Advanced Risk Management Workshop

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The Word “Risk”

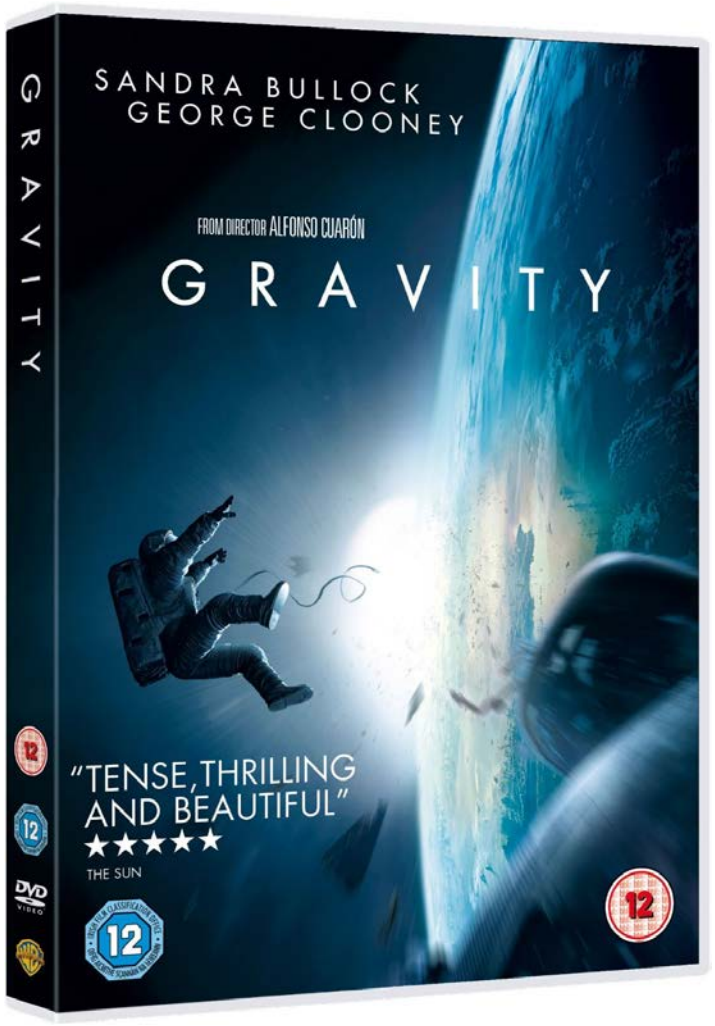
The Oxford English Dictionary cites the earliest use of the word in English (in the spelling of risque from its Arabic original " ("رزقwhich mean working to gain income gain and profit (see Wikipedia Arabic meaning) as of 1621, and the spelling as risk from 1655.

It defines risk as: (Exposure to) the possibility of loss, injury, or other adverse or unwelcome circumstance; a chance or situation involving such a possibility.

