CHAPTER 1

INTRODUCTION AND BACKGROUND

1.1   INTRODUCTION

The stock market plays two crucial roles in the economy. The first role is to channel savings into investment. Put differently, it is the market where new capital is raised for production purposes when new securities are issued. At the same time it also forms the market where capital resources are allocated between different investment opportunities. The second role of the stock market is to provide a market for securities where it can be freely traded in a regulated system – a crucial function in any capitalist economy. In other words, it provides investment liquidity as well as an evaluation of the firms of which securities are traded (Fourie, Falkena and Kok 1999:189). Since the stock market plays such an important role in the economy, it is crucial to understand the functioning of the stock market as well as the interrelationships between the stock market and macroeconomic indicators. In this study, a structural econometric model of the South African stock market will be developed in order to empirically estimate the relationships between the stock market and macroeconomic variables.

This model will have four main purposes, namely to quantify the relationships between the South African stock market and macroeconomic variables, to analyze the relationships between the South African stock market and foreign stock market, to forecast the South African stock market and, since the stock market is a leading indicator, to use this stock market forecast to forecast the direction of the economy. First, since stock prices reflect the expectations of investors on future dividends and hence the performance of the aggregate economy, the stock market is influenced by the economy and is fundamentally driven by economic factors. In order to identify the economic variables that influence the stock market and to quantify these impacts, an econometric model has to be developed that can empirically estimate and evaluate these relationships. This will improve the general understanding of all economic agents of the stock market as well as the relationships between the stock market and

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macroeconomic variables. In addition, it will be useful to investors for designing trading rules based on structural relationships which should improve profits in the long-run.

Second, it is widely accepted that there is a strong relationship between the stock market and the aggregate economy, which means that a forecast of the stock market can also be used to give an indication of the direction of the aggregate economy. This mainly stems from the fact that any particular stock price reflects investor expectations on the future performance of the firm, which is in turn substantially affected by the overall performance of the economy. However, this relationship is not contemporaneous, but rather stock markets lead the real economy. Since stock prices reflect expectations of future earnings and dividends, investors attempt to forecast current stock prices based on future and not current earnings and economy activity. When they invest in the stock market based on these expectations, the relationship between the stock market and the macroeconomy becomes self-fulfilling. Although the primary objective of the stock market model developed in this study is structural analysis rather than forecasting, any success in forecasting the stock market can therefore also give an indication of the direction of the aggregate economy.

A third use of a stock market model is to evaluate the relationships between the South African stock market and foreign markets. The so-called "contagion" effect between international stock markets has received considerable attention in recent literature, especially since the emerging market crises. However, if the stock market is found to be driven in the long run by fundamental domestic factors, then contagion influences only short-run fluctuations and not the long-run level or intrinsic value of the stock market. This issue is very important since it has crucial implications for the role of stock markets in the broader economic development process. Stock markets can support the process of economic development by increasing the growth in savings, and improving the efficient allocation and utilization of investment resources (Leigh 1997)[1]. However, stock markets can only fulfill these roles if they are being driven by economic fundamentals, so that their pricing and allocation of capital within the

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[1] According to the IMF (2003:70), local securities markets can also be a "more stable source of local currency funding… thereby mitigating the funding difficulties created by sudden stops in cross-border capital flows" as well as a "vehicle for improving the efficiency and stability of financial intermediation".

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economy properly reflect risk and expected returns. If stock markets are not economically efficient in the broad sense of allocating financial capital efficiently to competing uses, they are unlikely to make a positive contribution to economic development, but would more closely resemble gambles (Jefferis and Okeahalam 2000). The only way in which these relationships can be evaluated is by estimating an empirical model that can distinguish between the long-run and determinants short-run dynamics of the stock market.

Finally, the model can be used to forecast the stock market. Forecasts of the level of the stock market also imply forecasts of the direction of the stock market, which can be used by investors as trading rules. So although the model is not developed as a trading tool, it can be used as one.

