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International Stock Market Linkages: The case of Zimbabwe and South Africa

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Thesis submitted in fulfilment of the requirements for the degree of

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DECLARATION

I, Rusununguko Conwell Manungo declare that the research work reported in this dissertation is my own, except where otherwise indicated and acknowledged. It is submitted for the degree of Master of Management in Finance and Investment at the University of the Witwatersrand, Johannesburg. This thesis has not, either in whole or in part, been submitted for a degree or diploma to any other universities.

Signature of candidate: Date:

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ABSTRACT

The aim of this paper is twofold. First, it aims to investigate whether or not there are both short run and long run bilateral linkages between the Zimbabwe Stock Exchange (ZSE) and the Johannesburg Stock Exchange (JSE) markets. Secondly, it aims to find out whether or not the extent of linkages between the two markets has been changing over time.

The results of the study can be stated simply: - correlation coefficients calculated for the two sub-periods 1980(1)–1990(12) (apartheid in South Africa and independence in Zimbabwe, but still some controls on the economy) and 1991(1)–1999(12) (death of apartheid in South Africa and financial liberalization in Zimbabwe) show that they were not constant overtime. The extent of the linkage has been increasing overtime.

Bivariate co-integration tests indicate that there is a common trend linking the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange stock price indices in the period 1991–1999, but none was found for the period 1980-1990. The results suggest that the interrelations between the two markets have increased overtime. They are in line with macroeconomic trends that have taken place since 1991, which were sufficient to strengthen the linkages between the markets, including capital market liberalization, securitization of national markets and a significant increase in cross - listing of stocks of multinational and national companies.

This paper thus provides new empirical evidence on international stock market linkages between the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange.

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CHAPTER 1

1.0 INTRODUCTION

Policy makers and academics have debated the role of the stock market integration in the financial world. This was necessitated by the increase in capital flow across national boundaries, potential benefits from investment diversification at international level and a nearly worldwide collapse of equity markets in 1987 (Jefferies et.al, 1997). Marashdeh and Shrestha (2010) argue that the integrated stock markets provide risk sharing opportunities. In addition, having integrated stock markets as a result enhances competition and therefore contributes to the overall financial stability. This is achieved through the reduction of capital costs and volatile prices in integrated markets (Tai, 2007). Levine (2001) points out that this will also promote both investment and domestic savings, ultimately having an effect on economic growth. Some opponents however, are not in support of the integration. Furthermore, they argue that the issue of contagion risk being evidenced by the global financial crisis of 2007 and the Asian crisis in 1997.

Prospectively, stock market prices show a positive trend. By this it can be deduced that advantages of diversifying will not show therefore, and investors may not benefit from international portfolio diversification. The development of the economies' stock markets is becoming integrated due to globalization and liberalization of financial markets and the relaxation of controls on international capital movement. With the advent of e-commerce, it has become increasingly easy for investors to buy and sell securities.

Risks, complexity and costs that are associated with cross border trading have resulted in the Global Straight Processing Association (GSTPA) being established. This has due to its establishment, assisted in the processing of cross - border transactions and efficient flow of information to all cross - border trading parties. The execution of cross border trade is facilitated by the transaction manager who provides a standard method of communication of its execution and this could serve as a way of storing data for global transactions. This system helped to minimize the number of trade losses and at the same time improve the inter-connectivity of traders involved in the processing of securities.

International financial transactions were improved by these technological advances as well as reducing cost associated with security processing which lead to T+1 trading (where T is the day on which the transactions were done:- so T+1 means that the transaction will be processed in one day).

Allen, Otchere and Senbet (2010) state that, as a result of less development and illiquidity in the market, research in African stock markets has not been effectively conducted. However, technological advancements, financial markets liberalization and globalization have resulted in some studies being conducted that relate to the stock markets in Africa.

1.1 OVERVIEW OF NATIONAL STOCK MARKETS IN THE SOUTHERN AFRICA REGION

The two stock markets with particular reference to the study in the southern region of Africa will be discussed. They are the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange, which will be discussed below.

1.1.1 ZIMBABWE STOCK MARKET IN PERSPECTIVE

Zimbabwe's first stock exchange opened in Bulawayo, in 1896. To fund gold mining ventures, the exchange was a necessity and it was closed after the South African Anglo-Boer War of 1899-1902. In Mutare, another exchange was opened in 1896 but it was closed in 1924, after the realisation that there were insufficient mining deposits. In the town of Gweru, an exchange was also operated between 1900 and 1930. Two exchanges were opened in Bulawayo and Harare in 1946 and 1951 respectively. An act was established in 1974 that consolidated the Harare and Bulawayo exchanges: - The Zimbabwe Stock Exchange Act of 1974. The Act governed the operations, obligations and rights of the members and the investing public.