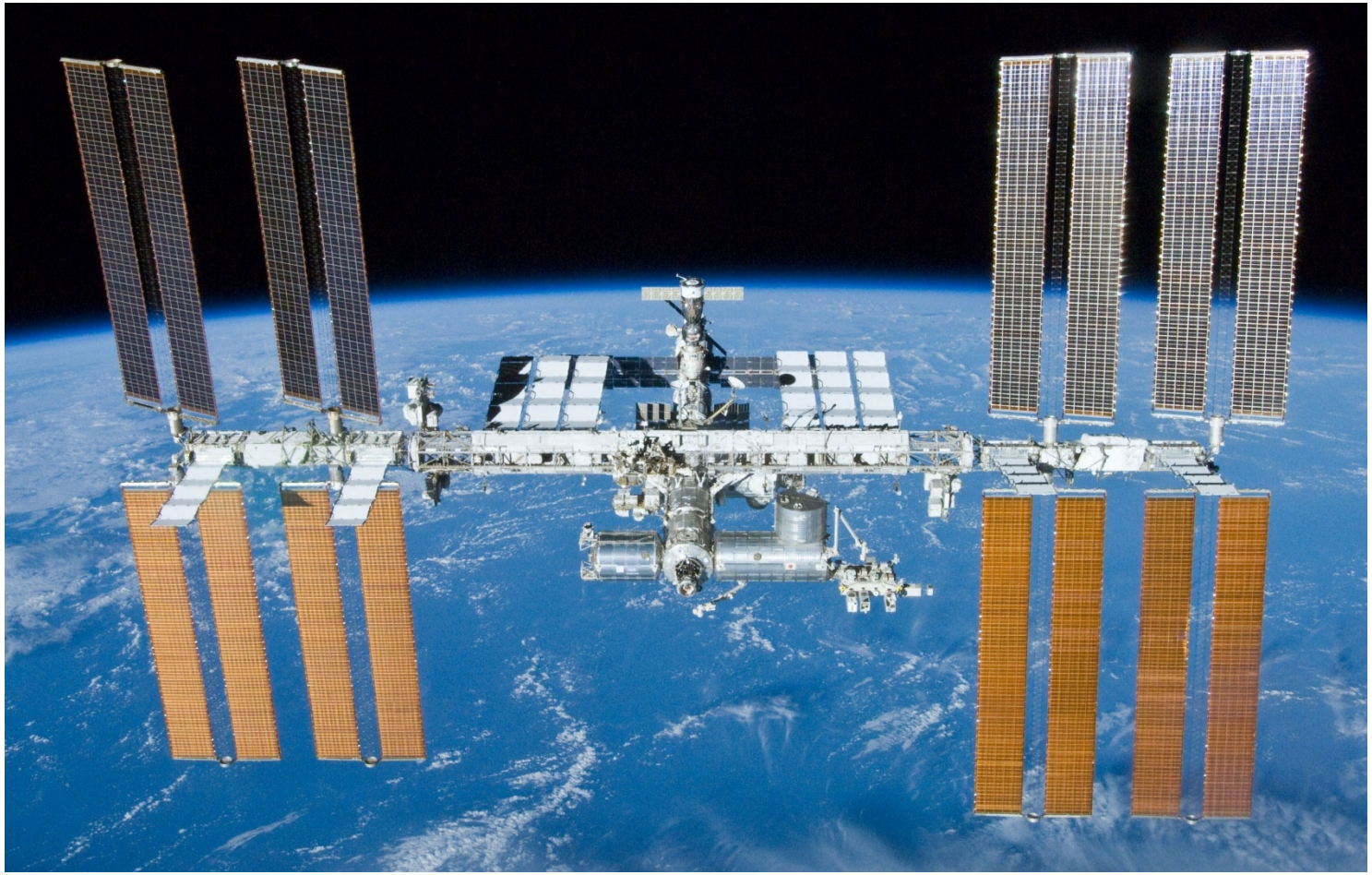
https://en.wikipedia.org/wiki/Risk

Risk management is the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of unfortunate events or to maximize the realization of opportunities.

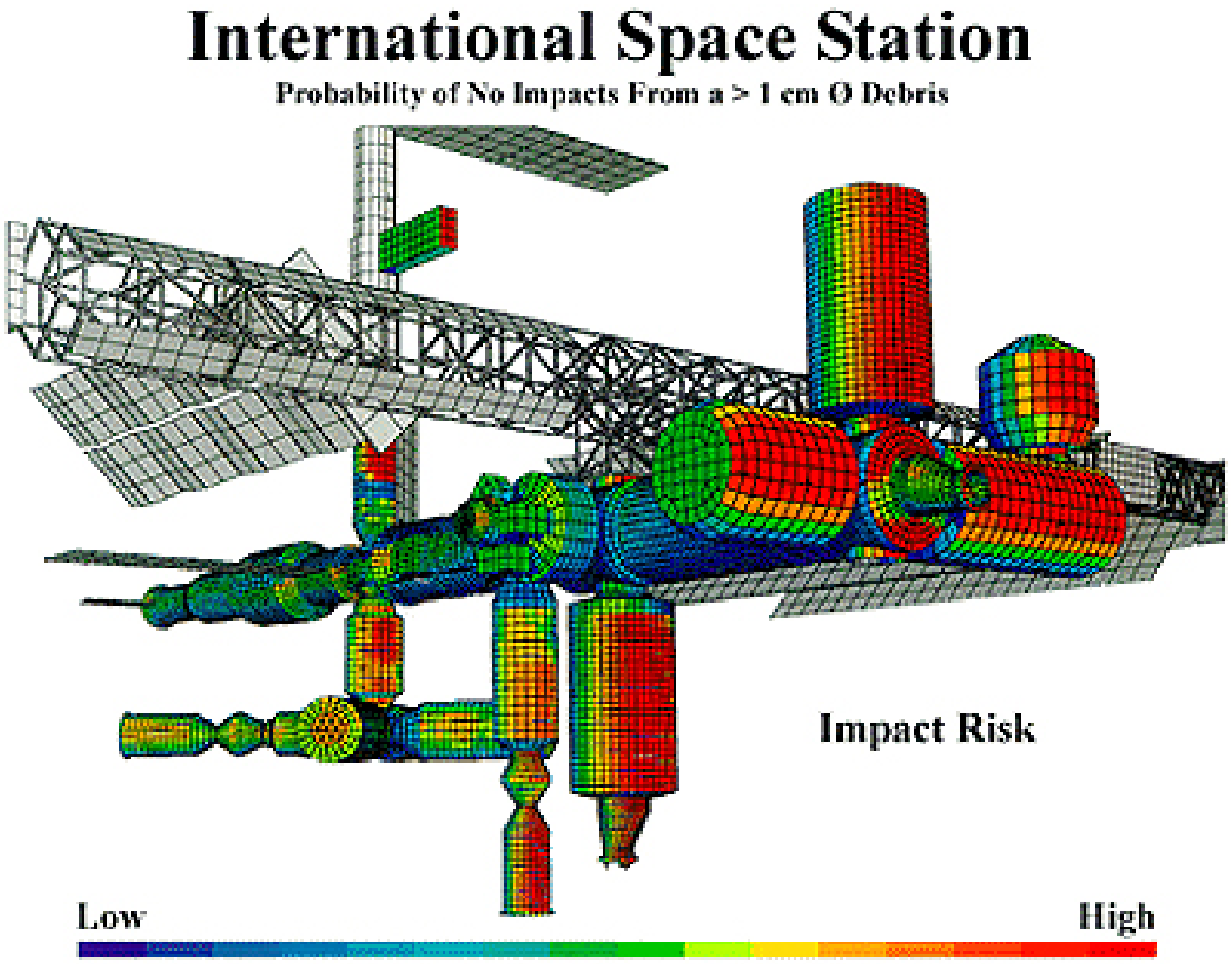
Hubbard, Douglas (2009). *The Failure of Risk Management: Why It's Broken and How to Fix It*. John Wiley & Sons.



