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THE CAPITAL ASSET PRICING MODEL AND ARBITRAGE PRICING THEORY ON THE JOHANNESBURG STOCK EXCHANGE

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ABSTRACT

This paper investigates the two most well known asset pricing theories within the context of the Johannesburg Stock Exchange (JSE). The theoretical and empirical underpinnings of both the capital asset pricing model (CAPM) and the arbitrage pricing theory (APT) are reviewed. Various empirical studies are contained within the body of the paper.

The layout of the paper follows both a logical and historical development. Before any study of capital markets can proceed, it is necessary to determine whether that market is efficient or not. After a literature review this paper proceeds on the assumption that the JSE is sufficiently efficient for the ourposes of the study.

Chapter three of the paper contains both a literature review on the CAPM and empirical work. In this chapter, it is shown that the stable Paretian distribution hypothesis is not a valid descriptor of share return distributions, this allows us to proceed with the use of standard statistical methods in later studies. Later in the chapter it is shown that the number of stocks within a diversified portfolio should exceed the amount normally advocated in the literature. Finally, it shown, using the traditional tests that the standard CAPM is not well specified for the JSE.

Chapter four contains a review of the anomalies within the CAPM and some of the attacks that have been made on that theory. Here it is shown that the CAPM is not well specified on the JSE by making use of a multivariate test. As regards market anomalies, it is shown that the "Monday effect" is absent from the JSE. It was previously thought that this anomaly was present in the pattern of returns. We are able to confirm that there is no "turn of the year effect".

Chapter five contains a literature review of the APT. Chapter six contains both

endogenous and exogenous tests of the APT using JSE data. The results indicate that there is at least more than one priced factor, but we are unable to specify the exact number. None of the priced factors that have been found on the New York Stock Exchange appear to be priced on the JSE. The dollar price of gold does appear to have some significance in explaining returns.

In conclusion we argue that while the CAPM is flawed, it takes a theory to beat a theory and at present the APT is unable to do so. While the APT might be theoretically superior, at present we have failed to operationalise it.

DECLARATION

I declare that this research report is my own, unaided work. It is being submitted in fulfilment of the requirements for the degree of Master of Commerce at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

_____

Sinclair Richard Davidson

This sixteenth day of November, 1993.

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There are several people who have contributed in various ways to the production of this thesis and whom I must thank.

- My wife Ilana, who has given me emotional support and encouragement these past three and a half years.
- My usual co-author Steve, who has taken a keen interest in this paper and contributed to my knowledge of statistics. Steve also wrote several computer programmes that made data processing so much less tiresome. In return for his input Steve is the co-author on those papers (see preface).
- My friends who have encouraged me throughout the production of this paper.

PREFACE

In choosing a topic for a masters dissertation, I was confronted by the following choice: A topic in capital structure and agency theory - something I am very interested in, or a topic in a subject where I was ignorant and had little interest. Ignorance prevailed. I must offer (dubious) thanks to my supervisor, Dan Leach for my choosing the latter option.

A great deal of pain and suffering went into this paper, especially so when Mike Page demonstrated that the methodology that I hoped to use was fatally flawed. All was not lost, he saved me from delusions of transforming this paper into a Ph.D. In addition, some other good has come from this paper. A number of academic articles have been published, in addition to conference papers being delivered. I am no longer ignorant of portfolio theory and have acquired some statistical knowledge.

The broad conclusions of the paper are not overly satisfying. I was able to demonstrate that the capital asset pricing model (CAPM) was not well specified for the Johannesburg Stock Exchange. This finding is directly contradictory to the findings of David Bradfield, whose research of the CAPM is extensive. Two potential reasons exist for this: Firstly the statistical tools that I have employed may be too crude to find the CAPM (David's explanation) and secondly I have made no corrections for the thin trading problem which exists on the exchange.

As far as the arbitrage pricing theory (APT) is concerned, I was able to show that there is at least more than one factor, but was unable to specify how many there are. Not that I had expected to be able to do this (following Mike's findings). In addition a replication of the standard Chen, Roll and Ross (1986) methodology did not reveal any of the New York factors to be priced in South Africa. It seems that the "derived factors" approach is the only source of further research.

Some of the material contained in this thesis has been accepted for publication in academic journals. Two of these papers have been co-authored with Steven Meyer, who performed a great deal of the computational work.

(with S Meyer) "The Monday Effect and the Johannesburg Stock Exchange: Revisited." *The South African Journal of Business Management* September 1993 24(3): 83-87.

(with S Meyer) "Diversification and Second Order Risk." *Studies in Economics and Econometrics* November 1993 17(3): 41-51.

Some of the material contained in this thesis has been accepted for presentation at an academic conference.

"Some Suggestions on Teaching the Efficient Markets Hypothesis." Delivered at the *First Annual Conference of the Association of Southern African Finance Academics*. Held at the University of the Witwatersrand, Johannesburg. 6 and 7 February 1992.

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CHAPTER ONE

INTRODUCTION

The purpose of this study is to test the applicability of the Capital Asset Pricing Theory (CAPM) and the Arbitrage Pricing Theory (APT) to the South African market, viz. The Johannesburg Stock Exchange (JSE). While the CAPM and APT are similar in many respects, they are markedly different in their approach to risk. Indeed, it can be said that the two theories are mutually exclusive. If the CAPM is valid, there is no need to incur the expense of developing the APT. If the CAPM is not valid it needs to be replaced by a theory that is valid.

The importance of this line of enquiry is highlighted by the fact that money managers (may) rely on these techniques in order to allocate money to various projects and investments. If one or both of these models is inappropriate then it seems that inefficient resource allocation can occur. The topic is of interest for other reasons. In the recent past, the CAPM has come under attack from one of its early adherents (Eugene Fama), yet researchers have claimed that it is well specified for the JSE. This is an empirical question. Either it is well specified, or it is not.

If the CAPM is not a valid description of the share return generating process, then we need to examine other theories that could explain this process. The APT seems to be the most likely candidate in this respect. Unfortunately, the model is expensive to develop as the theory is vague on the number and identity of the relevant "factors" that drive the market.

1.1 CHAPTER SUMMARY

In order to achieve this aim, both theoretical and empirical research will be undertaken.

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