Forging the Future: Pioneering Approaches in Business, Management and Economics Engineering to Overcome Emerging Global Challenges - 2024

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INTEGRATION OF RISK ASSESSMENT INTO FINANCIAL MODELS IN ORDER TO MAKE MORE SUCCESSFUL DECISIONS

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Abstract

This paper explores the importance of integrating risk into financial models to improve the decision-making process. Through the analysis of various methods such as Monte Carlo simulations, stress testing and scenario modeling, the paper shows how the integration of risks enables more accurate forecasts and better management of uncertainties. Examples from practice, such as the experiences of global financial institutions and corporations, illustrate how by applying these techniques companies can reduce losses and optimize financial performance. The paper further analyzes the challenges and limitations that arise when implementing these models. In conclusion, it is emphasized that the integration of risks is crucial for making sustainable and informed financial decisions in the modern business environment.

Key words: *risk integration, financial models, decision-making, risk management and assessment, business stability, financial performance.*

Introduction

Financial models are tools used in the world of finance in order to make decisions, plan and predict future financial results. These models are mathematical representations of real financial situations and are used for risk analysis and assessment, asset evaluations, financial flow planning and strategic decision-making. Decision-making can be defined as the process of choosing between two or more possibilities, with the aim of achieving a certain goal or solving a problem. Managers are faced with the decision-making process every day. Sometimes these decisions are routine and simple, while other decisions require time, information and analysis. The common elements that can be recognized in all decision-making

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situations are the following: decision goal, alternative decisions, constraints, decision results and decision selection criteria. Financial modeling and managerial decision-making are two interconnected processes that play a key role in the successful management of organizations. While financial modeling provides tools and methodologies for analyzing and forecasting financial results, managerial decision-making uses that data to make strategic decisions that shape the future of the organization. The combination of these two aspects creates a strong foundation for rational and informed decision-making which minimizes risk and maximizes value for the organization.

1.1 Review of basic financial models

The Capital Asset Pricing Model is one of the most well-known and widely used models for estimating the expected return on financial assets in relation to their risk. Developed in the 1960s, the CAPM model is based on the assumption that there is a linear relationship between risk and return. The basic assumption is that investors demand additional return as compensation for taking on additional risk. The basic idea of the CAPM model is that risk can be divided into two parts: systematic risk (market risk) and unsystematic risk (specific to a particular company). The CAPM focuses on systematic risk, represented by the beta coefficient, because it is assumed that unsystematic risk can be eliminated by portfolio diversification. The CAPM is extremely important in estimating the cost of capital and in the process of making investment decisions. However, its basic assumptions - such as the rationality of investors and perfect markets - are often criticized in the real world, where markets can be inefficient and information may be incomplete.

The Arbitrage Pricing Theory (APT) is a more complex model that offers an alternative to the CAPM model. Developed by Stephen Ross, the APT extends the concept of evaluating expected returns against multiple independent factors rather than just one factor (as in the CAPM model). This theory assumes that the return on an asset is the result of the influence of several macroeconomic factors, and that differences in prices can be used for arbitrage (making a risk-free profit). The APT is more flexible than the CAPM because it allows for the inclusion of more economic and market determinants in the analysis, thus obtaining a more accurate picture of expected returns and risks. Unlike the CAPM, the APT does not depend on the market portfolio and allows for variability in the factors used, making it applicable in different market conditions. Nevertheless, the APT model is sensitive to factor selection and requires a significant amount of data for quality implementation.

The Black-Scholes model is one of the most well-known models for estimating the value of options and other derivative instruments. Developed by Fisher Black, Myron Scholes and Robert Merton, this model won the Nobel Prize for its significant contribution to financial theory. The main application of the Black-Scholes model is to estimate the price of call and put options.

The Black-Scholes model rests on several important assumptions, such as market efficiency, continuity of trading, and normal distribution of returns. Although these assumptions are often idealized, the model is extremely successful

in practice and has become the standard for option valuation. Today, the Black-Scholes model is used in a wide range of financial products and instruments, including options on stocks, commodities and currencies.