There are two main indices, which are namely: - industrial and mining. The industrial index measures the overall performance in the market share in terms of all industrial companies, other than mining companies. More than 60% of total market activities are

represented by this. Hence, it is held to represent the market as a whole. The mining index measures the overall performance of the mining shares. This index contributes less to market capitalization as there are only four mining companies listed on the bourse. For both indices this method of calculation is identical.

According to World Development Indicators (2012), the Zimbabwe Stock Exchange was ranked number eight, using the basis of market capitalisation of USD 4.6 billion. The number of listed counters and market capitalisation of the Zimbabwe Stock Exchange for the period 1990 to 2010 is shown in Table 1.1. Standard and Poors (2001) rated the Zimbabwe Stock Exchange as the second - best performer against thirty-three other emerging stock markets in developing capital markets. The performance was based on both the USD returns and share prices. In 2005, Zimbabwe Stock Exchange was rated by the African Stock (ASEA) Exchange as the best performing stock market in Africa. Sunde and Zivanomoyo (2008) found that Zimbabwe Stock Exchange market capitalisation increased by 1542% and 240% in ZWD and USD terms, respectively, between 1994 and 1996. The notion that, in USD terms, the market capitalization increased at an annual average rate of 36% between 1994 and 1996 was supported. Comparably, the Zimbabwe Stock Exchange has more diversity and depth than other stock markets in the region. The sectors on the counters include manufacturing, construction, retail, insurance, transport, telecommunications, pharmaceuticals, agriculture and property.

Table 1.1: Key Zimbabwe Stock Exchange statistics 1990 to 2010

Period Year	Market Capitalisation in USD billion	Number of listed companies
1990	2.4	57
1994	1.8	64
1995	2.1	64
1996	3.9	64
1997	5.7	65
2008	4.2	81
2009	3.9	81
2010	4.2	81

Source: Zimbabwe Stock Exchange

Trading on the Zimbabwe Stock Exchange was automated in 2013; the call over system was initially used. This was supported by the open-cry floor system was used in support which was based on a matched bargain basis. To buy or sell shares listed on the Zimbabwe Stock Exchange, one has to go through the proper channels and registered stockbrokers.

After the starting of the Economic Structural Reform Programme (ESAP) in 1991, the Zimbabwe Stock Exchange became a largely active capital market. In 1993, participation in the Stock market by foreigners was introduced, after the partial liberalisation of exchange control regulations. Since January 1994, foreign investors and resident Foreign Currency Accounts (FCA) holders were permitted to invest in listed and unlisted companies in Zimbabwe up to a threshold of total foreign shareholdings not exceeding 35% of total equity. This marked an important era of financial liberalization in Zimbabwe's capital markets, with the Zimbabwe Stock Exchange becoming one of Africa's leading stock exchanges in facilitating the raising of capital and share trading. Smith and Jerreris (2001) noted the opening of the Zimbabwe Stock Exchange to foreign investors in 1993 which led to an imperative boost for the stock exchange. The turnover ratio through purchases by foreign investors rose significantly from 0.48% in June 2009 to 1.31% in January 2014, showing the increasing interest by foreign investors participating on the Zimbabwe Stock Exchange without any difficulties in trading stocks on the market.

In 1995, the ratio of the market capitalization to GDP was 31%, which was less than that of the Johannesburg Stock Exchange. Between 1990 and 1998, there was an increase in capitalization by more than 1542% in local currency terms and more than 240% in US dollar terms. The differences in the growth rate depicted the depreciation of the ZWD. In 1996, the Zimbabwean Stock Exchange capitalization increased from ZWD 19,9 billion to ZWD 52,8 billion (i.e. by approximately USD 4,87 billion), representing a 165% increase: this made the Zimbabwe Stock Exchange one of the emerging market performers (Reserve Bank of Zimbabwe, 2002). Between January and December of 1996, the industrial index increased from 3972 to 8786: - this was the result of the

bumper harvest in 1996. The index's industrial performance is relatively linked to the agricultural sector.

