THE ANXIOUS PROP

A WALK IN THE PARK WITH MODELS

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Some argue that models can be used to predict economic performance, stock movements, prices, and shopping patterns, among other things. Not only do models accurately predict values, but the models themselves can influence our future economic processes.[1] Time after time these models will fail to predict high impact and otherwise implausible events. In defense of models, their users will tell you that these events happen once in a lifetime, and their own models work in "normal" environments. Yet, in the past twenty years we have seen asset bubbles burst and financial crises in Asia, the United States, South America, and Europe. All of these are events would qualify and were described as once-in-a-lifetime events.

Broadly speaking, all models used in the financial sector are mathematical equations that give a value based on certain inputs used in order for companies to be able to give investors future performance guidelines. Businesses need economic guidance in order to make decisions. Financial companies need to value complex financial instruments. Put bluntly, models are used to make money, to figure out how much money can be made, as an alternative to marking financial instruments at fair value on corporate balance sheets, to provide mediocre to good guidance in certain times, poor guidance in uncertain times, and to appear that we are exterminating risk and uncertainty from our financial markets. Outside of finance, models can be used for forecasting purposes such as forecasting population for urban planning purposes, or for general government statistics.

In early 2007, the subprime mortgage market collapsed due to high default rates. A year earlier, despite slowing business, not one bank or homebuilder publicly acknowledged the coming crisis. When the crisis started by wreaking havoc on unregulated subprime lenders, banks, homebuilding companies, and most financial analysts were not initially worried. As a credit analyst looking at homebuilders, I saw the evolution of how these companies thought the crisis would affect them. Initially they were mostly confident it would have little to no impact on business operations, later they were confident it wouldn't last long, finally they were only confident that it would take a long time to get through.

Of course, these organizations were not basing their guidance on gut instinct. These are professionals who back up their statements with data and sophisticated models, which they use to forecast housing demand, prices, etc. A researcher turned consultant who worked for Credit Suisse, Ivy Zelman, made an interesting observation regarding homebuilding companies during housing crises. As their forecast models take past performance as guidance for future performance, it can take a very long time for homebuilders to realize how much they lost and to accurately forecast new demand. According to Zelman's research, the average time it took for homebuilders to figure out how bad it was going to get during a housing bust was when losses peaked. Essentially, you won't know how bad it will get until the worst arrives.[2]

1. Jon McKenzie, "Performativities, Counter-Performativities, and Meta-Performativities" (paper presented at the conference Performing the Future at the Haus der Kulturen der Welt, Berlin, July 8, 2010).
2. This document is not publicly available. My company paid Credit Suisse for research.

If you read any investment literature you will see the words, "Past performance is not indicative of future performance." Since models that look at past performance can have major flaws in predictive abilities, where do mathematically based models come into play? The Black Scholes Merton Model (BSM Model) is such a model.

The formula—C(S,t) = SN(d1) – Ke –r(T – t) N(d2)—is specifically used for what is called a "European call." A call gives one the right to buy a stock at price agreed upon by the buyer and seller. A European call allows one to buy the stock at the specified price only on the date the contract expires.

The formula says: the price of a call of S at time "t" is equal to option's delta minus the strike price to the power of negative risk free rate "r" (that is continuously compounded) multiplied by the time to expiration then multiplied by the asset's volatility.

This model, like all other models, makes assumptions about the environment that it operates in:

- The price of an underlying asset follows a lognormal distribution.
- The (continuous) risk free rate is constant and known.
- The volatility of the underlying assets is constant and known.
- Markets are frictionless (meaning there is no restriction to short selling, and no arbitrage).[3]
- The underlying asset generates no cash flows (i.e. no dividends, if it does you must adjust the model).
- The options are European (can only be exercised on the end date).