Fiction



Reality

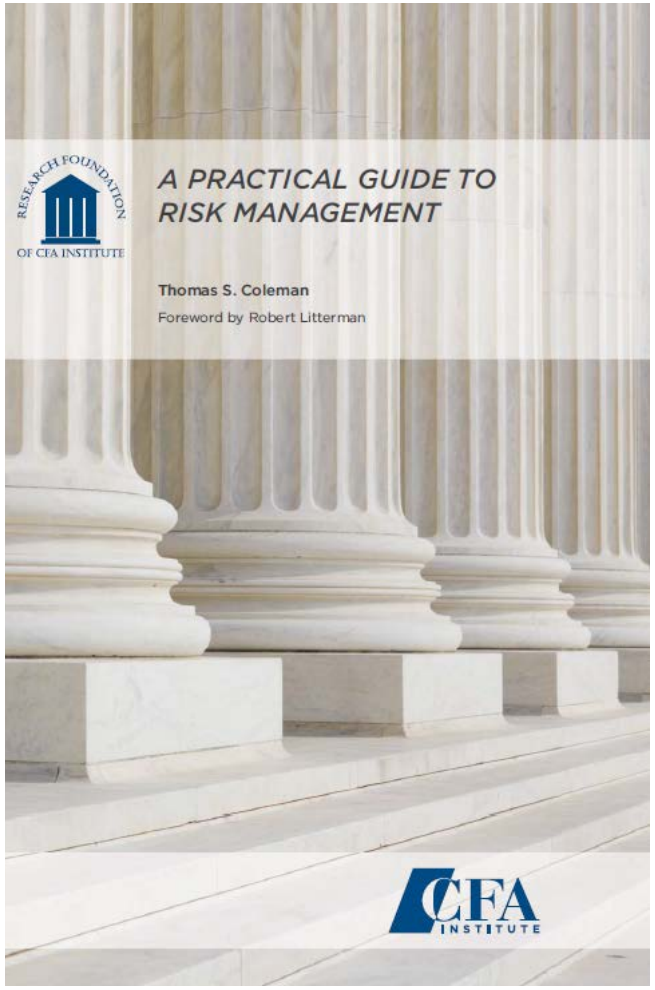


NASA's illustration showing high impact risk areas for the International Space Station

National Aeronautics and Space Administration (NASA): NASA Johnson Space Center Orbital Debris Program Office - Orbital Debris Education Package

The 1960 Valdivia earthquake or Great Chilean earthquake (Gran terremoto de Chile) of Sunday, 22 May 1960 was **the most powerful earthquake ever recorded**, rating a 9.5 on the moment magnitude scale.

It occurred in the afternoon (19:11 GMT, 15:11 local time), and lasted approximately 10 minutes. **The resulting tsunami** affected southern Chile, Hawaii, Japan, the Philippines, eastern New Zealand, southeast Australia, and the Aleutian Islands.



Coleman, Tom, A Practical Guide to Risk Management (July 27, 2011). CFA Institute Research Foundation M2011-2.
Available at SSRN:
http://ssrn.com/abstract=2586032

Risk measurement has three goals:

- **Uncovering "known" risks** faced by the portfolio or the firm. By "known" risks, I mean risks that can be identified and understood with study and analysis because these or similar risks have been experienced in the past by this particular firm or others. Such risks often are not obvious or immedi-ately apparent, possibly because of the size or diversity of a portfolio, but these risks can be uncovered with diligence.

- **Making the known risks easy to see**, understand, and compare—in other words, the effective, simple, and transparent display and reporting of risk. Value at risk, or VaR, is a popular tool in this arena, but there are other, complementary, techniques and tools.

- **Trying to understand and uncover the "unknown"** or unanticipated risks—those that may not be easy to understand or anticipate, for example, because the organization or industry has not experienced them before.

