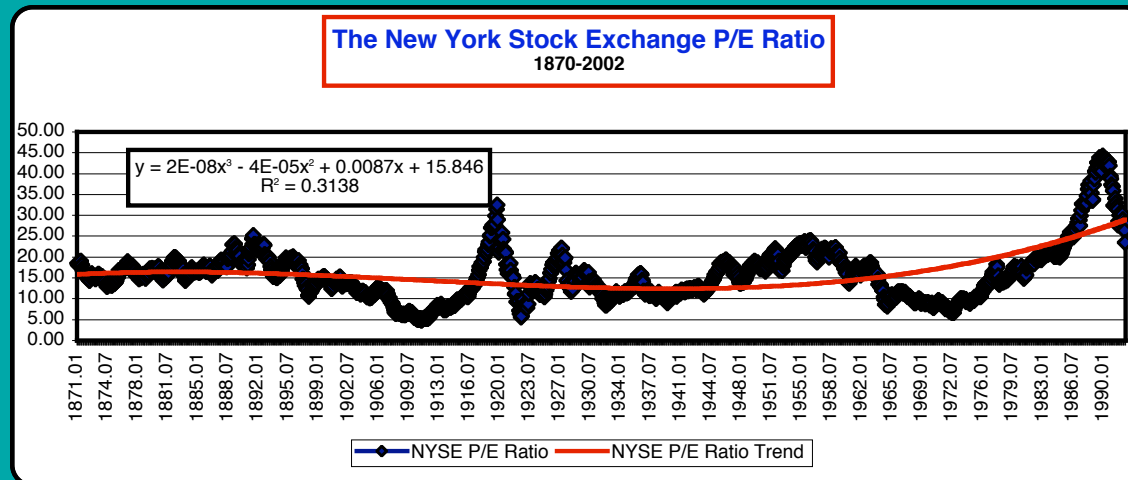
Can We Be Wrong Again on the Stock Market?



Elaine Garzarelli

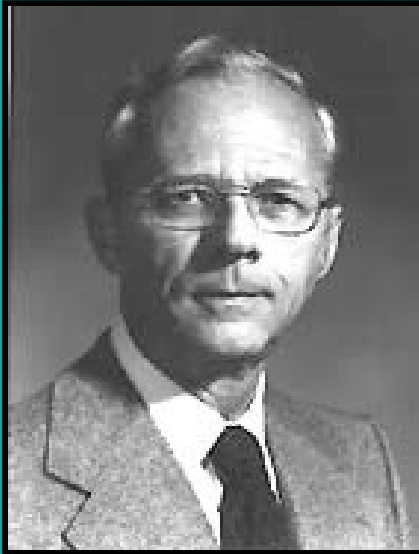


Robert Shiller

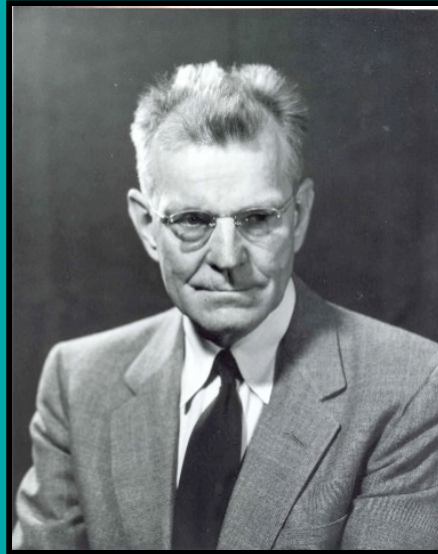


•In 1987 one of the few who called a stock market correction was Lehman Brothers analyst Elaine Garzarelli. She then became an independent stock market analyst for her original Cassandra prediction. However, when it came to calling the 2000 stock market correction, she was not among the leaders. Instead, Yale economist Robert Shiller was, using a simple comparison of relative price-earnings ratios of the Dow Jones Industrial average portfolio of stocks. In his 2000 book, *Irrational Exuberance*, Shiller argued, correctly, that valuations were inconsistent with past behavior and that a correction was due, and for which he used the Cassandra-like phrase “Irrational Exuberance” that was later quoted by Alan Greenspan, then Chair of the Federal Reserve Bank.