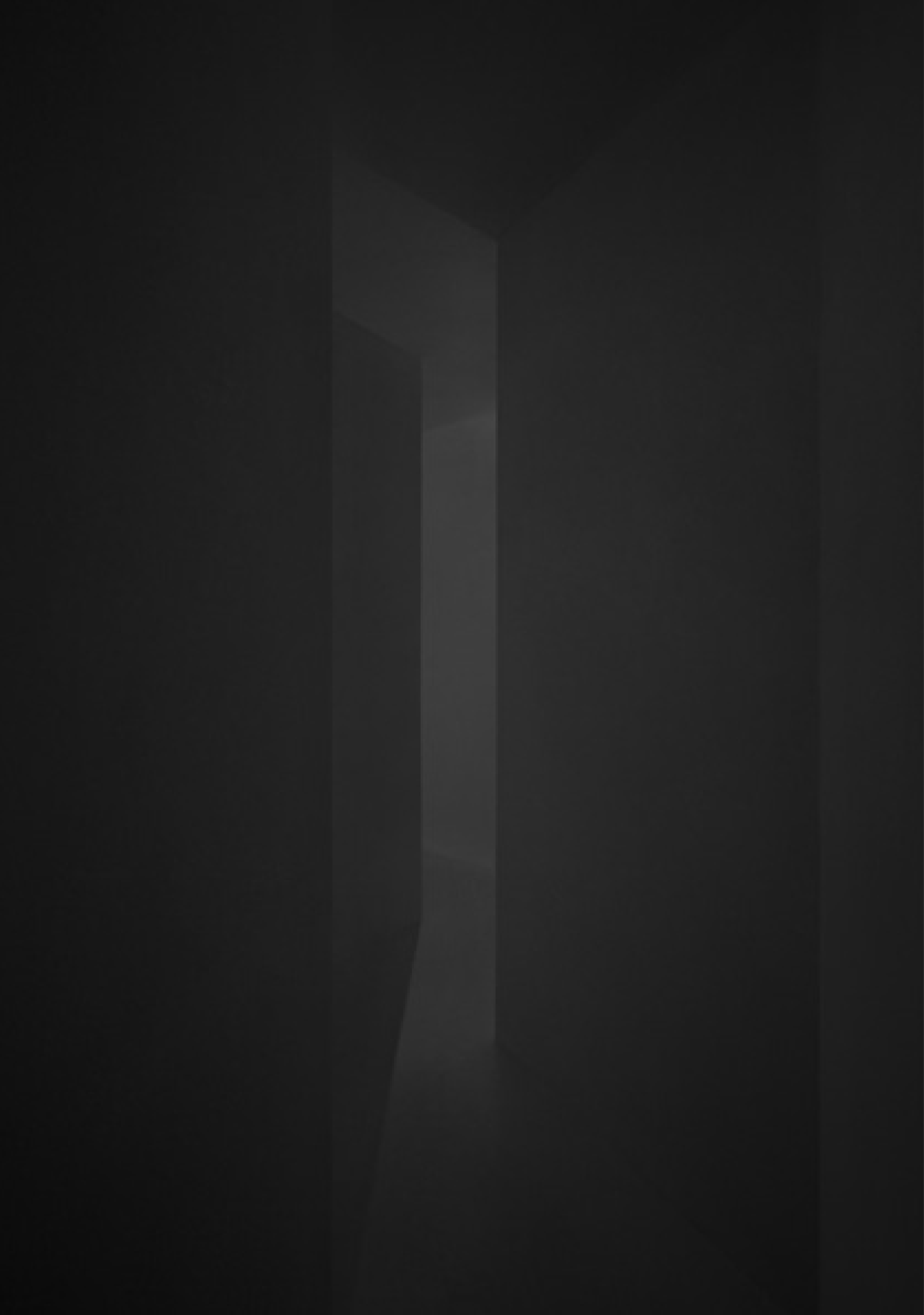
These assumptions are not realistic, except for the last one. At certain times arbitrage will be possible. In fact, some traders will use modified versions of this formula to find arbitrage opportunities. The volatility of the underlying asset will change. Additionally, the price of the asset is not lognormal, to assume so underestimates the risk of extreme price movements.[4]

Since this model cannot handle the possibility of any deviation in volatility, it allows portfolio managers who use options and the BSM Model to take on large amounts of risk. For example, Long Term Capital Management, the hedge fund that employed the BSM Model's namesake Nobel Prize winning economists, imploded in the aftermath of the Russian financial crisis in 1998. Before the crisis, the fund and its investors enjoyed total returns of forty percent. The Federal Reserve Bank of New York organized a bailout due to the massive exposure of banks to the fund.

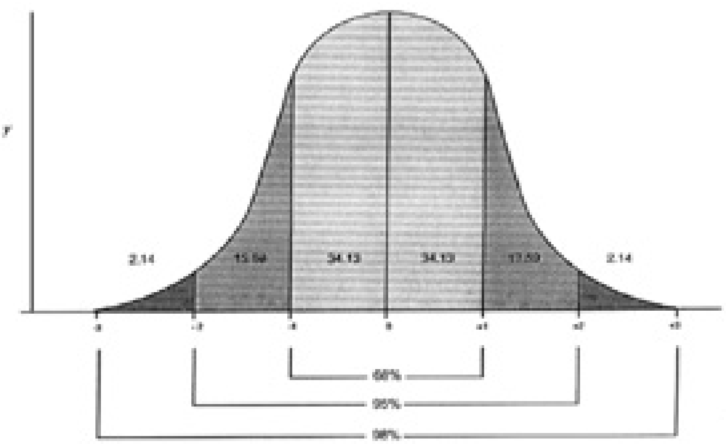
Let's look at the assumed lognormal nature of the underlying stock measured through Gaussian mathematics. The risk of a stock is measured with σ its standard deviation. Let's say I have a stock X, with an average value of ten and σ of five. If we plot all the possibilities of price outcomes of this stock, according to Gaussian principles, the graph will look like the one shown below.

