Report on The Risks of Financial Modeling, VaR and the Economic Breakdown

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INTRODUCTION

Mr. Chairman, Ranking Member, Members of the Committee, thank you for giving me the opportunity to testify on the risk measurement methods used by banks, particularly those concerned with blowup risk, estimates of probabilities of losses from extreme events ("tail risks"), generally bundled under VaR. [1]

What is the VaR? It is simply a model that 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. Take an 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[2]. There are many modifications around VaR, "conditional VaR"[3], so my discussion concerns *all* quantitative (and probabilistic)

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[1] The author thanks Daniel Kahneman, Pablo Triana, and Eric Weinstein for helpful discussions.

[2] 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.

[3] 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.

methods concerned with losses associated with rare events. Simply, there are limitations to our ability to measure the risks of extreme events.

Thirteen years ago, I warned that "VaR encourages misdirected people to take risks with shareholders', and ultimately taxpayers' money." I have since been begging for the suspension of these measurements of tail risks. But this came a bit late. For the banking system has lost so far, according to the International Monetary Fund, in excess of 4 trillion dollars directly as a result of faulty risk management. Most of the losses were in the U.S. and will be directly borne by taxpayers. These losses do not include the other costs of the economic crisis.

Data shows that banks routinely lose everything earned in their past history in single blowups -- this happened in 1982, 1991, and, of course now. Every time society bails them out -- while bank risk-takers retain their past bonuses and start the game afresh. This is an aberrant case of capitalism for the profits and socialism for the losses.

MAIN PROBLEMS ASSOCIATED WITH VAR-STYLE RISK MEASUREMENT

1. ***These problems have been obvious all along***. My first encounter with the VaR was as a derivatives trader in the early 1990s when it was first introduced. I saw its underestimation of the risks of a portfolio by a factor of 100 --you set up your book to lose no more than $100,000 and you take a $10,000,000 hit. Worse, there was no way to get a handle on how much its underestimation could be.

Using VaR after the crash of 1987 proved strangely gullible. But the fact that its use was not suspended after the many subsequent major events, such as the Long-Term Capital Management

"Jumps" are not predictable from past jumps. See Taleb, N. N. (in press) "Errors, robustness, and the fourth quadrant", *International Journal of Forecasting* (2009).

blowup in 1998, requires some explanation. Furthermore, regulators started promoting VaR (Basel 2) just as evidence was mounting against it[4].

2. ***VaR is ineffective and lacks in robustness***

- Alas, we cannot "measure" the risk of *future* rare events like we measure the temperature. By robustness, I mean that the measure does not change much if you change the model, technique, or theory. Indeed risk estimation has nothing to do with the notion of *measure*. And the rarer the event, the harder it is to compute its probability --yet the rarer the event, the larger the consequences[5].

- Furthermore, the type of randomness we have with economic variables does not have a well-tractable, well-known structure, and can deliver vastly large events --and we are unable to get a handle on "how large". Conventional statistics, derived on a different class of variables, fail us here[6] [7] [8].

3. ***VaR encourages "low volatility, high blowup" risk taking which can be gamed by the Wall Street bonus structure***

[4] My recollection is that the VaR was not initially taken seriously by traders and managers. It took a long time for the practice to spread --and it was only after regulators got involved that it became widespread.

[5] See Taleb N.N. and Pilpel, A. (2007) Epistemology and Risk Management, *Risk and Regulation*, 13

[6] We are in the worst type of complex system characterized by high interdependence, low predictability, and vulnerability to extreme events. See N.N. Taleb, *The Black Swan*, Random House, 2007.

[7] There are other problems. 1) VaR does not replicate out of sample -- the past almost never predicts subsequent blowups. (see data in the *Fourth Quadrant*). 2) A decrease in VaR does not mean decrease in risks; often quite the opposite holds, which allows the measure to be gamed.

[8] The roots of VaR come from modern financial theory (Markowitz, Sharpe, Miller, Merton, Scholes) which, in spite of its patent lack of scientific validity, continues to be taught in business schools. See Taleb, N.N., (2000), *The Black Swan: The Impact of the Highly Improbable*, Random House.

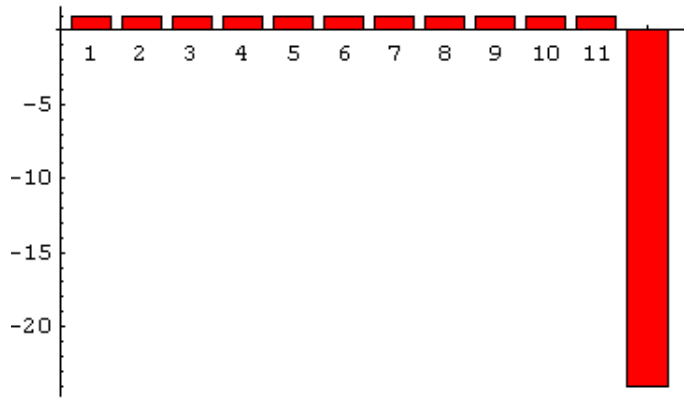

Figure 1- A typical "blow-up" strategy with hidden risks: appearance of low volatility, with a high risk of blowup. The trader makes 11 bonuses, with no subsequent "clawback" as losses are borne by shareholders, then taxpayers. This is the profile for banks (losses in 1982,1991, and 2008) and many hedge funds. VaR encourages such types of risk taking.