Stock market movements are difficult to understand and forecasting it is even more difficult. This creates a need for empirical structural analysis, which can assist in understanding the functioning of the stock market and potentially assist in forecasting the stock market. Most studies on stock markets are done for developed countries. This study attempts to address the gap in the literature on analyzing emerging stock markets and in particular the lack of studies on the South African stock market.

1.2   OBJECTIVES AND RESEARCH METHODOLOGY

The primary objective of this study is to develop and estimate a structural econometric model of the South African stock market, the Johannesburg Stock Exchange (JSE). The model will primarily be used for structural analysis, but its forecasting ability will also be evaluated. The model will expose the macroeconomic variables that influence the stock market as well as the magnitudes of these impacts. In addition, the role of phenomena such as globalization, policy shifts and contagion will be evaluated.

There are two alternative approaches that can be followed in modeling stock markets, namely technical analysis and fundamental analysis. Technical analysis builds on the belief that stock prices move in trends that persist. It believes that the patterns in

financial markets repeat themselves and therefore their stock market models and analyses are aimed at capturing historical patterns which they then use to forecast the stock market. Technical analysts believe that when new information comes to the market, it is not immediately available to everybody but rather disseminated from professional investors to the aggressively investing public and then to the great bulk of investors. Therefore it is possible to outperform a buy-and-hold strategy with a trading rule based on historical price data.

This is in direct contrast to even the weak form of the efficient market hypothesis, according to which security prices adjust rapidly to reflect all new information (Reilly 1989:244). This means that if capital markets are efficient, prices fully reflect all the relevant information, so that trading based only upon past data cannot be profitable since by the time information is publicly available it is already reflected by the share prices. It has been shown in the literature that the South African stock market is operationally efficient (Thompson and Ward 1995), which means that share prices cannot be predicted on the basis of historical share prices alone and hence technical analysis is not the relevant approach to model the South African stock market.

In contrast with technical analysis, fundamental analysis focuses on determining the fundamental factors that drive the stock market and base any modeling on the structural and theoretically justifiable relationships between the stock market and economic variables. However, while economic theory should be able to explain the long-run trend of the stock market, the short-run movements are potentially driven not only by the variables dictated by theory but also by variables reflecting market sentiment as well as other factors such as political instability, emerging market crises, exchange rates etcetera (Jefferis and Okeahalam 2000). The influence of these short-run determinants can only be determined empirically (Harasty and Roulet 2000). The long-run behavior of stock prices are usually modeled based on the expected present value model and then the short-run fluctuations of the market around this long-run trend are determined empirically.

The technique of cointegration makes it possible to distinguish between the long-run equilibrium level or intrinsic value of the stock market and the short-run fluctuations around the equilibrium level by estimating both a cointegration equation and an error

correction model (ECM). In the long-run or cointegration equation, the intrinsic value or long-run level of the stock market is modeled based on the relationship between the stock market and economic variables dictated by theory. According to theory, stock prices are a function of future dividends discounted by a discount rate. In the error-correction model, fluctuations around the long-run and the speed of adjustment to a new equilibrium is modeled. In the short-run, not only the economic variables dictated by theory but also variables reflecting market sentiment and important socio-political changes and other non-fundamental factors play a role. However, none of these relationships necessarily have to be symmetric. This study will describe the potential causes of asymmetry and then empirically test whether stock market behavior is asymmetric.

1.3   CONTRIBUTIONS OF THIS STUDY

This study makes two important contributions to the literature. First, it develops and estimates a structural model of the South African stock market. There is a wealth of literature modeling stock markets and examining the relationship between share prices and various economic factors, both theoretically and empirically. However, most studies use data for developed countries in their analyses and very little literature exists for the South African stock market. The most important studies analyzing the structural determinants of the JSE are those of Van Rensburg (1995, 1998, 1999), Jefferis and Okeahalam (2000) and Bar and Kantor (2002). Van Rensburg studied bivariate relationships between the JSE and economic variables and Bar and Kantor developed an econometric model of South African economy focusing on the linkages between the real and financial markets and between domestic and foreign financial markets. Jefferis and Okeahalam estimated an atheoretical stock market model. However, no theoretical, structural econometric model of South African stock market has been estimated yet. The main contribution of this study to the literature is the development of a structural model of South African stock market will be estimated econometrically using cointegration techniques and error correction modeling.