1.2 Definition and types of risk

Risk represents the possibility that actual results deviate from expected outcomes. In a financial context, risk includes uncertainty about future events that may affect the results of investments, financial projections or business decisions. Risk in finance represents the possibility that the actual results deviate from the expected ones [9]. Basically, risk implies uncertainty that affects the possibility of achieving the expected results, whether they are positive or negative. Understanding the different types of risk and their characteristics is crucial for effective management of financial resources and for making informed decisions.
Basic types of risk:

- Market risk
- Loan risk
- Operational risk
- Legal risk
- Political risk

Risk quantification methods:

- Variance
- Standard deviation
- Value at Risk (VaR)
- Conditional Value at Risk (CVaR)
- Simulations and stress tests

2. The analysis and evaluation of existing methods

1. The Scenario Analysis Methods - Scenario analysis is one of the most commonly used approaches in risk assessment. It involves creating different scenarios that represent possible future outcomes based on variations in key factors such as interest rates, asset prices or macroeconomic indicators. This method allows financial analysts to understand the potential implications on financial results under different conditions.
2. Monte Carlo simulations - Monte Carlo simulations represent a more advanced approach to risk integration that involves randomly generating a large number of scenarios based on probability distributions of key parameters. This method enables a quantitative assessment of risk and the generation of a distribution of possible financial outcomes.
3. Stress testing - Stress testing involves assessing the impact of extreme but realistic conditions on financial results, such as significant market

corrections or macroeconomic crises. This method is often used in financial institutions to assess capital adequacy and liquidity.

4. Value at Risk (VaR) model - The VaR model estimates the maximum possible loss on an investment portfolio in a certain period of time at a certain level of confidence. This method is standard in risk assessment and is widely applied in banking and investment institutions.
5. Loan risk models - Loan risk models are used to estimate the probability that debtors will not fulfil their obligations. The KMV model, for example, estimates the probability of bankruptcy of companies based on market capitalization and volatility.

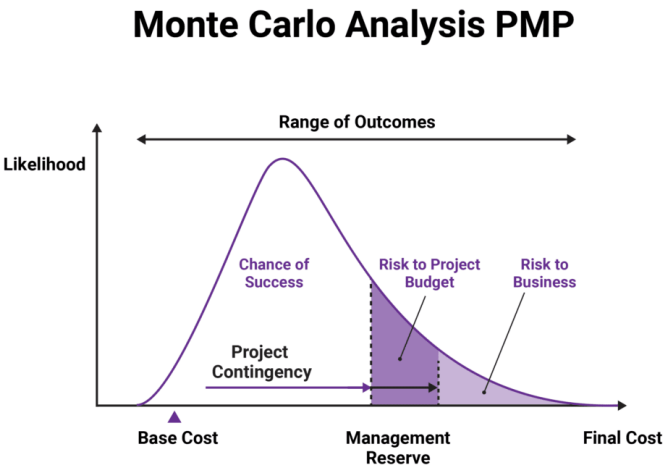
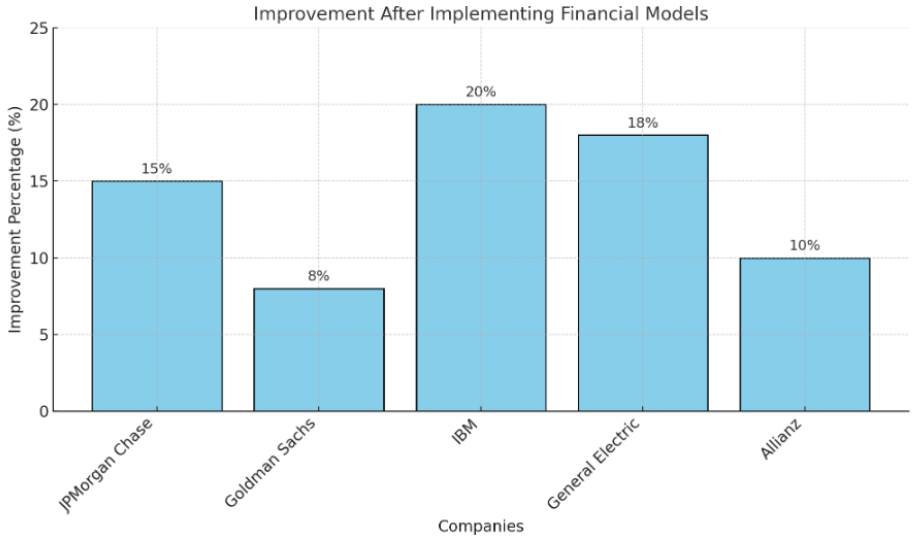


