

# Why Did The Crisis of 2008 Happen?

Nassim Nicholas Taleb

**DRAFT**

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This paper —while a standalone invited essay for *New Political Economy* — synthesizes the various technical documents by the author as related to the financial crisis. It can also be used as a technical companion to *The Black Swan*.

## Summary of Causes:

The interplay of the following five forces, all linked to the misperception, misunderstanding, and hiding of the risks of consequential low probability events (Black Swans).

### I-CAUSES

1) **Increase in hidden risks of low probability events (tail risks)** across all aspects of economic life, not just banking; *while tail risks are not possible to price*, neither mathematically nor empirically. The same nonlinearity came from the increase in debt, operational leverage, and the use of complex derivatives.

a- This author has shown that it is *impossible* to measure the risks in the tails of the distribution<sup>1</sup>. The errors swell in proportion to the remoteness of the event. Small variations in input, smaller than any uncertainty we have in the estimation of parameters, assuming generously one has the right model, can underestimate the probability of events called of "12 sigma" (that is, 12 standard deviations) by close to *a trillion* times —a fact that has been (so far) strangely ignored by the finance and economics establishment.

b- Exposures have been built in the "Fourth Quadrant" <sup>ii</sup>, where errors are both consequential and impossible to price and vulnerability to these errors is large.

c- Fragility in the Fourth Quadrant can be re-expressed as concavity to errors, where losses from uncertain events vastly exceed possible profits from it, the equivalent of "short volatility". These exposures have been increasing geometrically.

2) **Asymmetric and flawed incentives that favor risk hiding in the tails**, two flaws in the compensation methods, based on cosmetic earnings not truly risk-adjusted ones a) *asymmetric payoff*: upside, never downside (free option); b) *flawed frequency*: annual compensation for risks that blow-up every few years, with absence of claw-back provisions.

a- *Misunderstanding of elementary notion of probabilistic payoffs across economic life*. The general public fails to notice that a manager "paid on profits" is not really "paid on profits" in the way it is presented and not compensated in the same way as the owner of a business given the absence of negative payment on losses (the *fooled by randomness* argument). States of the world in which there can be failure are ignored —"probabilistic blindness". This asymmetry is called the "manager option", or the "free option", as it behaves exactly like a call option on the company granted by the shareholders, for free or close to little compensation. Thanks to the bailout of 2008-2009 (TARP), banks used public funds to generate profits, and compensated themselves generously in the process, yet managed to convince the public and government that this compensation was justified since they brought profits to the public purse—hiding the fact that the public would have been the sole payer in the event of losses.

b- *Mismatch of bonus frequency*. Less misunderstood by policymakers, a manager paid on an annual frequency does not have an incentive to maximize profits; his incentive is to extend the time to losses so he can accumulate bonuses before eventual "blowup" for which he does not have to repay previous compensation. This provides the incentive to

make a series of asymmetric bets (high probability of small profits, small probability of large losses) *below* their probabilistic fair value<sup>iii</sup>.

c- The agency problem is far more vicious in the tails, as it can explain the growing left-skewness (fragility) of corporations as they get larger (left-skewness is shown in Zeckhauser & Patel, 1999, rediscussed in argument on convexity).

**3) Increased promotion of methods helping to hide tail risks.** VaR and similar methods promoted tail risks. See my argument that information has harmful side effects as it does increase overconfidence and risk taking.

a- I said that knowledge degrades very quickly in the tails of the distributions, making tail risks non-measurable (or, rather, impossible to *estimate* —"measure" conveys the wrong impression). Yet vendors have been promoting method of risk management called "Value at Risk", VaR, that just measures the risks in the tail! it is supposed to project the expected extreme loss in an institution's portfolio that can occur over a specific time frame at a specified level of confidence (Jorion,1997). Example: a standard daily VaR of \$1 million at a 1% probability tells you that you have less than a 1% chance of losing \$1 million or more on a given day. There are many modifications around VaR, "conditional VaR"<sup>1</sup>, equally exposed to errors in the tails. Although such definition of VaR is often presented as a "maximum" loss, it is technically not so in an open-ended exposure: since, conditional on losing more than \$1 million, you may lose a lot more, say \$5 million. So simply, VaR encourages risk-taking in the tails and the appearance of "low volatility".

Note here that regulators made banks shift from hard heuristics (robust to model error) to such "scientific" measurements<sup>2</sup>.