The second contribution of this study is to incorporate the potential asymmetric effects introduced by the risk and loss aversion of investors. Risk aversion refers to

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the tendency of rational investors to prefer certainty to risk *ceteris paribus* (Reilly 1989:10,255; Renwick 1971:400). Loss aversion, on the other hand, refers to the inclination of economic agents to be more sensitive to reductions in their levels of well-being than to increases (Bernartzi and Thaler 1995). Two explanations have been given in the literature on why investors' risk and/or loss aversion induces stock market asymmetry. First, Chalkley and Lee (1998) argues that risk aversion encourages economic agents to react promptly on receiving bad news, while it prevents them from acting quickly when receiving good news. A downturn in the relevant economic data (which influences the particular stock price) may be indicative of other economic agents receiving bad news (or expectations) or it might be a random change, but in either case the cautious (i.e. risk averse) response is to act immediately as if the bad data is truly reflecting adverse conditions. In this case (adverse economic data) or "bad" news, risk aversion and uncertainty about the information value of aggregate data work together, leading informed agents to quickly respond to the downturn in economic data and other agents to quickly respond to that response. Of course, there is also uncertainty about the interpretation of an upturn in economic data, but in this case risk (and loss) aversion works against reacting to such a signal since investors will wait until the "good" news is confirmed before they act on it.

It can therefore be expected that investors will react more reluctantly to an upturn in economic data and vice versa. When the behavior of these individual investors are aggregated it implies that the stock market will react quicker during good conditions or on good news or expectations, or put differently, that its adjustment to equilibrium will be slower during adverse economic conditions and faster during positive economic conditions. The "upturn" and "downturn" of data in the Chalkley and Lee (1998) framework originally referred to good or bad conditions as reflected in the state of the business cycle. Since stock prices are discounted future dividends and since real economic activity is one of the main determinants of dividends, an economic upswing (downswing) will cause higher (lower) dividends and an indicator of the state of the business cycle can therefore be used to measure the upturn or downturn in economic data.

The second explanation for asymmetric investor (and hence stock market) behavior is driven by the potential loss (profit) in and overvalued (undervalued) stock market. Following the same line of reasoning as Chalkley and Lee (1998), Phelps and Zoega (2001) and Siklos (2002) also hypothesized different speeds of adjustment but they introduced a different driving force for the asymmetry by redefining the good and bad news or conditions that prompts the asymmetric behavior of investors. Their theory on stock market asymmetry is based on the paradigm of the structural slump developed by Phelps (1967). A structural slump is characterized by a steep decline in share prices followed by a gradual rise in unemployment. A structural boom, on the other hand, entails a steep rise in share prices followed by a decline in unemployment. In the case of a structural boom, investors calculate that this signals a jump in future asset returns and, consequently, the valuation of these assets as reflected in the stock market. The resulting rise in the profitability of investment signals a falling unemployment rate. The boom ends when the productivity rise increases investment costs.

Theoretically, this scenario works symmetrically, but Phelps and Zoega (2001) argued that it might in practice work asymmetrically since other factors may influence the progress of the business cycle. The potential asymmetry was first evaluated empirically by Siklos (2002). His results showed that the relationships between the economy and the stock markets of the UK and the US were indeed asymmetric.

