The Inverted Pyramid Model – A Physical Perspective To Understand How Risk Is Undermined In Designing Complex Financial Instruments

**** Dr. Shveta Singh***

INTRODUCTION

In an article by Charles O. Prince III, Citigroup's chief executive, describing the financial crisis and its impact on Citigroup's well being, he blamed the debacle on too many "souring mortgages". The bank owned $43 billion in mortgage-related assets. For months, his concerns were downplayed until finally in 2007, a risk management team was dispatched to look into the financial vulnerabilities the bank faced. However, they were a tad too late.

When the corporate world chose to listen to the rhetoric of the "big guns", they defeated the lessons from the basic principles of physics. The force being exerted on any object (an underlying security for the purpose of this paper) increases manifold as one uses it as a base for building further derived securities (Collateral Debt Obligations for the purpose of this paper).

It was a case of egos ruling the roost and clouding the judgment of all seeking their advice. Also, the lure of short-term gains and bonuses resulting because of the booming real estate sector forced the executives to turn a blind eye to the long term implications of the financial structuring of these derivations. The underlying greed of Wall Street can be best coined through the phrase "rush to riches".

THE FALL OF THE MIGHTIEST!

In events spanning just over a year, United States of America faced a crisis unprecedented in recent times. After the Great Depression of 1929, these events forced Wall Street giants to buckle under "bad" investments worth billions of dollars. The big names that once dominated the international financial market scene declared themselves bankrupt and were taken over by the government. In a nightmarish scenario, financial wizards and stalwarts fell prey to the basic lack of common sense. This led to a huge dent in investor sentiment and led to an unimaginable credit crunch for the businesses and consumers that these players in the financial system were servicing.

The United States federal government has announced a $787 billion bailout plan but the crisis has already travelled across international borders of the highly integrated global financial markets, into Europe and other emerging economies of the world thereby deepening the impact.

BACKGROUND AND EVENTS THAT LED TO THE CRISIS

The early 1990s saw the **Information Technology boom** hitting United States. The stupendous growth in this sector saw the American economy booming and growing like never before. However, when the tech-bubble burst after a skyrocketing decade, the US stock market crashed and the economy went into a resultant recession. In a mode of damage control, the Federal Reserve lowered interest rates.

This step made **loans cheaper and eased mortgage payments** and led to a resultant increased demand for homes. Increased demand led to increased prices and a lot of homeowners took the advantage of increased prices to refinance their mortgages. This led to a spiral of mortgages as the industry grew leading to an increased leverage on these assets resulting in a fall of their quality.

In 2006, the market started witnessing the beginning of **defaults on the mortgage payments** as home buyers had leveraged themselves to the hilt, credit ranging to almost six times of their incomes in some cases. Even with these warning signs, the financial institutions did not slow down on the lending or the deriving of complex financial products based on these mortgage loans. Their thought was that the asset (mortgaged house) would be strong enough to cover any risk.

THE BEGINNING OF THE END

Two hedge funds owned by Bear Stearns went under in 2007 starting the virtual siege of the financial world. This triggered off a chain reaction as more and more banks and financial instruments realized the financial "unworthiness" of the underlying assets. Soon, an increasing number of payment defaults were reported and these foreclosures led to a fall in the housing prices (the underlying asset)! The financial inverted pyramid built on the mortgaged house started to collapse like a pack of dominoes! The rest is history.

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* *Faculty,* MBA-IT & MSCLIS, Indian Institute of Information Technology-Allahabad, Devghat-Jhalwa, Allahabad -211012, Uttar Pradesh. Email:shveta_singh@iiita.ac.in

CURRENT LEGISLATIONS AFFECTING THE FINANCIAL AND BUSINESS SPECTRUM

There are two basic legislations that governed the financial sphere in recent times–the **Basel Accords** set up through the Bank of International Settlements and the **Sarbanes-Oxley Act** enacted in the United States of America. Though both these norms/legislations have enough teeth in theory, they proved that they lacked the bite. More truthfully, it was the lack of acceptance and adoption on the part of the greedy financial institutions and the blind eye that the enforcers turned on the participants that led to the worst ever financial crisis to hit the world. The rippling effect can be felt through all the participating economies.

Particular to the United States of America, the abolition of the Glass-Steagall Act allowed banks to not just conduct their basic commercial operations but also to indulge in investment banking activities to profit from a variety of other financial services. The erasing of this line of demarcation allowed banks to expand far beyond their traditional scope and eye the riches they didn't have access to earlier. Initially, this "megabank" model paid through billions of dollars in earnings from credit cards, mortgages, trading, etc.