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<sup>1</sup> Data shows that methods meant to improve the standard VaR, like "expected shortfall" or "conditional VaR" are equally defective with economic variables --past losses do not predict future losses. Stress testing is also suspicious because of the subjective nature of "reasonable stress" number --we tend to underestimate the magnitude of outliers. "Jumps" are not predictable from past jumps.

<sup>2</sup> Joe Nocera, NYT, January 4, 2009, "In the late 1990s, as the use of derivatives was exploding, the Securities and Exchange Commission ruled that firms had to include a quantitative disclosure of market risks in their financial statements for the convenience of investors, and VaR became the main tool for doing so. Around the same time, an

Criticism has been countered with the argument that "we have nothing better"; ignoring of iatrogenic effects and mere phronetic common sense.

b- *Iatrogenics of measurements (harm done by the healer)*: these estimations presented as "measures" are known to increase risk taking. Numerous experiments provide evidence that professionals are significantly influenced by numbers that they know to be irrelevant to their decision, like writing down the last 4 digits of one's social security number before making a numerical estimate of potential market moves. German judges rolling dice before sentencing showed an increase of 50% in the length of the sentence when the dice show a high number, without being conscious of it.<sup>3</sup>

c- *Linguistic conflation*: Calling these risk estimation "measures" create confusion in the mind of people, making them think that something in current existence (not yet to exist in the future) is being measured —these metrics are never presented as mere predictions with an abnormally huge error (as we saw, several orders of magnitude).

**4) Increased role of tail events** in economic life thanks to "complexification" by the internet and globalization, in addition to optimization of the systems.

a- *The logic of winner take all effects*: *The Black Swan* provides a review of "fat tail effects" coming from the organization of systems; consider the island effect, how a continent will have more acute concentration effects as species concentration drop in larger areas. The increase in "winner-take-all" effects is evident across economic variables (which includes blowups).

b- Optimization makes systems left-slewed, more prone to extreme losses —which can be seen in concavity effects under the perturbation of parameters.

**5) Growing misunderstanding of tail risks** Ironically while tail risks have increased, financial and economic theories that discount tail risks have been more vigorously promoted (while operators

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important international rule-making body, the Basel Committee on Banking Supervision, went even further to validate VaR by saying that firms and banks could rely on their own internal VaR calculations to set their capital requirements."

<sup>3</sup> See English and Mussweiler, English Mussweiler and Strack, 2006, LeBoeuf and Shafir, 2006.

understood risks heuristically in the past<sup>4</sup>), particularly after the crash of 1987, after the "Nobel" for makers of "portfolio theory". Note the outrageous fact that the *entire* economics establishment missed the rise in these risks, without incurring subsequent problems in credibility.

Principal errors by the economics establishment that contribute to increasing fragility:

a- *Ignorance of "true" fat tail effects*; or misunderstanding that fat tails lead to massive imprecision in the measurement of low probability events (such as the use of Poisson jumps by Merton, 1976 or the more general versions of subordinated processes —these models fit the past with precision on paper but are impossible to calibrate in practice and induce a false sense of confidence). Misunderstanding that true-fat-tails cancels the core of financial theory and econometric methods used in practice.

b- *Lack of awareness of the effect of parameter estimation on a model*. Some models —actually almost all models — take parameters for granted when the process of parameter discovery in real-life leads to massive degradation of their results owing to convexity effects from such layer of uncertainty.

c- *Interpolation v/s Extrapolation*. Misunderstanding of the "atypicality of events" —looking for past disturbances for guidance when we have obvious evidence of lack of precedence of such events. For instance, Rogoff and Reinhart (2010) look at past data without realizing that in fat tailed domains, one should extrapolate some properties from history, instead of interpolating or looking for naive similarities (see the metaphor of Lucretius's largest mountain in Taleb(2007-2010)).

d- *Optimization*. It can be shown that optimization causes fragility when the payoff is concave under perturbation errors, i.e., in most cases.

e- *Economies of scale*. There are fragilities coming from size, both for the institutions and causing externalities<sup>iv</sup>.

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<sup>4</sup> The key problem with finance theory has been supplanting embedded and time-derived heuristics, such as the interdicts against debt and forecasting, with models akin to "replacing a real hand with an artificial one".

## II-RESPONSIBLE PARTIES

**1) Government Officials of Both Administrations** promoting blindness to tail risks and nonlinearities (e.g. Bernanke's pronouncement of "great moderation") and flawed tools in the hands of policymakers not making the distinction between different classes of randomness.

**2) Bankers/Company executives:** The individuals had an incentive to hide tail risks as a safe strategy to collect bonuses.

