Some Statistical Analyses and Nonanalyses with Historical Consequences

James R. Thompson

Department of Statistics
Rice University, Houston, TX 77252=1892

Abstract
We note how the work of Thomas Bayes disproved the Cartesian Enlightenment view of "starting from zero." We note how the work of the Enigma group led by Marian Rejewski saved Britain from U-boat facilitated starvation and kept the UK in WWII, forcing Hitler to fight a two front war. We note how the subtle game theoretic considerations of Herman Kahn led to a favourable conclusion of the Cold War. We note how non-implementation of closure of the gay bathhouses in the USA has been responsible for over 650,000 American deaths from AIDS and made the US AIDS rate the highest in the First World. We demonstrate that the assumption of a martingale structure in stocks led to specious models based on the Efficient Market Hypothesis. These in turn led to the catastrophe of derivatives and subprime mortgages.

Key Words: AIDS, Bayes, Enigma, Kahn

1. Examples

We shall examine a few cases of statistical analyses or nonanalyses which have had significant real world importance.

1.1 Thomas Bayes versus the Enlightenment

There was a much touted intent of the Scottish Enlightenment as well as the French Enlightenment to "start from zero." By his simple examination of conditional probability, Bayes showed that one always starts with some prior information [1]:

$$\Longrightarrow \quad P(A_i|B) = \frac{P(B|A_i)\,P(A_i)}{\sum\limits_j P(B|A_j)\,P(A_j)}.$$

Bayes recognized he was sailing against the wind with his formula and requested that it be published only posthumously. The philosophical implications negated core assumptions of the French and Russian Revolutions.

1.2 The Enigma Code Breakers Zygalski, Różycki and Rejewski

Three professors from the University of Poznan were given the task in 1932 (one year before Hitler was elected in Germany) of breaking the code of an "unbreakable code"

machine, the Enigma of the German Kriegsmarine [2]. Thanks to their knowledge of German (all were from Kulturkampf Bydgoszc where speaking Polish in school had been forbidden), however, they were able to find solutions based on bureaucratic regularities such as the first word of any memo started with "Zu". They reduced the 10^{92} Enigma Combinations to a Manageable 10^{5}. They saved England from a U-boat strangulation which would have required it to make peace with Germany. Inadvertently, they saved the Soviet Union. It is interesting to note that the team leader Marian Rejewski remarked that the high-powered abstract mathematics which the team had could not help in solving the code. In one week a team of 20 cypher clerks could solve changes in the code implemented by the Kriegsmarine based on the empirical Rejewski model. Rejewski had taken his habilitation doctorate in actuarial science at Gottingen, but it was the empiricism of statistics, rather than any formulae, that gave him the key to unlock the code.

1.3 Herman Kahn and the Defeat of the Soviet Fulda Gap Strategy

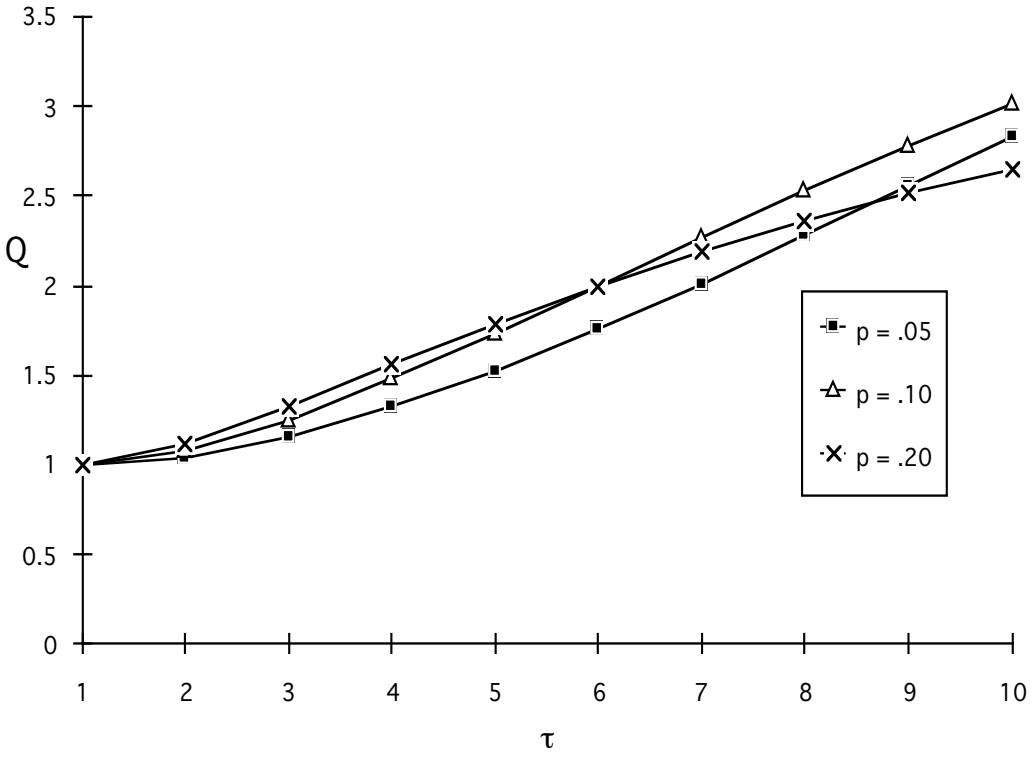
During the Brezhnev era, the Red Army developed a strategy for taking over West Germany. Starting behind a screen of 4,000 Polish tanks, a 50,000 tank march to the Rhine begins. After terrible losses, the NATO conventional forces are largely overwhelmed. At this point Brezhnev contacts the German Chancellor and informs him that the United States will shortly have to resort to nuclear artillery. This will lead to the turning of West Germany into a nuclear wasteland. On the other hand, if Germany leaves NATO, then Russia will agree to its essential independence a la Hong Kong with the annual payment of $40 billion in tribute to Russia. There is a very good chance Germany would have accepted such an offer. To come up with a countering strategy is obviously incredibly difficult. Data based simulation, at which Herman Kahn was expert, was not a possibility, no close precedent being available. However, based on the numerous volumes written by Kahn, President Reagan and Chancellor Kohl build up a strategy based on the