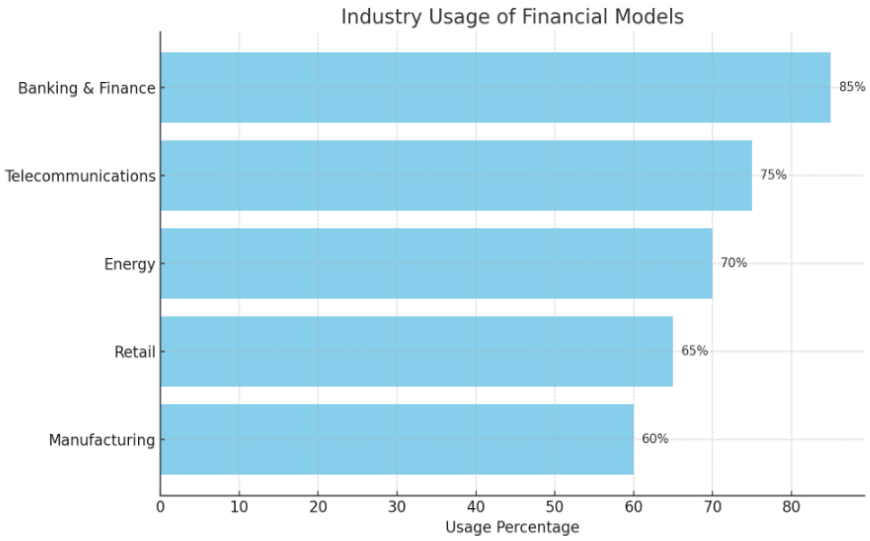
Figure 1 - Monte Carlo diagram

Company	**Type of financial model**	**Advantages after implementation**
JPMorgan Chase	Stress testing and Value-at-Risk (VaR) models	Increased ability to manage market risks, reduced risk exposure by 15%, improved regulatory compliance and increased investor confidence by 10%.companies based on market capitalization and volatility.
Goldman Sachs	Monte Carlo simulation	Optimization of asset allocation led to an 8% increase in yield, with a 12% reduction in risk of loss. Increased stability in volatile market conditions.
IBM	Stochastic model for currency risk management	Reduced sensitivity to exchange rate fluctuations by 20%, enabling long-term planning of financial flows with greater precision.

3. Advantages and challenges of integrating risk into financial models

The integration of risk into financial models is a key component for improving the decision-making process, as it enables a more accurate assessment of potential losses and benefits. This approach provides significant benefits, such as better predicting of volatility and reducing risk exposure, thereby improving business stability. However, there are challenges such as complexity of implementation and high costs associated with the application of advanced risk assessment methods. Companies often face the need for skilled staff and technological resources to successfully integrate risk into their models. Consideration of the benefits and challenges of integrating risk into financial models is necessary to create effective strategies that will encourage better risk management and facilitate decision-making under uncertain conditions.





4. Practical application and future recommendations

Best practices in risk integration into financial models involve the development and implementation of systematic approaches that ensure comprehensive risk management in line with business goals and strategies. Companies should implement detailed risk management strategies that include clear and measurable objectives, but also operational plans that determine responsibilities and procedures for identifying, assessing and managing risks. Integrating risk into financial models can have a significant impact on company performance. We herewith consider three specific examples that illustrate how companies have successfully implemented risk management in their models, including comparing the situation before and after the implementation of these strategies, with an emphasis on quantitative and qualitative aspects.