**3) Risk vendors and professional associations:** CFA, IAFE promotion of portfolio theory and Value-at-risk methods.

**4) Business schools and the economics establishment:** They kept promoting and teaching portfolio theory and inadequate risk measurement methods on grounds that "we need to give students something" (arguments used by medieval medicine)<sup>5</sup>. They still do<sup>6</sup>.

**5) Regulators:** Promoted quantitative risk methods (VaR) over heuristics, use of flawed risk metrics (AAA), and encouraged a certain class of risk taking.

**6) Bank of Sweden Prize, a.k.a. "Nobel" in Economics:** gave the Nobel stamp to empirically, mathematically, and scientifically invalid theories, such as portfolio theory (Markowitz and Sharpe), option pricing (Scholes and Merton), Engle's GARCH, Modigliani-Miller and many more. In general their scientific invalidity comes from the use of wrong models of uncertainty that provide exactly the *opposite* results to what an empirically and mathematically more rigorous model of uncertainty would do.

**Ethical considerations.** Surprisingly the economics establishment should have been aware of the use the wrong tools and complete fiasco in the theories, but they kept pushing the warnings under the rug, or hiding their responses. There has been some diffusion of responsibility that is at the core of the system. This author has debated: Robert Engle, Myron Scholes, Robert Merton, and Stephen Ross, among others, without any hint of their willing to accept the very

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<sup>5</sup> It would be rare to find an airplane pilot who would accept using the map of Saudi Arabia when flying over the Himalayas on ground that "there is nothing else" – human intuitions know better. Yet once framed in financial terms, the reasoning reverses.

<sup>6</sup> In early 2009 a Forbes journalist in the process of writing my profile spoke to NYU's Robert Engle who got the Bank of Sweden Prize ("Nobel") for methods that patently have never worked outside papers. He reported to me that Engle response was that *academia was not responsible for tail risks*, since it is the government job to cover the losses beyond a certain point. This is the worst moral hazard argument that played into the hands of the *Too Big to Fail* problem.

notion of the risks they were creating with their Procrustean bed methods of approximation —prompting the following metaphor by this author: "they are cutting part of someone's brain and claiming that we have a human with 95% accuracy". The seemingly favorable reactions this author encountered were even more harmful, with the discrediting half-way "you may have a point but you go too far" that can be vastly more damaging to society than just regular attacks.

### III- SUGGESTED REMEDY: SYMMETRY IN REWARDS

As we saw with banks, Toyota's problem, the BP oil spill, and other similar cases of blowups from underinsured small risks, an economic system with a severe agency problem builds a natural tendency to push and hide risks in the tails, even without help from the economics establishment. **Risks keep growing where they can be seen the least**; there is a need to break the moral hazard by making everyone accountable both chronologically and statistically.

Hence the principle of symmetry in rewards: ***The captain goes down with the ship; all captains and all ships***: making everyone involved in risk-bearing accountable, no exception, not a single one —morally, legally, whatever can be done. That includes the "Nobel" committee (Bank of Sweden), the academic establishment, the rating agencies, forecasters, bank managers, etc.<sup>7</sup>.

Time to realize that capitalism is not about free options<sup>8</sup>.

Note that organizations such as the CFA and the American Finance Association, vendors such as RiskMetrics, and finance departments in business schools, those that promoted tools that blew up society do not seem concerned at all into changing their methods or accepting their role. And they are *currently*, at the time of writing, still in the process of blowing up society.

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<sup>7</sup> Conversations of the author with the King of Sweden and members of the Swedish Academy resulted in the following astonishing observation: they do feel concerned, nor act as if they are in any way responsible for the destruction since, for them, "this is not the Nobel", just a bank of Sweden price.

<sup>8</sup> Speculators using their own funds have been reviled, but unlike professors, *New York Times* journalists, and others, they (particularly those without the free option of society's bailout) bear directly the costs of their mistakes.

### WHAT SHOULD WE DO?

Preaching is not effective in the background of such natural resistance and absence of accountability. Legal recourse is needed — as illustrated by **the long fight against the tobacco industry, which was "won" by lawsuits, not by scientific argument.**

Academia can be shielded from direct liability — academics can claim to be the generator of speculative thought; it would be hard to, say, make postmodern theorists accountable for their ideas on health and medicine. So it is those helping translate their ideas into practice who need to be made accountable: a theoretical biologist does not bear the same responsibility for harm as, say, the American Medical Association or a private doctor.