Pershing II rocket. That rocket has the range to reach Moscow, Krasnoyarsk and points east. So Reagan and Kohl begin the installation of Pershing II sites.
In the eastern part of West Germany, two officers, one American and one German control one site. As the Soviet juggernaut begins, Captain Miller and Hauptman Miller realize they have 20 minutes to live. Their families living in nearby Kleindorf have even worse prospects. It is a capital offense for the two captains to use their keys without NATO authorization. But you cannot kill a dead man. So, what will the captains do? It was this sort of mixed game strategy that Kahn developed for NATO. With Gorbachev, it would work. Then the Germans paid $60 billion for the Soviets to leave East Germany. As it turns out, no Fulda Gap attack occurred. Gorbachev was given $60 billion to leave the Wall and East Germany and the satellites to go their own way. Kahn's strategy thus ended the Cold War with victory for the West [3].

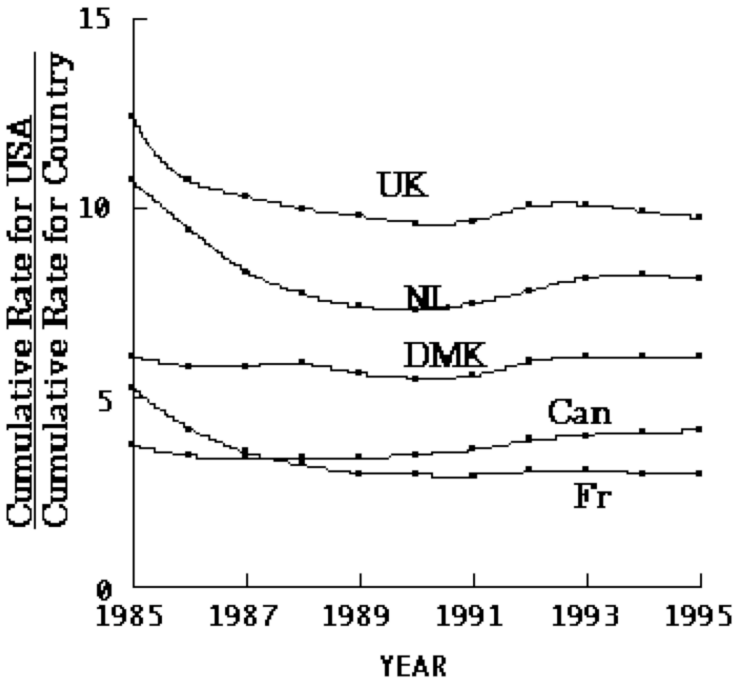
Herman Kahn

1.4 AIDS: The Mismanagement of the Epidemic in the United States.
From the early days of the epidemic in the United States, the Centers for Disease Control and local public health services have refused to close the gay bathhouses. Thompson's model graphed below show that if we have a proportion p of the population which has an activity level τ times that of the rest of the population (holding the total number of contacts of the gay male population constant) then the effect is the same as if the entire gay male population had an activity level Q times the average. In [6], Thompson goes through a branching process argument to show the reason for this surprising result. At this time, approximately 700,000 Americans have died from AIDS. This exceeds the total of AIDS deaths in the rest of the First World. Thompson has presented his results at conferences all over the United States and in Europe. In Europe the gay bathhouses were