Risk representation*

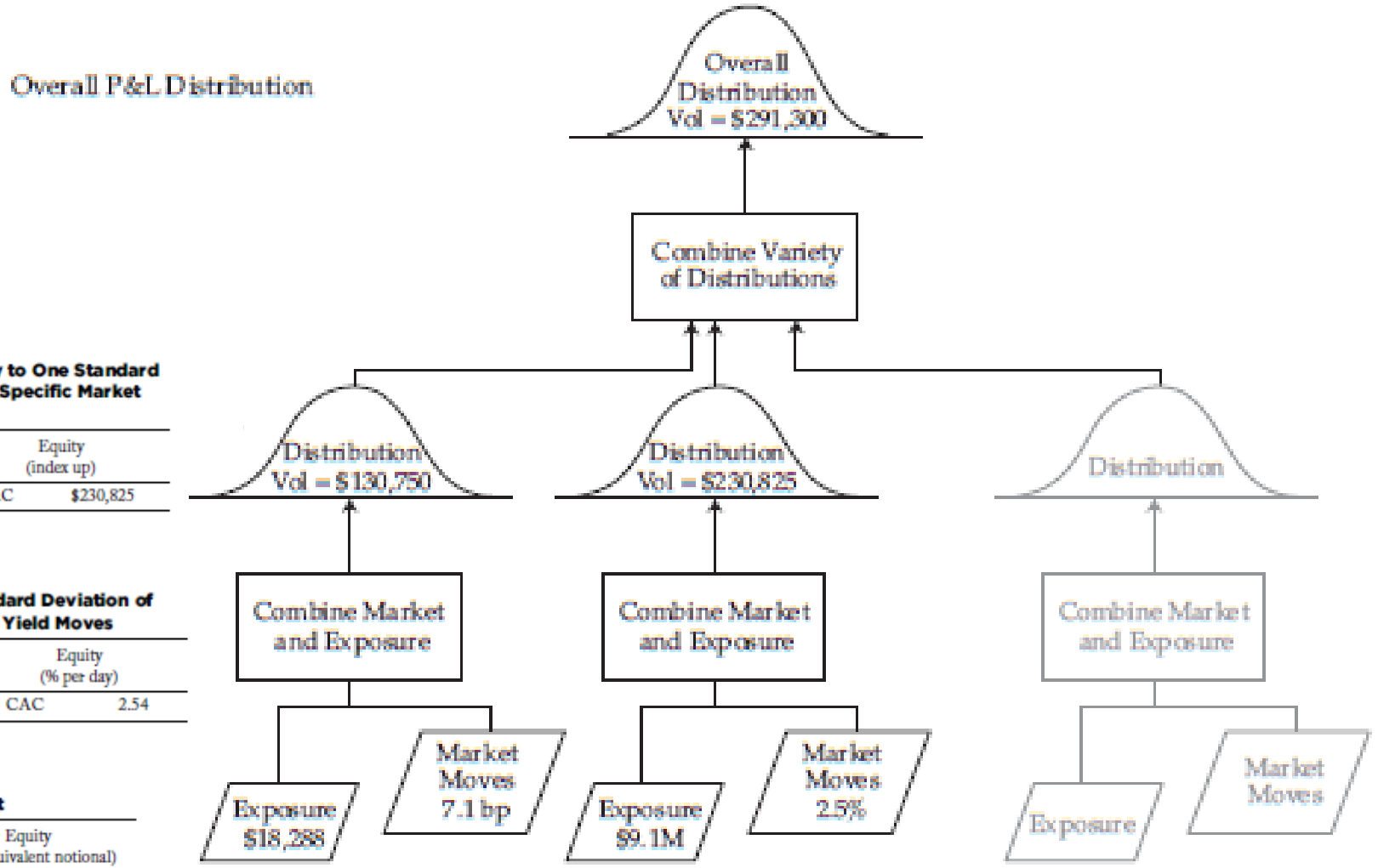


Table 1.3. Portfolio Sensitivity to One Standard Deviation Moves in Specific Market Risk Factors

Yield Curve (yield down)		Equity (index up)	
10-year par yield	$130,750	CAC	$230,825

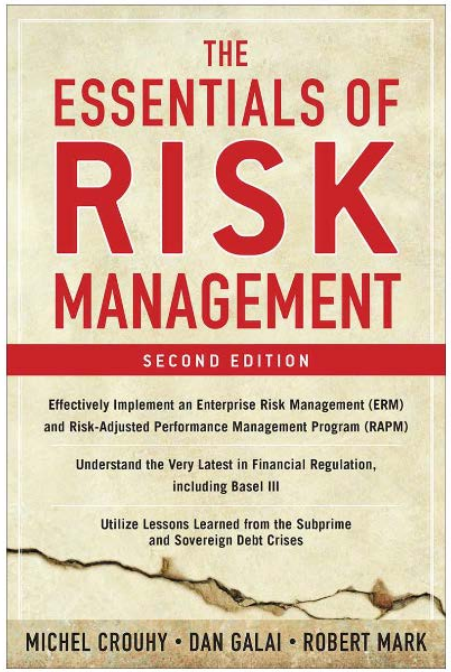
Table 1.2. Volatility or Standard Deviation of Individual Market Yield Moves