The two parties that need to be brought to account: 1) those associations and vendors that put these techniques into the hands of practitioners, and, most of all, 2) the Bank of Sweden prize that gave (and still gives) the "Nobel Stamp" to these techniques. For the "Nobel" stamp gave these methods the credibility to spread and displace time-tested heuristics.

### REFERENCES

Birte English and Thomas Mussweiler, 2001, "Sentencing under Uncertainty: Anchoring Effects in the Courtroom," *Journal of Applied Social Psychology*, vol. 31, no. 7 (2001), pp. 1535-1551

Birte English, Thomas Mussweiler, and Fritz Strack, 2006, "Playing Dice with Criminal Sentences: the Influence of Irrelevant Anchors on Experts' Judicial Decision Making," *Personality and Social Psychology Bulletin*, vol. 32, no 2 (Feb. 2006), pp. 188-200.

DeGeorge, François, Jayendu Patel, and Richard Zeckhauser, 1999, "Earnings Management to Exceed Thresholds." *Journal of Business* 72(1): 1–33.

Derman, E. and Taleb, N.N. (2005) *The Illusion of Dynamic Replication*, *Quantitative Finance*, vol. 5, 4

Haug, E.G. and Taleb, N.N. ,2010, *Option Traders Use Sophisticated Heuristics, Never the Black-Scholes-Merton Equation*, forthcoming, *Journal of Economic Behavior and Organizations*.

Le Boeuf, R.A., and Shafir E. The Long and Short of It: Physical Anchoring Effects. *J. Behav. Dec. Making*, 19: 393–406 (2006)

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Makridakis, S., & Taleb, N., 2009, "Decision making and planning under low levels of predictability", *International Journal of Forecasting*

Merton R. C. (1976). Option pricing when underlying stock returns are discontinuous. *Journal of Financial Economics*, 3, 125–144.

Merton, R. C. (1992). *Continuous-time finance* (revised edition). Blackwell.

Mussweiler, T., & Strack, F. (2000). Numeric judgments under uncertainty: The role of knowledge in anchoring. *Journal of Experimental Social Psychology*, 39, 495-518.

Rogoff, K. and Reinhart C. 2010, *This Time is Different, Eight Centuries of Financial Folly*, Princeton University Press.

Taleb N.N.and Pilpel, A. (2007)Epistemology and Risk Management, "Risk and Regulation", 13, Summer 2007

Taleb, N.N. (1997). *Dynamic Hedging: Managing Vanilla and Exotic Options*. New York: John Wiley & Sons. ISBN 0-471-15280-3.

Taleb, N. N. (2004) "I problemi epistemologici del risk management " in: Daniele Pace (a cura di) "Economia del rischio. Antologia di scritti su rischio e decisione economica", Giuffrè, Milano

Taleb, N. N. (2004) "On Skewness in Investment Choices." *Greenwich Rountable Quarterly* 2.

Taleb, N. N. (2004) "Roots of Unfairness." *Literary Research/Recherche littéraire*. 21(41-42): 241-254.[57]

Taleb, N. N. (2004) "These Extreme Exceptions of Commodity Derivatives." in Helyette German, *Commodities and Commodity Derivatives*. New York: Wiley.

Taleb, N. N. (2004) Bleed or Blowup: What Does Empirical Psychology Tell Us About the Preference For Negative Skewness? , *Journal of Behavioral Finance*, 5

Taleb, N. N. (2005) "Fat Tails, Asymmetric Knowledge, and Decision making: Essay in Honor of Benoit Mandelbrot's 80th Birthday." *Technical paper series, Willmott (March)*: 56-59.

Taleb, N. N. (2008) Infinite Variance and the Problems of Practice, *Complexity*, 14(2).

Taleb, N., and Tapiero, C. *Too Big to Fail and the Fallacy of Large Institutions* (forthcoming)

Taleb, N., and Tapiero, C.,2010, *The Risk Externalities of Too Big to Fail* in press,Physica A

Taleb, N.N. (2007) "Black Swan and Domains of Statistics", *The American Statistician*, August 2007, Vol. 61, No. 3

Taleb, N.N. (2009), *Errors, Robustness, and the Fourth Quadrant*, *International Journal of Forecasting*

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<sup>i</sup> Taleb 2007a, Taleb and Pilpel, 2007, 2007/2010, 2009, 2010a,2010b

<sup>ii</sup> Taleb, 2009

<sup>iii</sup> Taleb 2004, Taleb and Martin, 2007

<sup>iv</sup> Taleb (2010), Taleb and Tapiero(2010)