closed long ago. Never has Thompson received accusations of homophobia from members of the gay community. Such gay leaders as Gabriel Rotello, editor of *Outweek* have praised Thompson's work. However, Thompson's comments have disturbed very much the American public health community, which resents the accusation that they have failed to take simple and non-punitive steps (against gays) that would drive AIDS back to endemic rates in this country. The number of American deaths resulting from their inattention has exceeded that in our most deadly war, the Civil War [4], [5], [6].



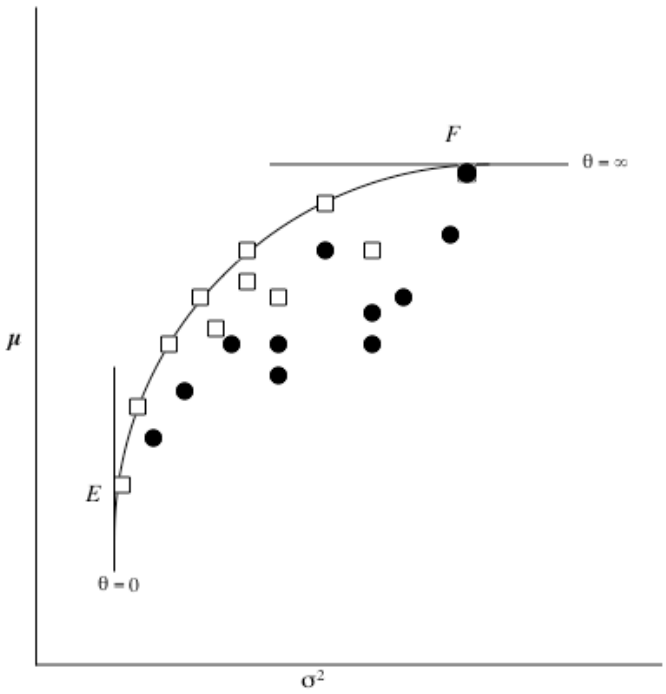
AIDS: the Bathhouse Effect



AIDS Rates in the USA Compared with Those in Other First World Countries

1.5 Some Consequenses of Bad Assumptions in Markets

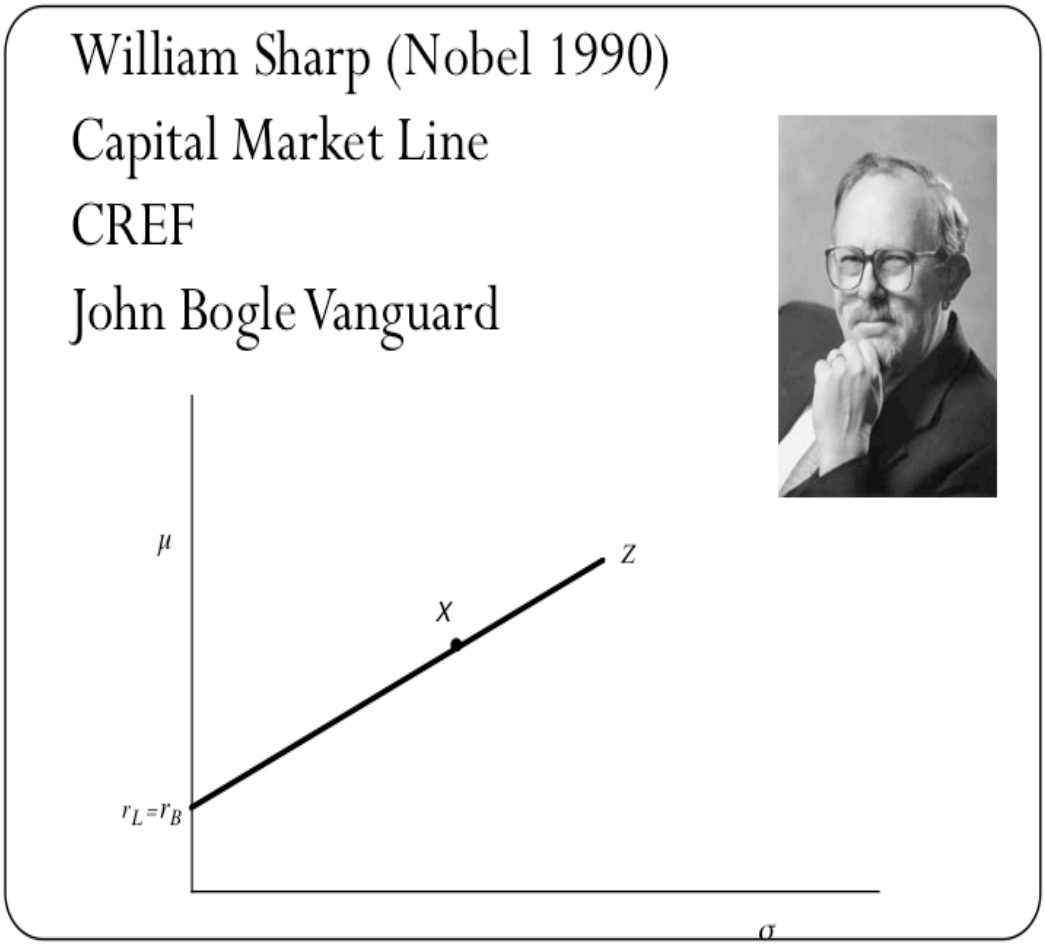
The false assumption that stock price is a martingale implies $E[X(t+s)] = X(t)$ for positive s gives us essentially the Efficient Market Hypothesis. One consequence of the Efficient Market Hypothesis is the Efficient Frontier of Harry Markowitz.