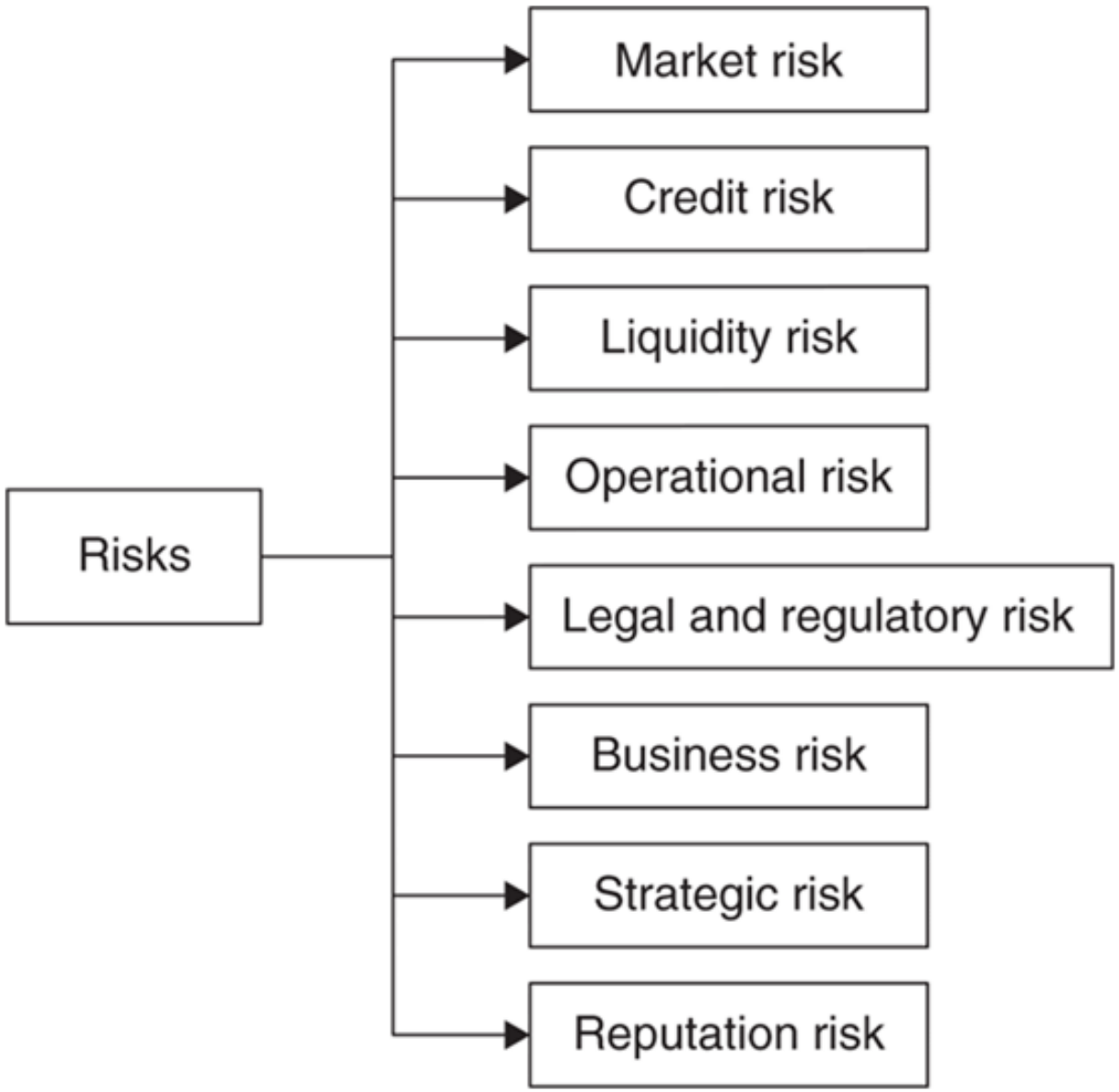
Yield Curve (bps per day)		Equity (% per day)	
10-year par yield	7.15	CAC	2.54