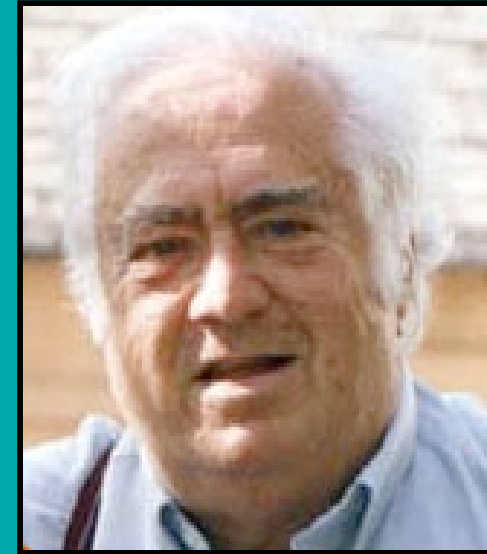
Are We Running Out of Energy (Again)?



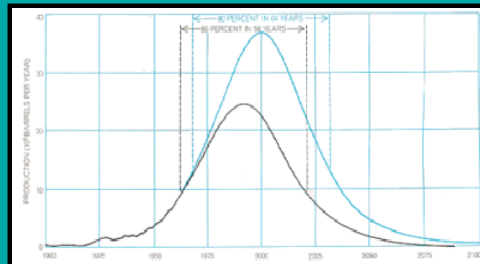
Jay Forrester (1918-)
The Limits to Growth (1972)



M. King Hubbert (1903-1989)
*Nuclear Energy
and the Fossil Fuels (1956)*



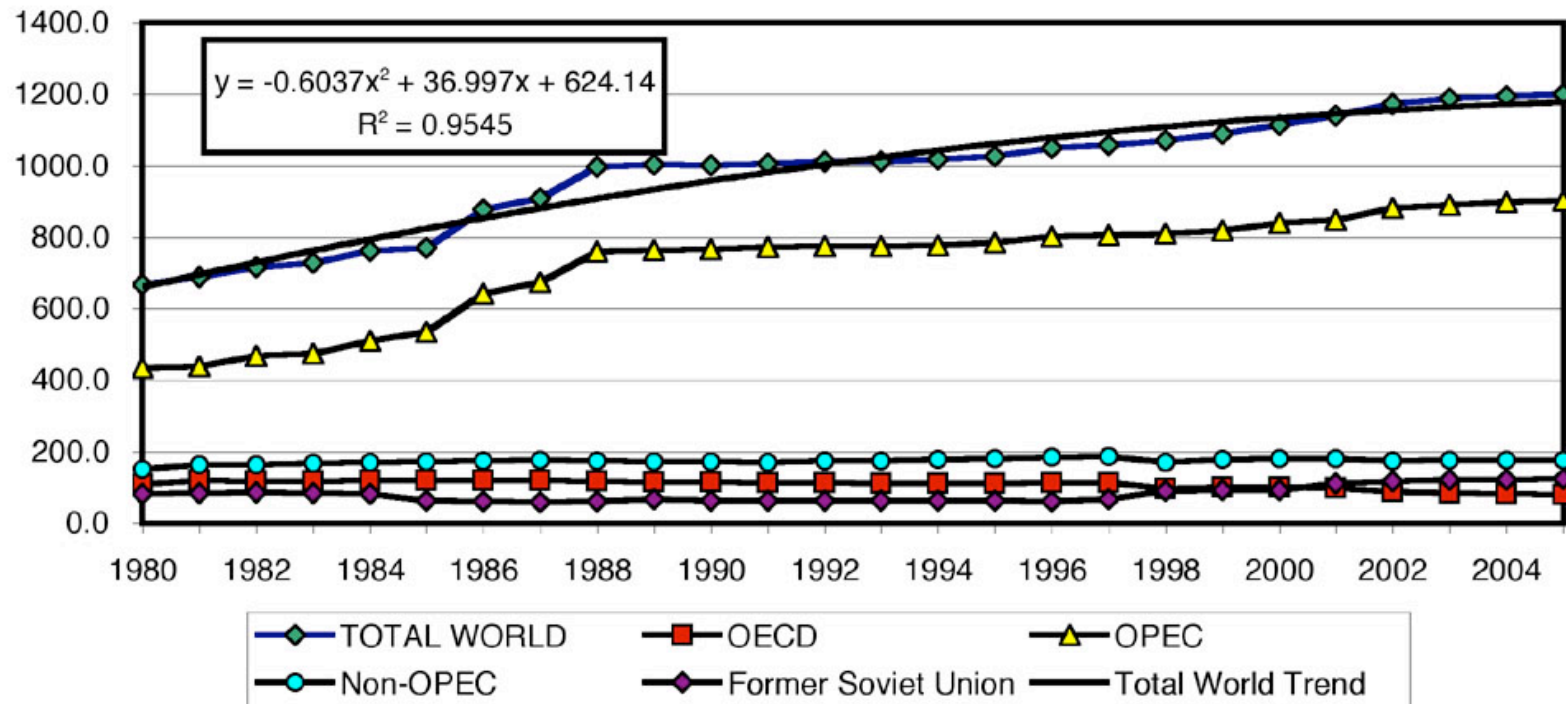
Kenneth Deffeyes
Beyond Oil (2005)