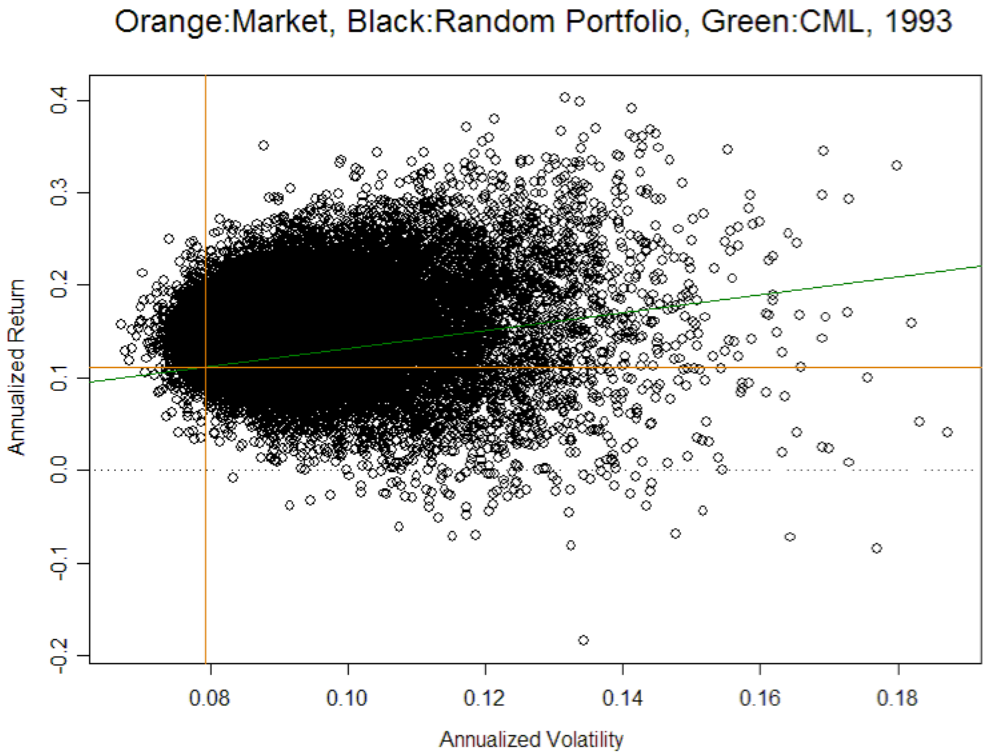
Markowitz's Efficient Frontier

Variance, however, is a poor surrogate for risk. Consequently many people do hold stocks indicated by the black dots.