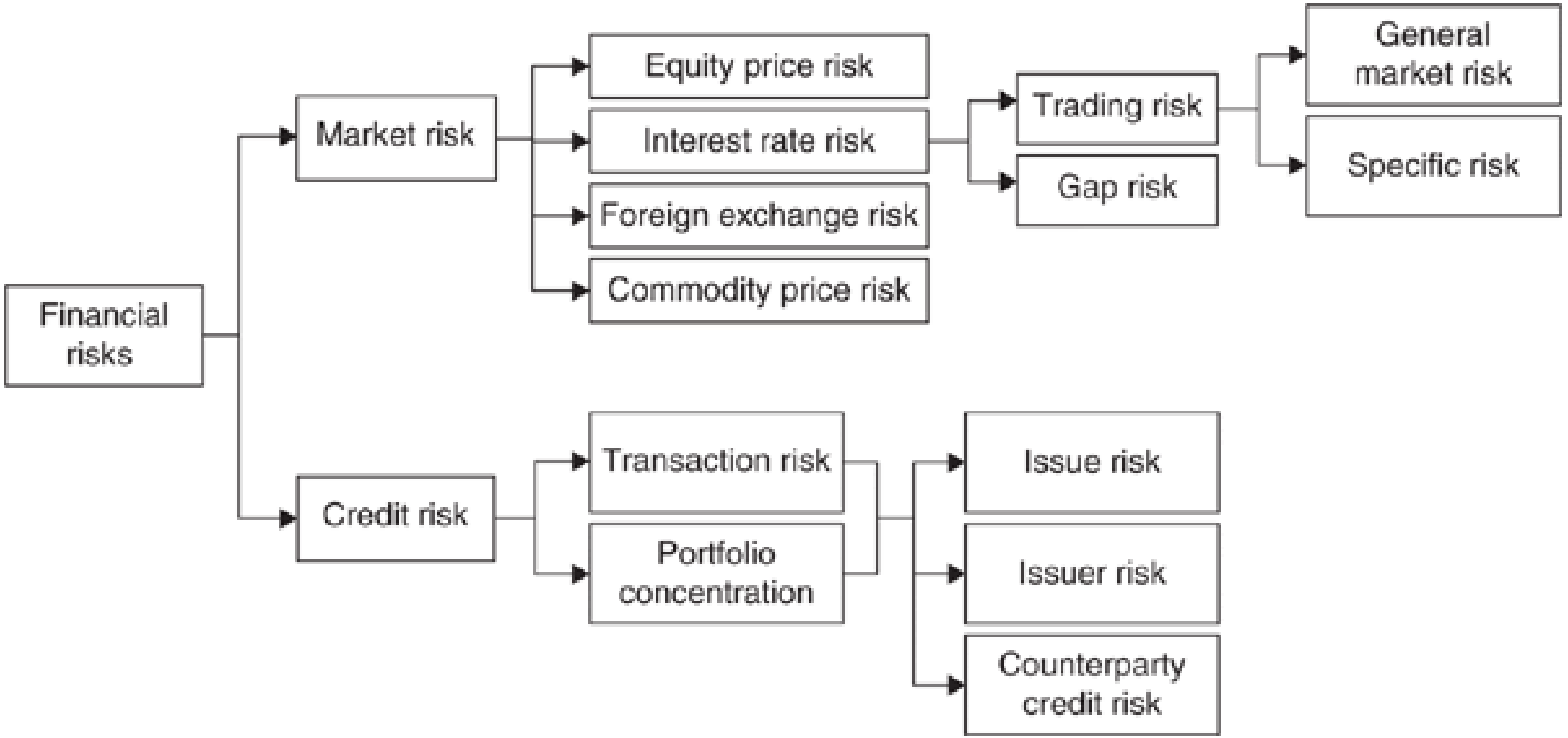
Table 1.1. Sample Exposure Report

Yield Curve (per 1 bp down)		Equity (beta-equivalent notional)	
10-year par yield	$18,288	CAC	$9,100,000

*after Coleman (2011)


THE
ESSENTIALS OF
RISK
MANAGEMENT
SECOND EDITION
Effectively Implement an Enterprise Risk Management (ERM) and Risk-Adjusted Performance Management Program (RAPM)
Understand the Very Latest in Financial Regulation, including Basel III
Utilize Lessons Learned from the Subprime and Sovereign Debt Crises
MICHEL CROUHY • DAN GALAI • ROBERT MARK


Risks
Market risk
Credit risk
Liquidity risk
Operational risk
Legal and regulatory risk
Business risk
Strategic risk
Reputation risk



After Crouhy, Galai, Mark, The Essentials of Risk Management, McGraw-Hill Education, 2014

Market Risk

Market risk is the risk that changes in financial market prices and rates will reduce the value of a security or a portfolio. Price risk can be decomposed into a general market risk component (the risk that the market as a whole will fall in value) and a specific market risk component, unique to the particular financial transaction under consideration. In trading activities, risk arises both from open (unhedged) positions and from imperfect correlations between market positions that are intended to offset one another.

Interest Rate Risk

The simplest form of interest rate risk is the risk that the value of a fixed-income security will fall as a result of an increase in market interest rates

Equity Price Risk

This is the risk associated with volatility in stock prices. The general market risk of equity refers to the sensitivity of an instrument or portfolio value to a change in the level of broad stock market indices. The specific or idiosyncratic risk of equity refers to that portion of a stock's price volatility determined by characteristics specific to the firm, such as its line of business, the quality of its management, or a breakdown in its production process.

Foreign Exchange Risk

Foreign exchange risk arises from open or imperfectly hedged positions in particular foreign currency

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Commodity Price Risk

The price risk of commodities differs considerably from interest rate and foreign exchange risk, since most commodities are traded in markets in which the concentration of supply is in the hands of a few suppliers who can magnify price volatility. For most commodities, the number of market players having direct exposure to the particular commodity is quite limited, hence affecting trading liquidity which in turn can generate high levels of price volatility. Other fundamentals affecting a commodity price include the ease and cost of storage, which varies considerably across the commodity markets (e.g., from gold to electricity to wheat). As a result of these factors, commodity prices generally have higher volatilities and larger price discontinuities (i.e., moments when prices leap from one level to another) than most traded financial securities.

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Operational Risk

Operational risk refers to potential losses resulting from a range of operational weaknesses including inadequate systems, management failure, faulty controls, fraud, and human errors; in the banking industry, operational risk is also often taken to include the risk of natural and man-made catastrophes (e.g., earthquakes, terrorism) and other nonfinancial risks.

Legal and Regulatory Risk

Legal and regulatory risk arises for a whole variety of reasons; it is closely related to operational risk as well as to reputation risk (discussed below). For example, a counterparty might lack the legal or regulatory authority to engage in a risky transaction. Legal and regulatory risks are classified as operational risks under Basel II Capital Accord.

Reputation Risk

From a risk management perspective, reputation risk can be divided into two main classes: the belief that an enterprise can and will fulfill its promises to counterparties and creditors; and the belief that the enterprise is a fair dealer and follows ethical practices.

The importance of the first form of reputation risk is apparent throughout the history of banking and was a dramatic feature of the 2007–2009 crisis. In particular, the trust that is so important in the banking sector was shattered after the Lehman Brothers collapse in September 2008. At a time of crisis, when rumors spread fast, the belief in a bank's soundness can be everything.

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MODEL RISK

Models are the wonder and, on occasion, the curse of the modern financial world. They are used throughout the financial and corporate world for any number of purposes, and especially to put a number against the value, or the risk, of investments and financial positions. They have become central to many of the key corporate activities already discussed in this book, including market, credit, and asset/liability risk management.