I have shown that operators like to engage in a "blow-up" strategy, *(switching risks from visible to hidden)*, which consists in producing steady profits for a long time, collecting bonuses, then losing everything in a single blowup.[9] Such trades pay extremely well for the trader --but not for society. For instance, a member of Citicorp's executive committee (and former government official) collected $120 million of bonuses over the years of hidden risks before the blowup; regular taxpayers are financing him retrospectively.

Blowup risks kept increasing over the past few years, while the appearance of stability has increased.[10]

4. ***Var has severe side effects (anchoring)***

Many people favor the adjunct application of VaR on grounds that it is "not harmful", using arguments like "we are aware of its defects". VaR has side effects of increasing risk-taking, even

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

[10] Even Chairman Bernanke was fooled by the apparent stability as he pronounced it the "great moderation".

by those who know that it is not reliable. We have ample evidence of so called "anchoring"[11] in the calibration of decisions. Information, even when it is known to be sterile, increases overconfidence.

5. ***VaR-style quantitative risk measurement is the engine behind leverage, the main cause of the current crisis***

Leverage[12] is a direct result of underestimation of the risks of extreme events --and the illusion that these risks are measurable. Someone more careful (or realistic) would issue equity.

April 28, 2004 was a very sad day, when the SEC, at the instigation of the investment banks, initiated the abandonment of hard (i.e. robust) risk measures like leverage, in favor of more model-based probabilistic, and fragile, ones.

CONCLUSION: WHAT REGULATORY STRUCTURE DO WE NEED?

Regulators should understand that financial markets are a complex system and work on increasing the robustness in it, by preventing "too big to fail" situations, favoring diversity in risk taking, allowing entities to absorb large shocks, and reducing the effect of model error (see "Ten Points for a Black Swan Robust Society", in Appendix II). This implies reliance on "hard", non-probabilistic

[11] 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. See Birte Englich and Thomas Mussweiler, "Sentencing under Uncertainty: Anchoring Effects in the Courtroom," *Journal of Applied Social Psychology*, vol. 31, no. 7 92001), pp. 1535-1551; Birte Englich, Thomas Mussweiler, and Fritz Strack, "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.

[12] There is a large difference between equity and credit bubbles. Equity bubbles are benign. We went through an equity bubble in 2000, without major problems.

Some credit can be benign. Credit that facilitates trade and economic transactions and finances conservative house-ownership does not have the same risk properties as credit for speculative reasons resulting from overconfidence.

measures rather than more error-prone ones. For instance "leverage" is a robust measures (like the temperature, it does not change with your model), while VaR is not.

Furthermore, we need to examine the toxicity of models; financial regulators should have the same test as the Food and Drug Administration does. The promoter of the probability model must be able to show that no one will be harmed even if the event is rare. Alas, the history of medicine shows translational gaps, the lag between the discovery of harm and suspension of harmful practice, lasting up to 200 years in pre-modern medicine[13]. Unfortunately, economics resemble pre-modern medicine[14]. But we cannot afford to wait 200 years to find out that the medicine is far worse than the disease. We cannot afford to wait even months.

APPENDIX I: AUTHOR'S WARNINGS, 1996-2007

1996-1997

VaR is charlatanism because it tries to estimate something that is scientifically impossible to estimate, namely the risk of rare events. It gives people a misleading sense of precision. *(Derivatives Strategy,* citing from *Dynamic Hedging)*

[13] "When William Harvey demonstrated the mechanism of blood circulation in the 1620s, humoral theory and its related practices should have disappeared, because the anatomy and physiology on which it relied was incompatible with this picture of the organism. In fact, people continued to refer to spirits and humors, and doctors continued to prescribe phlebotomies, enemas, and cataplasms, for centuries more --even when it was established in the mid-1800, most notably by Louis Pasteur, that germs were the cause of disease." Noga Arikha "Just Life in a Nutshell: Humours as common sense", in *The Philosophical Forum Quarterly*, XXXIX, 3

[14] Most of the use of probabilistic methods lacking both mathematical and empirical justification can be attributed to the prestige given to modern finance by the various Nobel memorial prizes in economics. See P. Triana, 2009, *Lecturing Birds on Flying: Can Mathematical Theories Destroy the Markets?*, J. Wiley.

