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APPLICATIONS OF MATHEMATICS IN FINANCIAL CHALLENGES

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ABSTRACT:

In this paper primarily I focus on the application of mathematics in financial Challenges which arise in financial market. At first it is very essential to prepare a specific framework covering all aspects of applying those techniques to understand mathematical operation research on the financial market. In the beginning, this Paper discusses the attractiveness and application of operation research in the financial market.This paper also presents the frequency and the percentage of the use in financial market of various operational strategies, which analyses the proportion of the service within certain operational principles. The paper also highlights different challenges and how mathematics has applied to solve them: economic understanding, strategic difficulties, financial marketing imperfections.

Keywords: Financial Marketing, Funding Decisions, Economic Understanding, Legal Problems, Different Strategies, Operation Research.

Introduction: In the area of financial, mathematical, engineering and other literature, there are still more papers on applying operations Research (OR) techniques. Often,OR has played a role in the introduction of new theories of finance on the capital markets [6]. Also, investment banks have hired personnel qualified for quantitative methods, like OR, to develop prices equations and analyse market data. It is apart of the uses of mathematical models in financial market. In this paper I discuss how OR strategies are applied in financial markets.This includes trading decisions by decision-makers in financial markets (e.g., the debt,equities and exchange markets etc.) and the latest and increasing field for the use of OR finance techniques. This paper discusses the key types of problems that can be analyzed or examined and records some of the numerous financial market problems that were dealt with using OR techniques[3].

Attractiveness of financial marketing problem: These problems are almost always monetarily expressed to maximize income or minimize risk and related quantifiable variables. In these problems there is a sense of concern to identify the correct issue.The resulting OR model often shows the reality of the situation, especially since the non-quantitative factors are often small.The availability of real-time data is also an advantage and solutions are also easily deployed. As financial applications, particularly financial markets,consist primarily of numerical quantities with particular boundaries and targets with the simple interplay between variables,OR contributes to changing the quality of the least-favoured long-term decisions [1].

Contribution of various principles of Operations Research in financial market: The table shows the frequency of use and the percentage of use for each financial-sector operational technique for all these techniques to be classed and analyzed.

Technique	Frequency of Use	Percentage
Linear Programming	97	20.17
Goal Programming	04	0.83
Integer Programming	00	0.0
Stochastic Programming	45	9.36
Simulation	25	5.20
Queuing	03	0.62
Heuristics	04	0.83
Statistical Analysis	85	17.67
Other Technique	171	35.55

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The application of OR techniques in financial market

The study revealed that statistical analysis and linear programming, the preferred methods used 20 years ago, continue to be one of today's main methods. Linear programming, statistical analysis, other approaches, stochastic programming, simulation are the most commonly used technologies, as seen in the table. Linear Programming is one of the most important techniques used, and even in multiple factors and variables, it contributes to optimization.

Explanation of financial issues and contribution to these areas through Operation Research: The following points illustrate the importance of operational analysis to these financial problems and the use of various methods used to solve them:

Funds raising decisions: OR strategies are also used to help companies determine the best way to collect capital from financial markets to fund different activities undertaken by the company. In 1983, mathematicians including Brick,Melon, Surkis, and Mohl developed a lucky linear programming model in order to calculate debt/equity values that help companies maximize the value of their products [7].

Strategic problems: All traders are seeking at attractive rates and big trades are also divided into a series of smaller trades. The game theory has analyzed these financial decisions. This OR strategy is used to resolve a strategic bond issue by dividing large businesses into smaller business.

Economic understanding: In addition to enhancing the consistency of decision-making in financial market considerations, the OR also helps recognize the economic power in the financial sector. If the limitations or costs of meeting existing constraints are changed endogenously, financial innovation in OR takes place.

Financial Markets Imperfections: The trader wants to find in the stock market imperfections that can be manipulated to make gains simple money. Models of OR networks were frequently used to find opportunities between currency sets. This issue can be defined as a maximum flow network in order to maximize the flow of funds from the network or as the network with the shortest distance. While some network formulations are linear and could be formulated and resolved as linear programming models.