Although Siklos (2002) tested the stock market asymmetry based on the relationship between the stock market and unemployment, the asymmetry also holds for any other stock market model. If the stock market is undervalued it means that the market prices of shares are below their intrinsic value, so that a profit opportunity created since investors can buy shares at the low current market price and eventually resell it at a higher price once the market has corrected the discrepancy between the market and intrinsic value. In contrast, when the stock market is overvalued market prices of shares are above the intrinsic values. Eventually the market will correct this discrepancy so that share prices fall, in which case investors will loose money. Since investors are loss averse it is more important to avoid the potential loss if the market is overvalued than to make the profit if the market is undervalued. Therefore, if

investors are uncertain, they will react faster to an overvaluation that poses a potential loss than to an undervaluation that poses a potential profit.

The techniques of cointegration and error correction modeling are ideally suited for modeling different speeds of reaction of investors. In the error correction model, the adjustment to equilibrium is modeled and the speed of adjustment is estimated. Usually the coefficient measuring the speed of adjustment is assumed to be constant, but the model can easily be adapted to capture different speeds of adjustment in different circumstances. Econometrically, the two potential causes of asymmetric investor (and stock market) behavior have to be modeled differently. Siklos and Enders (2001) developed a threshold cointegration technique with which different speeds of adjustment can be modeled for overvalued and undervalued series. This test can be applied directly to under- or overvaluation of the stock market. However, this test is not applicable when the asymmetry is caused by different states of the business cycle and this type of asymmetry therefore has to be evaluated differently. In the case of asymmetry with respect to the state of the business cycle, a variable is needed that reflects the different states of the business cycle. In this study, the state variable will be constructed using a Markov switching regime model of the South African business cycle. The Markov switching regime model can be used to simultaneously estimate the probability of the economy being in an expansion or recession and the expected economic growth rate.

The estimation of the Markov switching regime model is in itself a significant contribution to the literature since no Markov switching regime model has been estimated for the South African business cycle yet. Apart from its use in the stock market model to capture the potential asymmetry, the Markov model can be used for two additional purposes. First, it estimates the data generating process (DGP) of the variable under consideration, which is real economic growth in this study. Second, it estimates a probability of the economy or business cycle being in either of two possible states, for example being in a recession or an expansion, for each period. Since this time series of probabilities reflects the likelihood of a recession or expansion, it can therefore be used to classify each observation into one of two regimes. For example, the economy is regarded as being in a low-growth (high-growth) or recession (expansion) regime or state if the probability of being in

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recession (expansion) is higher than the probability of being in an expansion (recession). In addition, the probabilities may be used to reflect the degree of certainty of economic agents regarding the state of the business cycle, if it is assumed that a recession probability of one (zero) indicates that the economic agent is absolutely certain that the economy will (not) be in a recession, while a probability of 0.5 indicates that a recession or expansion is equally likely and therefore there are no certainty regarding the state of the business cycle. In other words, the closer the recession probability is to zero or one, the higher the certainty regarding the state of the business cycle. On the other hand, the close the recession probability is to 0.5, the higher the uncertainty regarding the state of the business cycle.

The estimated Markov-switching regime business cycle model can therefore be used not only to forecast economic growth, one of the most important macroeconomic indicators, but also to forecast the occurrence of recessions and expansions. The only indicator currently available to reflect recessions and expansions is that of the South African Reserve Bank, but their indicator is only available with a considerable time lag. It is therefore not useful for forecasting purposes at all. The Markov-switching regime indicator can fill this gap and will consequently be extremely useful for policy-makers, investors and producers that want to plan their economic decisions or actions.

To summarize, in this study a structural model of South African stock market incorporating both the fundamental factors driving stock prices as well as the influence of the risk aversion of investors are estimated. Cointegration techniques will be used to distinguish between the long-run behavior and short-run fluctuations of the stock market, allowing for the possibility that fundamental factors might drive the long-run behavior but that additional factors comes into play in the short-run. Two potential causes of asymmetric investor (and hence stock market) behavior will be evaluated. First, the Siklos and Enders (2001) threshold cointegration test will be used to evaluate asymmetric adjustment in under- and overvalued stock markets. Second, asymmetry with respect to the state of the economy will be evaluated, which necessitates the construction of a state variable. A Markov switching regime model will be developed to estimate the probability of the state of the economy, reflecting

both the expected direction of the business cycle as well as the certainty regarding this expectation.