Unfortunately, models can be wrong, in the sense of containing some internal error, and they can also be misapplied, fed the wrong input information, and their results misinterpreted. As our dependence on models to understand a complex world has grown, model risks have grown too, including within risk management. In this chapter, we explain the importance of model risk, using the example of market risk, examining:

- The extent of the problem
- Model error
- Implementation problems
- Mitigation of model risk
- A detailed case history: LTCM and model risk

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BOX 15-1 MODEL RISK AND GOVERNANCE: THE LONDON WHALE

During the first half of 2012, JPMorgan Chase lost billions of dollars from exposure to a massive credit derivative portfolio. We compiled this case study of the event using word-for-word extracts from the 300-page report produced by a subsequent Senate investigation.[1]

SETTING THE SCENE

"JP Morgan Chase & Company is the largest financial holding company in the United States, with $2.4 trillion in assets. It is also the largest derivatives dealer in the world and the largest single participant in world credit derivatives markets. Its principal bank subsidiary, JP Morgan Chase Bank, is the largest U.S. bank. JP Morgan Chase has consistently portrayed itself as an expert in risk management with a "fortress balance sheet" that ensures taxpayers have nothing to fear from its banking activities, including its extensive dealing in derivatives. But in early 2012, the bank's Chief Investment Office (CIO), which is charged with managing $350 billion in excess deposits, placed a massive bet on a complex set of synthetic credit derivatives that, in 2012, lost at least $6.2 billion.

The CIO's losses were the result of the so-called "London Whale" trades executed by traders in its London office—trades so large in size that they roiled world credit markets. Initially dismissed by the bank's chief

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executive as a "tempest in a teapot," the trading losses quickly doubled and then tripled despite a relatively benign credit environment...."[2]

THE RISK EXPOSURE GROWS

"... In 2006, the CIO approved a proposal to trade in synthetic derivatives, a new trading activity. In 2008, the CIO began calling its credit trading activity the Synthetic Credit Portfolio (SCP)."

"Three years later, in 2011, the SCP's net notional size jumped from $4 billion to $51 billion, a more than tenfold increase. In late 2011, the SCP bankrolled a $1 billion credit derivatives trading bet that produced a gain of approximately $400 million. In December 2011, JPMorgan Chase instructed the CIO to reduce its Risk Weighted Assets (RWA) to enable the bank, as a whole, to reduce its regulatory capital requirements. In response, in January 2012, rather than dispose of the high risk assets in the SCP – the most typical way to reduce RWA – the CIO launched a trading strategy that called for purchasing additional long credit derivatives to offset its short derivatives positions and lower the CIO's RWA that way. That trading strategy not only ended up increasing the portfolio's size, risk, and RWA, but also, by taking the portfolio into a net long position, eliminated the hedging protections the SCP was originally supposed to provide."[3]

OPERATIONAL RISK: HIDING LOSSES

"In its first four years of operation, the SCP produced positive revenues, but in 2012, it opened the year with sustained losses. In January, February, and March, the days reporting losses far exceeded the days reporting profits, and there wasn't a single day when the SCP was in the black. To minimize its reported losses, the CIO began to deviate from the valuation practices it had used in the past to price credit derivatives. In early January,

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the CIO had typically established the daily value of a credit derivative by marking it at or near the midpoint price in the daily range of prices (bid-ask spread) offered in the market place. Using midpoint prices had enabled the CIO to comply with the requirement that it value its derivatives using prices that were the "most representative of fair value." But later in the first quarter of 2012, instead of marking near the midpoint, the CIO began to assign more favorable prices within the daily price range (bid-ask spread) to its credit derivatives. The more favorable prices enabled the CIO to report smaller losses in the daily profit/loss (P&L) reports that the SCP filed internally within the bank."

"... by March 16, 2012, the SCP had reported year-to-date losses of $161 million, but if midpoint prices had been used, those losses would have swelled by at least another $432 million to a total of $593 million."[4]

"... One result of the CIO's using more favorable valuations was that two different business lines within JPMorgan Chase, the CIO and the Investment Bank, assigned different values to identical credit derivative holdings. Beginning in March 2012, as CIO counterparties learned of the price differences, several objected to the CIO's values, resulting in collateral disputes peaking at $690 million. In May, the bank's Deputy Chief Risk Officer ... directed the CIO to mark its books in the same manner as the Investment Bank, which used an independent pricing service to identify the midpoints in the relevant price ranges. That change in valuation methodology resolved the collateral valuation disputes in favor of the CIO's counterparties and, at the same time, put an end to the mismarking."[5]

CORPORATE GOVERNANCE: POOR RISK CULTURE

"In contrast to JPMorgan Chase's reputation for best-in-class risk management, the whale trades exposed a bank culture in which risk limit breaches were routinely disregarded, risk metrics were frequently criticized or

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downplayed, and risk evaluation models were targeted by bank personnel seeking to produce artificially lower capital requirements."

"The CIO used five key metrics and limits to gauge and control the risks associated with its trading activities, including the Value-at-Risk (VaR) limit, Credit Spread Widening 01 (CS01) limit, Credit Spread Widening 10% (CSW10%) limit, stress loss limits, and stop loss advisories. During the first three months of 2012, as the CIO traders added billions of dollars in complex credit derivatives to the SCP, the SCP trades breached the limits on all five risk metrics. In fact, from January 1 through April 30, 2012, CIO risk limits and advisories were breached more than 330 times."