THE SARBANES-OXLEY ACT

Sarbanes-Oxley contains 11 titles that describe specific mandates and requirements for financial reporting. Each of these titles establishes the undisputable role of independent auditors which act as financial watchdogs through the **Public Company Accounting Oversight Board (PCAOB).** This and the **Corporate Responsibility** clause should have been enough to ensure that organizations take responsibility for their actions and work in the greater interest of shareholders and stakeholders alike. This, however, was not the case. The clause of **Financial Disclosure** and **Corporate Fraud Accountability** should have been adequate to deter the unscrupulous behavior on the part of the so called financial wizards and fund managers but it failed to run their conscience in.

The most contentious aspect of SOX is Section 404, which required management and the external auditor to report on the adequacy of the company's internal control over financial reporting (ICFR). Since this was the most costly aspect of the legislation for companies to implement and required enormous effort, it was not taken up in the strictest sense of the word.

THE BASEL ACCORDS

The Basel Accords are milestones for the financial world. Both Basel 1 and Basel 2 have provided detailed principles and guidelines to the financial institutions and banks to put their house in order and maintain a free and robust financial world, with very few surprises. Basically, they have published guidelines of minimum capital requirements.

The Basel 2 standards are an internationally accepted and implemented standard that banking regulators use. Some countries are still in the process of a phased wise implementation. The objectives of Basel 2 are: ensuring that risk is assigned due importance in terms of capital allocation, risk is divided into operational and credit risk and both are quantified and guarded against, and to align both economic and regulatory capital in such a fine tuned manner that it leaves no scope for regulatory arbitrage.

TREATMENT OF RISK BY THE BASEL ACCORDS

The operational three pillars of Basel 2

1. Risk assessment - minimum capital requirements.
2. Supervisory Assessment.

The second pillar provides background support to the basic risk assessment pillar to help regulate the system. It also provides tools and frameworks for dealing with kinds of risks a bank may face, for instance, risks related to liquidity, legal and strategic viewpoints, to name a few.

3. Financial Market discipline and stability.

The third pillar basically deals with high standards of corporate governance issues in terms of the public disclosures and reporting that a the bank must do to ensure transparency in the marketplace and also to allow the investor community to make sound investment decisions unmarred by speculations and/or insider trading. This will enable us to ensure a sound financial system in place with very few surprises for anyone.

RISK ASSESSMENT UNDER BASEL 2

Under Basel 2, risk assumes three shapes for a bank or financial institution that are related to -

1. Credit.
2. Operations, and
3. The Market (Environment).

IMPLICATION FOR THE PROPOSED INVERTED PYRAMID MODEL

Part 1 of the inverted pyramid model (dealing with the calculation of pressure at a point) aims to look at credit risk in terms of formation of a security or financial asset, and Part 2 of the inverted pyramid model aims to look at the market (environment) risk associated with the resultant environment or financial system that deals with complex derived securities.

Treatment of credit risk - So far the credit risk was being calculated using three approaches, viz., standardized approach, Foundation IRB (Internal Rating-Based Approach) and Advanced IRB (Internal Rating-Based Approach). The most popular approach, i.e., the standardized approach sets out specific risk weights for different types of credit risk. Basel 1 listed out the standard risk weight categories for different kinds of securities depending on their credit worthiness, for example, 0% for short term government bonds, 20% for exposures to OECD Banks, 50% for residential mortgages and 100% weighting on commercial loans. There is also a 150% rating for borrowers with very dubious credit ratings. The minimum capital requirement (the percentage of risk weighted assets to be held as capital) remains at 8%.

Treatment of Operational risk under Basel II - So far Basic indicator approach or BIA, standardized approach or TSA, and advanced measurement approach or AMA are the three approaches used to understand operational risk.

QUESTIONS ON OVERSIGHT THAT THE PROPOSED INVERTED PYRAMID MODEL TARGETS

Risk management or the exercise to determine the riskiness of any financial product took a backseat in the high growth euphoria that struck the United States and indeed the rest of the world post the 9/11 revival. Most banks and financial institutions put this as a backend operation and treated it as that–something that happened in the background which did not merit the same glamour as the world of multiple level securitization–sophisticatedly called collateral debt instruments or objects. Putting aside the sophisticated nomenclature, these stood for securities that packaged mortgages and other debt instruments into bundles for resale to the investor community.