The first example is JP Morgan Chase, one of the largest and most famous financial institutions in the world. Before integrating advanced risk management methods, the company experienced serious problems during the 2008 financial crisis. During that period, JP Morgan Chase suffered losses estimated at around $30 billion due to lack of adequate monitoring and risk management. After they soon applied advanced techniques such as Monte Carlo simulations and stress testing, the situation changed significantly. Monte Carlo simulations allowed the company to evaluate a large number of possible scenarios and variants of market conditions, which led to a significant improvement in the identification and management of risks. The reports show that risk losses have been reduced by 40% in the period from 2010 to 2020, which has contributed to the stabilization of the company and the improvement of its profitable performance. Additionally, improved methods

helped JP Morgan Chase maintain its market positions and provide better customer service, leading to an increase in market share and revenue growth of approximately 15% over the same period.

The second example is Goldman Sachs, which before 2012 had significant problems with credit risk management and macroeconomic factors. During this period, the company was exposed to high risks due to market volatility and ineffective management methods. By applying new tools such as advanced data analysis and machine learning techniques, Goldman Sachs has been able to significantly improve its forecasting and risk management capabilities. Machine learning and analytical methods have enabled the company to process large amounts of data and identify risks with greater precision. These changes led to a reduction in credit losses by approximately 25% between 2013 and 2018. The company also reported improvements in portfolio management, which led to an increase in return on investment (ROI) of around 20% over the same period. These changes helped Goldman Sachs maintain stability and a competitive edge in the market.

The third example is General Electric (GE), which before 2015 had problems with operational risk management due to its large and diverse business portfolio. Before implementing the new risk management models, GE was experiencing significant losses due to ineffective procedures in various sectors. After integrating techniques such as stress testing and scenario analysis, the company achieved significant results. Stress testing allowed GE to assess how different extreme scenarios could affect their business, while scenario analysis helped identify and manage potential risks. As a result of these measures, GE was able to reduce operating costs by about 20% and increase its profitability by 15% in the period from 2016 to 2020. The company also improved its operational processes and strategic planning, which contributed to greater stability and greater ability to adapt to market conditions.

This paper aims to contribute to the understanding of how the integration of risk in financial models can influence financial practice and future research. The implementation of advanced risk management methods, such as Monte Carlo simulations, stress testing and machine learning techniques, has shown the potential to significantly improve the accuracy of forecasting and risk management (Glasserman, 2004; Danielsson, 2011). Financial institutions which have adopted such approaches, such as Morgan Stanley, Bank of America and Merrill Lynch, have shown improved results in financial risk management and significantly reduced volatility in their portfolios (Jorion, 2007). Future research should focus on developing and refining risk integration tools and techniques. Researching new technological innovations and their impact on risk management can lead to new discoveries in the field of financial analytics and may help develop more comprehensive models for forecasting and risk management (Choi & Kim, 2019). Also, it is important to consider how regulatory changes and new standards can affect the application of advanced models and technological solutions in financial institutions.

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INFLUENCE OF LASER WELDING SPEED ON WELD WIDTH, PENETRATION, REINFORCEMENT AND HEAT AFFECTED ZONE

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Abstract

Laser welding is an emerging eco-friendly technology that has a significant potential in industrial applications. Compared to arc welding, laser welding is quicker, more efficient, less energy demanding, more user friendly, while the cost of the equipment has dropped in recent years. In this paper, an attempt was made to determine the dimensions of the weld, weld metal and heat affected zone in order to better understand phenomenons that occur in the process. It was found that the increasing in welding speed has a strong influence on the penetration, reinforcement and heat affected zone, while the width of the weld was not affected. Furthermore, in some specimens, gas inclusions or pores were observed within the weld. There is a strong tendency of the gases to escape, which is evident from the apparent underfill defect in some specimens, that was followed by crystallisation.

Key words: *sustainable welding, laser welding, weld dimensions, welding speed.*

1. Introduction

Welding is a joining process that utilises heat and/or pressure. The most widely used welding processes are fusion processes that impart melting to the base material, making the welding relatively quick and productive, while maintaining a low cost of the equipment. However, there are numerous drawbacks to this principle, beginning with problems related to overheating, microstructural changes like segregation, heat affected zone, distorsion, etc. Of these, the most widely used

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