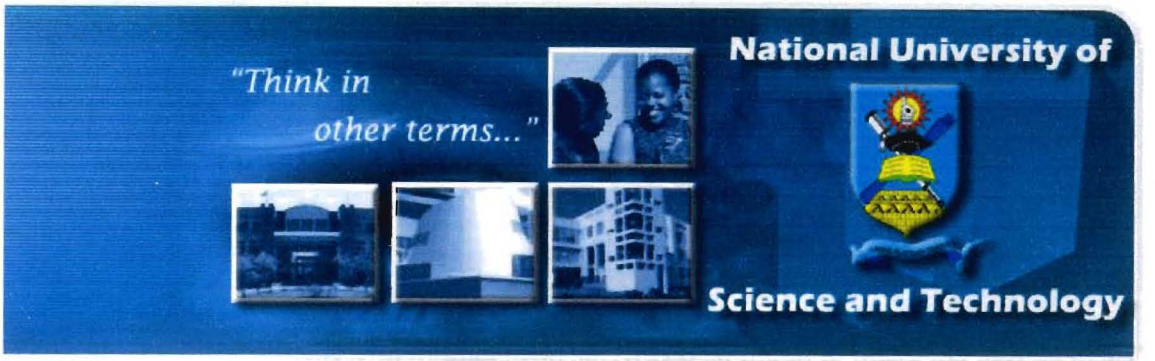

FACULTY OF COMMERCE

DEPARTMENT OF FINANCE

RESEARCH PROJECT ON

ALGORITHMIC TRADING MODELS AND THE ARBITRAGE-BASED FORMULATION OF OPTIMAL DYNAMIC PORTFOLIO LIQUIDATION STRATEGIES: A STOCHASTIC OPTIMIZATION MODEL FOR OPTIMAL CONTROL OF EXECUTION COSTS WITH ALPHA VALUE CONSTRAINTS.

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ABSTRACT

An analysis of the applicability of Algorithmic Trading Models and the study of price formation on the Zimbabwe Stock Exchange was made which was necessitated by the recognition that equity trading costs, especially market impact were a drag on investments portfolio performance. This dissertation developed trading strategies for liquidation of a single asset portfolio, modelling investors' behaviour as resembling that of arbitrageurs. The optimization problem to optimally control execution costs was formulated as a stochastic linear programming problem, which utilized the Monte Carlo scenario representation of possible returns. Two cases, both utilizing the case study of three of the highly traded counters on the Zimbabwe Stock Exchange (Delta, Econet and Old Mutual), were considered; a case based on the hyperinflationary environment and case based on the dollarisation environment. In the first case, in which Monte Carlo simulations were drawn on a GARCH (1,1) process to realistically capture the heteroscedastic and clustering nature of volatility during the 2007-2008 period, it was found out that parallel exchange order flows affected stock returns and specific stock characteristics such as fungibility status had significant implications on the design of trading algorithms and hence the optimization solution premised on parallel exchange rate-determined alpha values was found to be optimal. In the second case, Algorithmic Trading Models were still found to be better tools for controlling trading costs on the Zimbabwe Stock Exchange, especially if higher alpha values, far above those recommended by standard asset pricing models like CAPM, were chosen, reflecting the relevance of including liquidity risk premium in asset pricing models as is suggested by market microstructure theory, especially in a highly illiquid equity market like ZSE. The algorithms for both cases, which were solved, using LINGO optimization software, provided path-dependent strategies which sold some fractions of security depending upon price sample-path of security up to the current moment. The performance of the considered approaches was tested using a set of historical sample paths of prices and was found out to approximate historical stock returns with a high level of accuracy and were also shown to outperform simple traditional trading strategies. Algorithmic Trading Models were recommended to portfolio managers and stockbrokers to effectively control portfolio execution costs and also the research finding that investors exhibit an arbitrageur's behaviour in making portfolio liquidation strategies was found to be a major input in crafting policies by the Reserve Bank of Zimbabwe and Zimbabwe Stock Exchange. The case for multi-asset portfolios, multi-risk factor models such as those modelling both stock returns and trade volumes and the use of jump diffusion models in Algorithmic Trading Models to capture the discontinuity mostly experienced by ZSE stock prices were suggested for further study.

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