"... The SCP's many breaches were routinely reported to JPMorgan Chase and CIO management, risk personnel, and traders. The breaches did not, however, spark an in-depth review of the SCP or require immediate remedial actions to lower risk. Instead, the breaches were largely ignored or ended by raising the relevant risk limit."[6]

MODEL RISK: FUDGING VAR MODELS

"... CIO traders, risk personnel, and quantitative analysts frequently attacked the accuracy of the risk metrics, downplaying the riskiness of credit derivatives and proposing risk measurement and model changes to lower risk results for the SCP. In the case of the CIO VaR, after analysts concluded the existing model was too conservative and overstated risk, an alternative CIO model was hurriedly adopted in late January 2012, while the CIO was in breach of its own and the bankwide VaR limit. The bank did not obtain OCC approval as it should have to use the model for the SCP. The CIO's new model immediately lowered the SCP's VaR by 50%, enabling the CIO not only to end its breach, but to engage in substantially more risky derivatives trading. Months later, the bank

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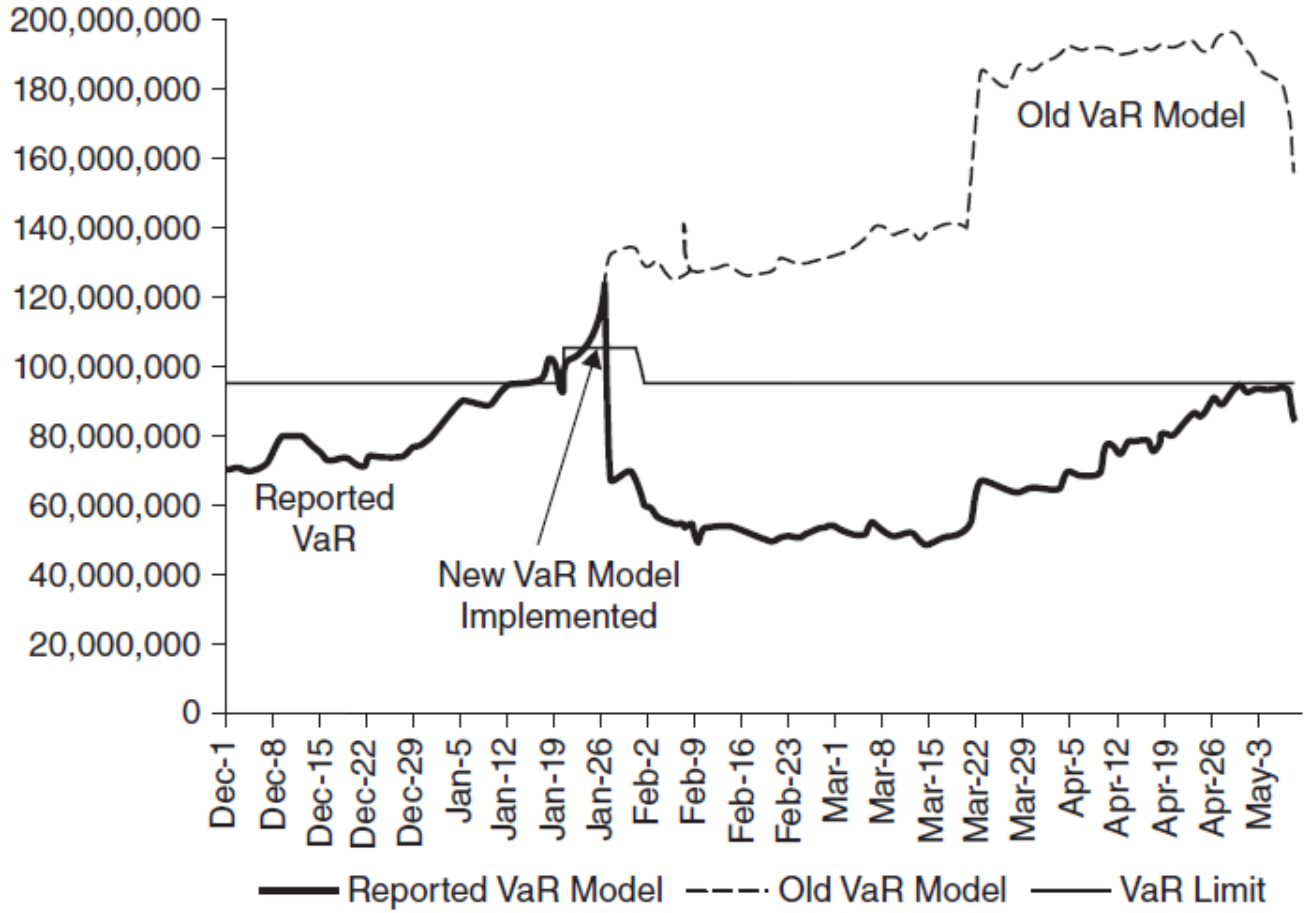
determined that the model was improperly implemented, requiring error-prone manual data entry and incorporating formula and calculation errors. On May 10, the bank backtracked, revoking the new VaR model due to its inaccuracy in portraying risk, and reinstating the prior model."



United States Senate Permanent Subcommittee on Investigations, *JP Morgan Chase Whale Trades: A Case History of Derivatives Risks and Abuses*, Hearing, March 15, 2013, Exhibits.

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