- In 1956, noted geologist M. King Hubbert predicted that oil production would peak around 1970 and begin an inevitable decline thereafter. When the energy crisis of 1973 unfolded, it looked as though Hubbert was correct. What was missing in Hubbert's model was any account of relative prices.
- In 1972, MIT Systems Analyst professor Jay Forrester published a study for the Club of Rome in which economic growth would slow as a result of unchecked consumption of fossil fuels and other depletable natural resources. Forrester's team also overlooked the role of relative prices in modifying historical trends.
- In 2004, Princeton Geologist professor Kenneth Deffeyes updated Hubbert's prediction for a new generation in the 21st century with a similar prediction as Hubbert's original one. Deffeyes' predictions repeat the same problem, namely, relative economic prices are not factored in his model.

Growth of World Proven Oil Reserves

World Proven Oil Reserves
in millions of barrels



Source: BP Statistical Review 2006

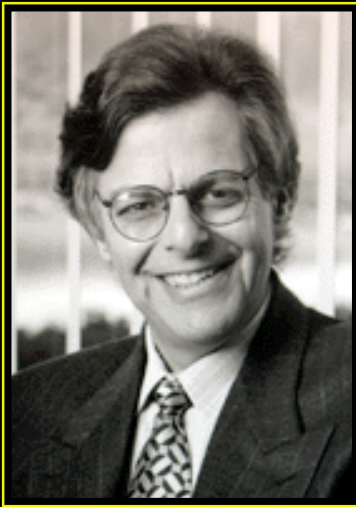
- In a geological sense, we are always running out of energy, be it in the form of coal, oil, natural gas, or any depletable resources. At the same time, proven oil reserves have increased. This paradox can be explained in terms of the role of relative prices: the higher the price of an exhaustible natural resource, the higher the stock of proven reserves. Admittedly, at some point, higher prices do not bring forth an increase in proven reserves. At that point, whether we are “running out” of reserves depends on the availability of substitute resources and technology, something that few economists have been able to predict, let alone noted geologists and engineers working in the field of natural resources. The verdict: we do not lack for Cassandras, but their predictions are not always true.

Tools for Managing an Uncertain Future



- As Yogi Berra once said, “it’s hard to make predictions, especially about the future.” Since the future can be so uncertain, economists have come up with a variety of tools not just for predictions, but for managing the inherent risks of an uncertain world. Yet, not all of these tools have survived the harsh realities they were designed to avert.