This **lack of oversight** on allotting the due importance to the act of risk assessment led to the debacle. Because C.D.O.'s included so many forms of bundled debt, gauging their risk was particularly difficult. Leave aside the micro risk assessment of specific securities, the financial world never accounted for or hedged against macroeconomic downturns, for instance, a fall in the real estate sector's growth or the credit patterns of home owners and consumers. Instead of focusing on their own risk assessment criteria, they took the credit ratings provided by credit rating agencies as the Law and chose to turn a blind eye against their judgment or the way the microenvironment was shaping up.

What made matters worse was the fact that these institutions were so convinced about the risk ratings that they themselves held on to **big positions in these securities,** hence going under the moment things turned sour with no chance of escape.

For the purview of this paper, we shall be looking at credit risk only as the operational risk gets incorporated in the basic valuations of securities at different levels of securitization. Also, the incorporation of both credit and operational risk is beyond the scope of this paper.

PHILOSOPHY BEHIND THE NEED OF ANOTHER APPROACH IN ESTIMATING CREDIT AND MARKET RISK THROUGH THE INVERTED PYRAMID MODEL

The recent financial upheavals which have originated in the United States of America and affected the world have forced us to look at financial product designs in a new light. Traditionally, financial products had remained rather simple in sense of their formation and design. However, over the last decade, we have been witness to some rather sophisticated financial wizardry, which led to the emergence of complicated debt instruments with names like Collateral Debt Obligations and Mortgage Backed Securities. Their complexity and their base underlying security and its nature and inherent risk are some of the features which have added a new dimension to the way banks and financial institutions look at credit risk and market risk now. Due to these rising complexities and breadth of these instruments, there is a need for still more conservative approaches towards assessment of both credit and market risk and a need for greater capital requirements to ensure financial stability and robustness.

Though the calculations of the standardized approach are very robust and conservatively reasonable, the inverted pyramid model will be an aid in further helping in tiering and segmenting these asset bases as the level of complexity builds up in a security (for example, CDOs and MBS).

To further emphasize the importance of reassessment of risk segments, we quote U.S. FDIC Chairman Sheila Bair

criticizing the existing Basel II standards during June 2007: "There are strong reasons for believing that banks left to their own devices would maintain less capital -- not more -- than would be prudent. The fact is, banks do benefit from implicit and explicit government safety nets." Hence, there is a need for further prudence in understanding risk assessments and guarding against it.

So far, VaR or (value at risk) approach is the only popular approach to look at market risk. Through this model, the author(s) aims to provide another tool and perspective to understand the phenomenon.

PROPOSED MODEL

This model aims at stating that the risk associated with a security increases directly with the amount of complexity involved in its securitization and the force acting upon the security from the environment increases exponentially with each level of securitization that is based on the fundamental asset security.

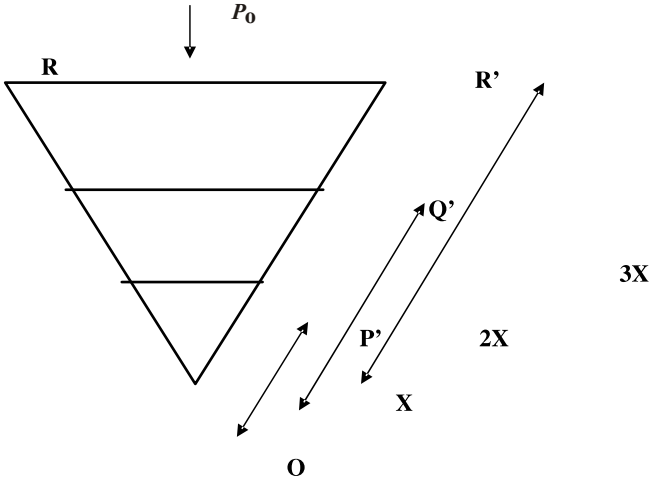
Let us examine the recent financial restructuring of securities that led to the crisis through a series of diagrams and figures from the world of basic physics mirroring the structure of securities -

Any financial security is affected by the risk inherent in the environment that exerts a force on it and the complexity of the instrument itself in terms of creation, valuation and the underlying asset.

• This paper links the physical pressure at a point with the complexity of the financial instrument in terms of underlying assets and valuations, and treats it akin to the density of the material for the calculation of pressure.

• This paper links the physical force at a point with the risk inherent in the environment of the financial instrument in terms of market forces, riskiness of the underlying assets and inaccurate valuations, and treats it akin to the effect that increased risk has on the well-being of the security.