3. Arbitrage is defined as riskless profit where equivalent assets have different prices.
4. Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2007).

Overleaf: Elín Hansdóttir, One of three random incidents of visitor destruction, all occurring at the same location in PATH *(2008, National Gallery of Iceland)*



This is a standard normal distribution chart. Stocks are assumed to be lognormal since the value cannot go below zero. Lognormal distributions are skewed above zero. We have a sixty-eight percent chance the price of the stock will be between five and fifteen; a ninety-five percent chance that the price will be between zero and twenty. Of course, practically speaking, the stock price cannot go below zero, but just in the case that it can, we have a two percent chance that that will ever happen.



The normal distribution is easier for descriptive purposes, and both distributions have the same problem: underestimation of tail risk (extreme possibilities). Additionally, we must remember that past performance is not indicative of future performance. The the risk profile or standard deviation of the stock can change at any time in the future.

Another fault of this model is that Gaussian mathematics does not fit with what is actually observed. As you can see from the example above, not only is it easy to exclude extreme events from the range of possibility, but the math underestimates less extreme events—events that only deviate 3σ from the average. In purely mathematical models, the assumed Gaussian nature of data will skew the results to the average.

In Berlin, citing the work of Donald MacKenzie, Jon McKenzie stated that the possibility our future is performative, exemplified by the models we have developed and rely on. That is, originally designed to predict the future, our models can have the power to construct the future. The price of a European call is such because the BSM Model says it is—forget supply and demand and self-fulfilling prophecy. As Donald MacKenzie sees our current world, the BSM Model has "lost" its performative powers because the volatility of the underlying asset is no longer flat. According to MacKenzie, assets lost their flat volatility around Black Monday in 1987.[5] He does not speculate that we had an imperfect understanding of the assets in the first place, but that our markets waded into a less performative state.

5. On Monday 19, 1987, worldwide markets crashed by a huge margin, losses ranged from twenty-two percent to forty-five percent.

Overleaf: Elín Hansdóttir, Trace*, archival inkjet prints, 2010*

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Blaming the underlying data is a common theme when constructing and using models, i.e. the statement, "Our housing forecast models are not working because they did not take into account the shadow inventory just unexpectedly released into the market." As this type of math can be applied to most disciplines, it seems all too easy to blame our lack of modernity and fix the data to fit our regression patterns and Gaussian bell curves.

Friedrich Hayek, a libertarian and anti-socialist economist, warned about applying rigid mathematics to economics. When a government tries to increase employment by stimulating demand, it can do more harm than good. There only seems to be a correlation between (aggregate) demand and employment because they are the most easily measurable metrics, but the correlation is impossible to prove.[6] On the opposite side of the political spectrum, Alain Badiou declares economic models and their graphical representation to be a tool of the bourgeois for economic enslavement. In a government's efforts to show "balanced expansion," it wards off social instability through its visual representation instead of scie ntific justification. This balanced expansion is merely governmental interventions in the economy designed at placating the lower classes while simultaneously allowing the bourgeois to retain power and property.[7]

Reliance on models can be more costly than imploding hedge funds as they have the power to shape societies, individuals, and determine how government interacts with both. Richard Sennett bemoans models of suburban development, advocating for densely populated areas and cities that are flexible to a dynamic evolving population. Hakim Bey rails against our social mores, the serfdom of children, and supports poetic terrorism aimed at injecting a little chaos in our lives.

The question is not simply binary, as in, "should we use models because they work properly or should we banish them because they fraudulently deceive." The recognition of a world not rationalized by math or another metatheory is unpalatable to most. Indeed, most proponents of this type of thinking often leave their readers unsure of precisely what is being proposed. These open ended (anti-)systems are complex, chaotic, unpredictable, anarchist, Marxist, laissez-faire and who knows what else.

When models are presented in any field, we can use them as tools, or theoretical constructs with their own limits. I propose not to be fooled into complacency about a world that can be simplified by rigid structures. In doing so we unwittingly submit to the very blindspots that these neatly crafted promises fail to articulate or simply ignore, which is exactly what puts our societies, our livelihoods at risk.

6. Friedrich August von Hayek, "The Pretence of Knowledge" (Lecture to the Memory of Alfred Nobel, December 11, 1974, http://nobelprize.org/nobel_prizes/economics/laureates/1974/hayek-lecture.html).
7. Alain Badiou, *The Concept of the Model, An Introduction to the Materialist Epistemology of Mathematics*, trans. by Zachary Luke Fraser and Tzuchien Tho (Melbourne: re:press, 2007), 12.