LTCM and the Role of Options



Myron Scholes (1941-)

The Model:

$$C = SN(d_1) - Ke^{(-rt)}N(d_2)$$

C = Theoretical call premium

S = Current Stock price

t = time until option expiration

K = option striking price

r = risk-free interest rate

N = Cumulative standard normal distribution

e = exponential term (2.7183)

$$d_1 = \frac{\ln(S/K) + (r + s^2/2)t}{s\sqrt{t}}$$

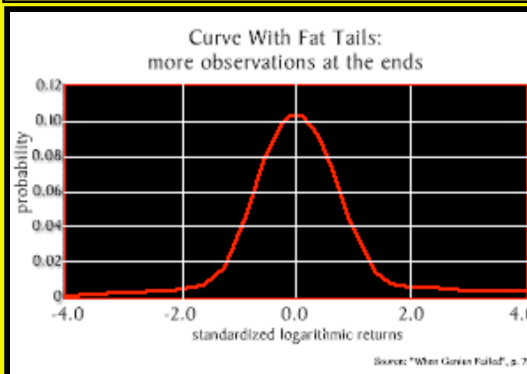
$$d_2 = d_1 - s\sqrt{t}$$

s = standard deviation of stock returns

ln = natural logarithm

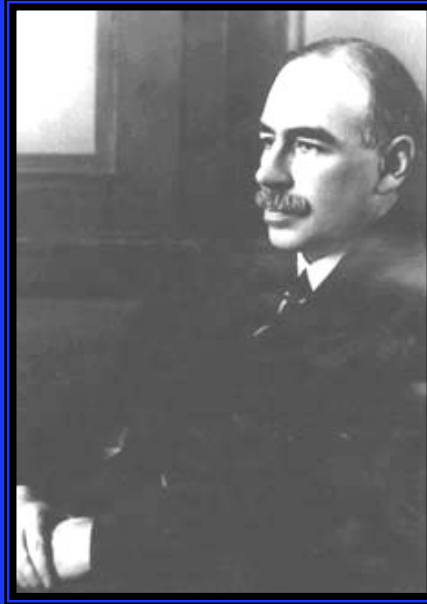


Robert Merton (1944-)



- One of the most ambitious efforts to manage risk in the 20th century was the application of option price contracts to global hedge funds. Building on the option-price model first developed by Myron Scholes (1944 -) and Fisher Black (1938-1995), Scholes and Robert Merton (1944 -), joined with John Meriwether of Salomon Brothers to form Long Term Capital Management in 1993. LTCM used option pricing to hedge risks across assets, space, and time. Initially they made exception returns, but in 1997, they were overtaken by the East Asia financial crisis that began with the devaluation of the Thai baht, which then spread to Korea, Hong Kong, the Philippines, Malaysia, and Indonesia. The killer was the Russian default in August 1998, which then caused financial markets to seize up in unprecedented ways. The Federal Reserve Bank of New York created a consortium of financial institutions to manage LTCM, pay off a proportion of its debts, and then closed down the fund in early 2000. The question is whether some new audacious approach to risk management will once again lead to excessively optimistic outcomes, something that Cassandra would not approved of, to say the least.

The Future of Economic Predictions



John Maynard Keynes (1883-1946)

- John Maynard Keynes (1883-1946), considered to be one of the greatest economists of the 20th century, became best known for his *General Theory of Employment, Interest, and Money* (1936). Published in the midst of the Great Depression, Keynes railed against the classical and neoclassical economists who had argued that the Great Depression would be a self-correcting event, and that given sufficient time, there would be no need for government intervention. Keynes' took the position that "in the long run, we are all dead" to argue in favor of deliberate budget deficits to stimulate the economy. Toward the end of his treatise, he concluded that "madmen in power are often slaves to some defunct economist", a phrase that was used to pillory Keynes himself long after he had passed in which a new generation of forecasters said that markets know better. That group, be they supply-siders, monetarists, or some other stripe, has characterized much of recent economic policy, leaving open the question of whether we all still are slaves of some defunct economist. What can be said is that as long as we must make decisions about the future, we must contend with both the Candides and the Cassandras, for we have little choice. So is forecasting a matter of science or luck?