MODEL 1 : FOR CALCULATION OF PRESSURE AT POINT 'O'



DESCRIPTION OF FIGURE 1–

- "O" here denotes the underlying security (mortgaged house).
- PP', QQ', RR' each denotes the number and levels of financial derivations, ie., a collateral debt obligation.
- ORR' denotes the "inverted pyramid" shape that the financial structuring took.
- OPP', OQQ' and ORR' denote the "inverted pyramids" formed by each level of collateral debt obligations created.
- P_0 denotes the pressure acting on the underlying security O as the levels of CDOs increase.
- X, 2X, and 3X each denotes the varying pressure quantum for "inverted pyramids" OPP', OQQ' and ORR' respectively.

Let pressure at RR' (surface) = P_0

Let density of inverted pyramid = ρ

Pressure at O =

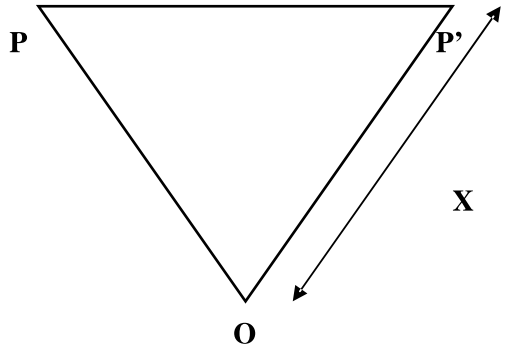
$$P = P_0 + \frac{3\sqrt{\{3\}}}{2}\rho g x$$

Inference: The complexity inherent in the formation of a financial instrument has a direct impact on the riskiness associated with the security.

MODEL 2 (A, B, C) FOR CALCULATION OF FORCE AT POINT O

MODEL 2 A: FIRST LEVEL OF SECURITIZATION

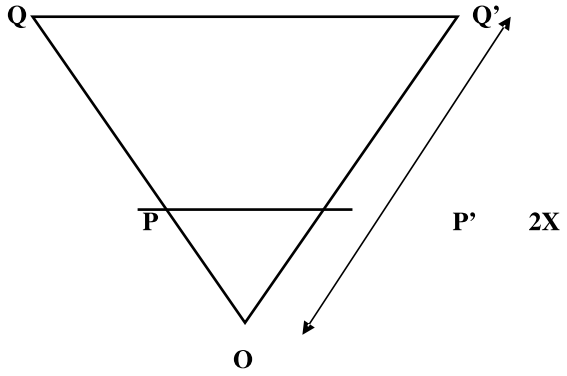
Case I: Due to Triangle POP'



$$F_1 = \frac{9}{8}\rho g x^3$$

MODEL 2 B: SECOND LEVEL OF SECURITIZATION

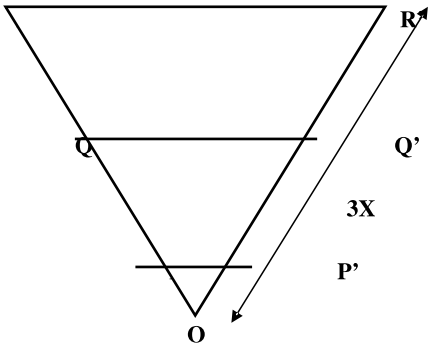
Case II: Due to Triangle QOQ'



$$F_2 = \frac{9}{2}\rho g x^3$$

MODEL 2 C: THIRD LEVEL OF SECURITIZATION

Case III: Due to Triangle ROR'



$$F_3 = \frac{81}{8}\rho g x^3$$

RATIO OF FORCES

Ratio between Triangle 1 and Triangle 2 is: $F_2 = 4F_1$

Ratio between Triangle 1 and Triangle 3 is: $F_3 = 9F_1$

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Inferences: The complexity inherent in the formation of a multi-tiered system of financial instruments has an exponential impact on the riskiness associated with the base security.

The force exerted will be the square of the level of further securitization, i.e., for the second level, the force exerted would increase four times, for the third level, the force exerted would increase nine times, and so on.

TO CONCLUDE WITH - A WORD OF CAUTION

Financial intermediaries and experts should hence exert an immense amount of care when designing financial products as it draws risk not just inherent to the security itself but from the environment generated due to repeated securitization. Risk assessment departments which were almost defunct for the past few years or took a backseat in the euphoria of growth and incomes should function as watch dogs and at the forefront of the financial structuring of securities. These departments need to be present at the financial institution and also at the credit rating agencies.

This paper was an effort to quantify the extent of risk faced by an underlying security through repeated securitization through sophisticated sounding nomenclatures. It drew a parallel from the physical-mechanical sciences to convey to the reader the immense challenges and risks underlying such a venture.

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