Operation Research techniques applied in financial market:

Portfolio Theory: A quadratic problem of programming used particularly to solve financial issues, was invented by Henry Markowitz. Individuals engaged in financial markets typically want diversified portfolios, as this offers risk reduction benefits without changing the anticipated return rates [6]. The danger is modeled using the variance as returns create a linear target function, which results in an objective function with quadratic variance and covariance terms. .

Applications of quadratic programming in financial market: Although theoretical portfolio use is most common in equity portfolios, many implementations of this principle are available and it is used in financial market in the following way:

Although Konno and Kobashi proposed using portfolio theory to form both equity and bond portfolios, others used quadratic programming to maximize the expected value, to manage interest rate risk, but also used the theory to choose fixed-interest securities that maximize the expected utility of the terminal wealth and many other sectors.

The square programming of pension funds holding all portfolios of assets and liabilities is also applied.

Construct index tracking portfolios that achieve minimum risk in combination with a short position in the tracking index.

Valuation of Assets: Operational analysis has been used to value financial assets because the input variables for an asset that varyfromasset to asset will result in a feasible conclusion and an optimum solution.

Valuation of MBS and CMO's: In this context, the Monte- Carlo procedure can be used to plan future returns and use this to plan their cash flows and incorporate them into the valuation of MSB, which is the real value of MSB. Then, those MSBs can really assess the value and the extent to which an individual should invest in them. CMO bonds or collateral pricing bonds CMO is the apothecary pool Structured into a sequence of bonds with varying maturities and risks.

Valuation of Bonds and Bonds Stripping: After calculating the return curve, we can see the contribution of each interest rate on various maturities that a trader can use to estimate the price of the bond and then choose the most optimal. One does not include the bond value as most m bonds have coupons to calculate their yield curve while using them. This essentially implies that higher preferences will be given if two

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bonds have a similar maturity period. This means that the risk is low, the profit is high, and we are thus more advantageous.

Operations Research provides essential tools to help enterprise risk management in all these four pillars:

i. For pricing: The price of pricing complex track-dependent options depends on the accuracy value and the history of asset prices, Monte Carlo simulation methods are needed. In order to achieve option prices arising from optimum strategies, Theoretical price models of risky assets must be connected with dynamic programming algorithms [2]. In the pricing choices, there are linear programming and linear supplementary problems. The activity research models often appear as alternative formulations with certain computational advantages to other alternatives. In other cases, only formulations are given.

ii. For secularization: Secularization takes place with financial product innovation and financial risk repackaging[9].This can be improved through the application of optimization models.Financial engineers employ optimization models in the competing risk and reward dimension[5].

iii. For management of assets liabilities: Asset and liability management based on the principles of diversification is based on quadratic models of optimization. A new wave of multi-period portfolio optimization models has led to significant developments since the ground breaking contribution of Markowitz in the 50s --derivative securities that contravene assumptions on normal returns, a long horizon of complex liability arrangements, an increasing transaction cost for derivative securities.

iv. For indexation: Finally, the indexing and compression of portfolios rely on combining pricing and simulation models with optimization models. The response of the market is replicated by the simulated risk factors of the index and optimization models build portfolios that respond to risk factors.The optimized portfolio would closely follow the index when the risk factors are defined and correctly simulated.

Conclusions: Use of OR methodology in financial marketing is a mathematical programming. Quadratic, nonlinear, integer, goals, stochastic, and dynamics are used for most forms of programming. Mathematical programming has been used to resolve a wide variety of financial market challenges, including the development of equity portfolios, bonds, loans and currencies, general hedge, immunization, equity and bond index tracks, estimation of implied risk neutral option probabilities, design of a coupon schedule for municipal bills and the identification of bonds at low prices. Monte Carlo simulation is also widely used in financial markets-mainly to value exotic options and securities with embedded options, and Simulation has also helped test trading rules and examine the risks of a position in securities.The game theory has been used in fighting corporate controls, decision-making bodies analyzing choices on mortgages ,inventory models for size and timing of corporate bond issues and business performance research by the Markov chains. Portfolio problems and pricing of complex financial instruments are the key fields of financial markets where OR strategies are applied. This paper shows that OR techniques play an important role in finance and marketing and this role will increase as data is dramatically enhanced in real time and in machine speed recently. This will give OR techniques the chance to play an even bigger role in financial market.

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