VaR encourages misdirected people to take risks with shareholders,' and ultimately taxpayers' money. (*Derivatives Strategy)*

2003

Fannie Mae's models (for calibrating to the risks of rare events) are pseudoscience. *(New York Times -Alex Berenson's article on FNMA)*

"What happened to LTCM will look like a picnic compared to what should happen to you". *(Lecture, Women in Hedge Funds Association, cited in Hedge World)*

2007

Fannie Mae, when I look at its risks, seems to be sitting on a barrel of dynamite, vulnerable to the slightest hiccup. But not to worry: their large staff of scientists deems these events "unlikely". (*The Black Swan)*

Banks are now more vulnerable to the Black Swan than ever before with "scientists" among their staff taking care of exposures. The giant firm J. P. Morgan put the entire world at risk by introducing in the nineties RiskMetrics, a phony method aiming at managing people's risks. A related method called "Value-at-Risk," which relies on the quantitative measurement of risk, has been spreading. (*The Black Swan)*

APPENDIX II: TEN PRINCIPLES FOR A BLACK SWAN ROBUST WORLD (*FINANCIAL TIMES*, APRIL 8, 2009)

1. ***What is fragile should break early while it is still small.*** Nothing should ever become too big to fail. Evolution in economic life helps those with the maximum amount of hidden risks - and hence the most fragile - become the biggest.

2. ***No socialisation of losses and privatisation of gains .*** Whatever may need to be bailed out should be nationalised; whatever does not need a bail-out should be free, small and risk-bearing. We have managed to combine the worst of capitalism and socialism. In France in the 1980s, the socialists took over the banks. In the US in the 2000s, the banks took over the government. This is surreal.

3. ***People who were driving a school bus blindfolded (and crashed it) should never be given a new bus.*** The economics establishment (universities, regulators, central bankers, government officials, various organizations staffed with economists) lost its legitimacy with the failure of the system. It is irresponsible and foolish to put our trust in the ability of such experts to get us out of this mess. Instead, find the smart people whose hands are clean.

4. ***Do not let someone making an "incentive" bonus manage a nuclear plant - or your financial risks.*** Odds are he would cut every corner on safety to show "profits" while claiming to be "conservative". Bonuses do not accommodate the hidden risks of blow-ups. It is the asymmetry of the bonus system that got us here. No incentives without disincentives: capitalism is about rewards and punishments, not just rewards.

5. ***Counter-balance complexity with simplicity. Complexity from globalisation and***

highly networked economic life needs to be countered by simplicity in financial products. The complex economy is already a form of leverage: the leverage of efficiency. Such systems survive thanks to slack and redundancy; adding debt produces wild and dangerous gyrations and leaves no room for error. Capitalism cannot avoid fads and bubbles: equity bubbles (as in 2000) have proved to be mild; debt bubbles are vicious.

6. ***Do not give children sticks of dynamite, even if they come with a warning.*** Complex derivatives need to be banned because nobody understands them and few are rational enough to know it. Citizens must be protected from themselves, from bankers selling them "hedging" products, and from gullible regulators who listen to economic theorists.

7. ***Only Ponzi schemes should depend on confidence. Governments should never*** **need** ***to "restore confidence".*** Cascading rumours are a product of complex systems. Governments cannot stop the rumours. Simply, we need to be in a position to shrug off rumours, be robust in the face of them.

8. ***Do not give an addict more drugs if he has withdrawal pains.*** Using leverage to cure the problems of too much leverage is not homeopathy, it is denial. The debt crisis is not a temporary problem, it is a structural one. We need rehab.

9. ***Citizens should not depend on financial assets or fallible "expert" advice for their retirement.*** Economic life should be definancialised. We should learn not to use markets as storehouses of value: they do not harbour the certainties that normal citizens require. Citizens should experience anxiety about their own businesses (which they control), not their investments (which they do not control).

10. ***Make an omelet with the broken eggs.*** Finally, this crisis cannot be fixed with makeshift

repairs, no more than a boat with a rotten hull can be fixed with ad hoc patches. We need to rebuild the hull with new (stronger) materials; we will have to remake the system before it does so itself. Let us move voluntarily into Capitalism 2.0 by helping what needs to be broken break on its own, converting debt into equity, marginalising the economics and business school establishments, shutting down the "Nobel" in economics, banning leveraged buy-outs, putting bankers where they belong, clawing back the bonuses of those who got us here, and teaching people to navigate a world with fewer certainties.

Then we will see an economic life closer to our biological environment: smaller companies, richer ecology, no leverage. A world in which entrepreneurs, not bankers, take the risks, and companies are born and die every day without making the news.

In other words, a place more resistant to black swans.