1.4   OUTLINE OF THE STUDY

In the next chapter the characteristics of the Johannesburg Stock Exchange (JSE) as well as the unique socio-economic and political environment in which it functions are described. These factors have an important influence on the course and behavior of the stock market and are therefore crucial for the empirical analysis. A brief description of the JSE will be presented as well as an overview of three aspects of the South African economy that have an important impact on the JSE, namely the socio-political environment, the policy setting and the influence of globalization and the revolution in international financial markets.

Chapter three gives a detailed exposition of two theoretical models, the efficient market hypothesis and the expected present value model, which dominate the literature on stock market modeling. According to the efficient market hypothesis, capital markets are efficient in the sense that stock prices adjust rapidly and unbiasedly to reflect new and relevant price sensitive information. This has important implications for the empirical analysis, since trading based solely on historical prices, technical analysis cannot yield abnormal profits if the stock market is efficient and hence necessitates a structural model of the stock market.

According to the expected present value model, the price of a security equals the present value of the expected future income stream. This has been simplified by Gordon and Shapiro (1956) to the constant growth model according to which stock prices are a positive function of expected dividends and a negative function of the discount rate. However, recent studies have argued that these relationships and stock market behavior in general are not necessarily symmetric. Chalkley and Lee (1998) hypothesize that the stock market may be asymmetric conditional on the state of the business cycle, while Siklos (2002) hypothesize that the stock market asymmetry may be conditional on the over- or under-valuation of the stock market. Both types of asymmetry will be evaluated in the empirical analysis. The evaluation of business

cycle asymmetry requires an indicator of the state of the business cycle, which is constructed with a Markov switching regime model in chapter five.

In chapter four an exposition of the empirical studies that modeled international and South African stock markets is given. This will expose the empirical validity and the practical implications of the theories reviewed in chapter three.

In chapter five a state of the business cycle indicator is constructed to evaluate the potential asymmetry of the stock market conditional on the business cycle. This indicator should ideally reflect not only whether the economy is in a recession or an expansion, but also the degree of certainty with which investors can regard the economy as being in a recession or expansion. Such an indicator is developed by estimating a Markov switching regime model for the South African business cycle.

In chapter six a structural model for the South African stock market will be developed and estimated based on the theory presented in chapter three. Using cointegration techniques and error-correction modelling, the long run and short-run behaviour or the stock market will be modelled separately. Nonlinear cointegration tests and the state of the business cycle indicator developed in chapter five will be used to allow and test for the potential asymmetry described in chapter three.

The cointegration model of the South African stock market that will be developed and estimated in chapter six will make a contribution to the literature by establishing the factors that determine the level of the stock market in both the long-run and the short run. However, this model can also be used to forecast the stock market. This will enable investors to simulate the impact of change in macroeconomic indicators on the future course of the stock market and accurate forecasts of the stock market could be used by economists to forecast other macroeconomic indicators that lag the stock market such as consumption and investment[2]. In addition, forecasts of the stock

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[2] Gallinger (1994) gives three reasons why share prices are leading consumption and investment. First, changes in share prices are synonymous with changes in wealth, which influence the future demand for investment goods and consumption (Barro 1990). Second, the stock market is a leading indicator of the economy and reflects information about real activity before it occurs. Finally, an increase in real economic activity increases the demand on existing production capacity, which increases the return on assets and therefore induces increases in future capital investment.

market will predict the future direction of share prices and can hence be used by investors to construct trading rules that can increase profits.

In chapter seven the accuracy of the cointegration model will be compared to other stock market models. This comparison will be done separately for the in-sample and forecast periods. First the models' accuracy in modeling the level of the stock market will be compared. Then the models will be used to develop trading rules in order to compare its profitability and accuracy in modeling the direction of the stock market. Chapter eight provides a summary of the study and indicates some potential extensions for future research.