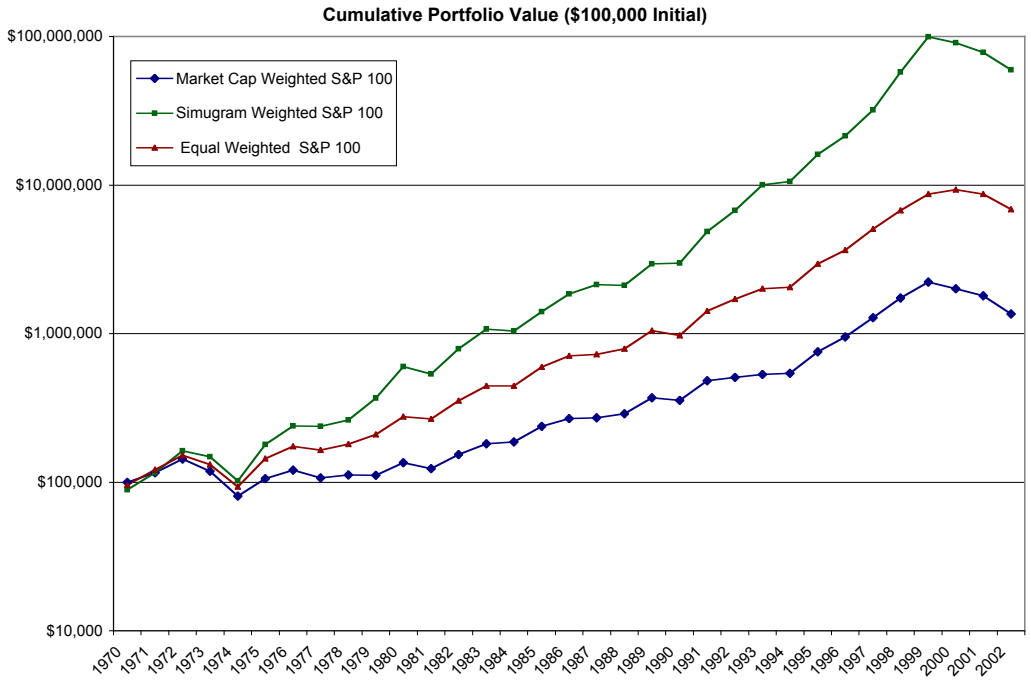
Next, Markowitz's doctoral student, Richard Sharpe, opined that if one looked at a growth versus variance plot with the left hand point anchored at the growth of a Treasury Bill and its variance (presumably zero) and drew another point which was the market cap average of all publicly traded stocks, then one would arrive at a "super efficient frontier" or Capital Market Line. No stock or portfolio of stocks could lie above this line.



Markowitz and Sharpe shared the Nobel Prize in Economics in 1990. However, Wojciechowski and Thompson [7] demonstrated in 2004 that looking back 40 years portfolios randomly formed from the 1000 largest market cap stocks lay above the Capital Market Line over 60% of the time. That nobody had bothered to stress the Markowitz and Sharpe models with actual market data speaks poorly of the way scientists have become followers of untested models rather than data analysts.



When we see an orthodox strategy such as the CML beaten by random strategies, we are tempted to go to something like an equal weighting strategy. Below we demonstrate the 32 year performance of the market cap weighted S&P 100 portfolio (analogous to the CML using the S&P 100 as the universe of stocks) with the equal weighted S&P portfolio. The improvement is roughly nine fold. Using Thompson's computer intensive and patented Simugram, the improvement is roughly eighty fold [8].



References

[1] Thompson, James R. (1989). *Empirical Model Building.* New York: John Wiley & Sons, pp. 208-212.

[2] Thompson, James R. (2011). *Data, Models, and Reality.* Hoboken, N.J.: John Wiley & Sons, pp. 131-132.

[3] Thompson, James R. (2011). *Data, Models, and Reality.* Hoboken, N.J.: John Wiley & Sons, pp. 64-65.

[4] Thompson, James R. (1984). "Deterministic versus stochastic modeling in neoplasia," *Proceedings of the 1984 Computer Simulation Conference*, North Holland, pp. 822-825.

[5] Thompson, James R. (1989). "AIDS: the mismanagement of an epidemic. " *Computers Math. Applic*., v. 18, pp. 965-972.

[6] Thompson, James R. (1999). "Understanding the AIDS Epidemic: A Modeler's Odyssey" in *Applied Mathematical Modeling*, D. Shier and T. Wallenius, eds., New York: CRC Press, pp. 41-69.

[7] Wojciechowski, William and Thompson, James R. (2006). "Market Truths: Theory versus empirical simulations," *Journal of Statistical Computation and Simulation*,v. 76, no 5, pp. 385-395.

[8] Thompson, James R., Baggett, L. Scott, Wojciechowski, William and Williams, Edward E. (2006). " Nobels for Nonsense," The Journal of Post Keynesian Economics, Fall, pp. 3–18.