In 1997, the shares that were traded on the Zimbabwe Stock Exchange rose by more than double in their value, to around Z$6.5 billion, regardless of the volatility of trading that was seen during the last quarter of the year. According to the Zimbabwe Stock Exchange, in 1998 shares over one billion were traded between foreign and local buyers and sellers. In 1997, one of the heaviest Stock Market crashes was recorded, which lead to the ZWD losing its value from USD1: ZWD10.00 to ZWD36.00. According to market analysts this was caused by the expenditure that was unbudgeted and it in turn resulted in the war veterans being paid a substantial package which was an amount of ZWD 50,000.00. In 1998 there was a drastic decline in the Zimbabwe's stock market, once viewed as one of the vastly emerging markets in the region, to a turnover of 60% of the volumes of the previous year and 88% of the shares value sold. High interest rates caused a decline in the economy in 1998, which then prompted investors to invest on the money market (which offered higher returns), leading to a loss of confidence due to factors such as social unrest including a mass stay-away and food protests amongst other things, which led to both social and political unrest in the country.

By March 1996, the participation of foreign investors on the Zimbabwe Stock Exchange had grown and accounted for 78% of the shares that were traded. Regulations such as Additional Exchange Control were placed on foreign investors: -transactions were only allowed to be completed through the commercial banks and repatriation of the income from stock market investments was free. They were however, liable to 10% capital gain tax and an additional 15% on dividends tax thereof. New controls on the dual listed shares were put in place: those that imported foreign - bought scrip as a result, needed permission to sell their products locally: - while the locally acquired dual listed scrip could not be sold internationally. However, exchange controls are still existent especially on foreign investors, as to check capital flight. A single investor is only allowed to own up to 5% of listed shares of a company and only up to 25% of listed outstanding shares of a single company for a foreign investor. The Foreign currency position of the country

needed to be controlled which is one of many reasons the Foreign Exchange Regulations were implemented.

In November 2008, the Zimbabwe Stock Exchange temporarily stopped trading, following intervention by the Reserve Bank of Zimbabwe; it re-opened on 19 February 2009 as the economy dollarized. The industrial and mining indices were rebased to 100. The result of the increase of investment and the investor interest was a primary means of exchange which yielded relative currency stability to the economy.

Historically, Zimbabwe Stock Exchange liquidity levels were comparable to those of the Johannesburg Stock Exchange. The liquidity rise has been matched by corresponding to the changes to trade volume due to foreign investors` presence (Chikoko and Muparuri, 2013). The Zimbabwe Stock Exchange is a member of the Stock Exchange Committee in SADC and the committee comprises Namibia, Zambia, Mauritius, Botswana, South Africa and Lesotho. Ultimately the final authority lies with the Securities Commission of Zimbabwe which plays the oversight role and has authority over the Zimbabwe Stock Exchange.

1.1.2 SOUTH AFRICAN STOCK MARKET IN PERSPECTIVE

The Johannesburg Stock Exchange is the main Stock Exchange in South Africa. It was established in 1887: - hence it is the oldest and largest stock market in Africa by far. Jefferies et al. (1997) argue that the capital raising initiatives of the market were limited due to mining capital being raised in Britain. Historically, rather than raising capital, the bourse was used for speculative purposes. Therefore the stock market was dominated by the mining companies. In 2002, the market capitalization was USD242 billion and there were 700 listed companies. The Johannesburg Stock Exchange was ranked the sixteenth in the world, based on market capitalization; and third in emerging markets after Taiwan and Malaysia. The USD242 billion represented 85% of total market capitalization in Africa. Market capitalization of the Johannesburg Stock Exchange grew by 84% and 240% in USD and ZAR terms between 1990 and 1998. The growth differentials were attributed to the ZAR’s depreciation against the USD. Political developments in 1994

resulted in renewed investor confidence both internationally and domestically. Other activities on the economic front included foreign exchange liberalization, fiscal discipline and tax reforms targeted at investment flow into South Africa. These actions resulted in net capital inflows in 1995. Acceptance of the Johannesburg Stock Exchange into the International Financial Corporation's Emerging Market Database (EMDB) also had a positive effect on non-resident investor confidence.

In 1995 the stock market due to its illiquidity was criticized and yet market capitalization was represented by 206% of GDP. In 1996, the total turnover, was only 10.9%. Noting that the Johannesburg Stock Exchange is dominated by few large conglomerate quoted companies and their stocks are at times limited for trading mainly due to the fact that they are not always available. In 1994, the domino effect from the political developments led to new listings on the Johannesburg Stock Exchange. In 1997, a total number of 53 companies were registered, with companies totaling 101 following suit in 1998. Those acknowledged as dual listed companies amounted to 150, where 142% of the traded shares were processed on the Johannesburg Stock Exchange of which they were traded by foreigners. Foreigners continued remain active on the Johannesburg Stock Exchange. The existing foreign exchange control policy in place then, allowed transactions of up to ZAR250 million.

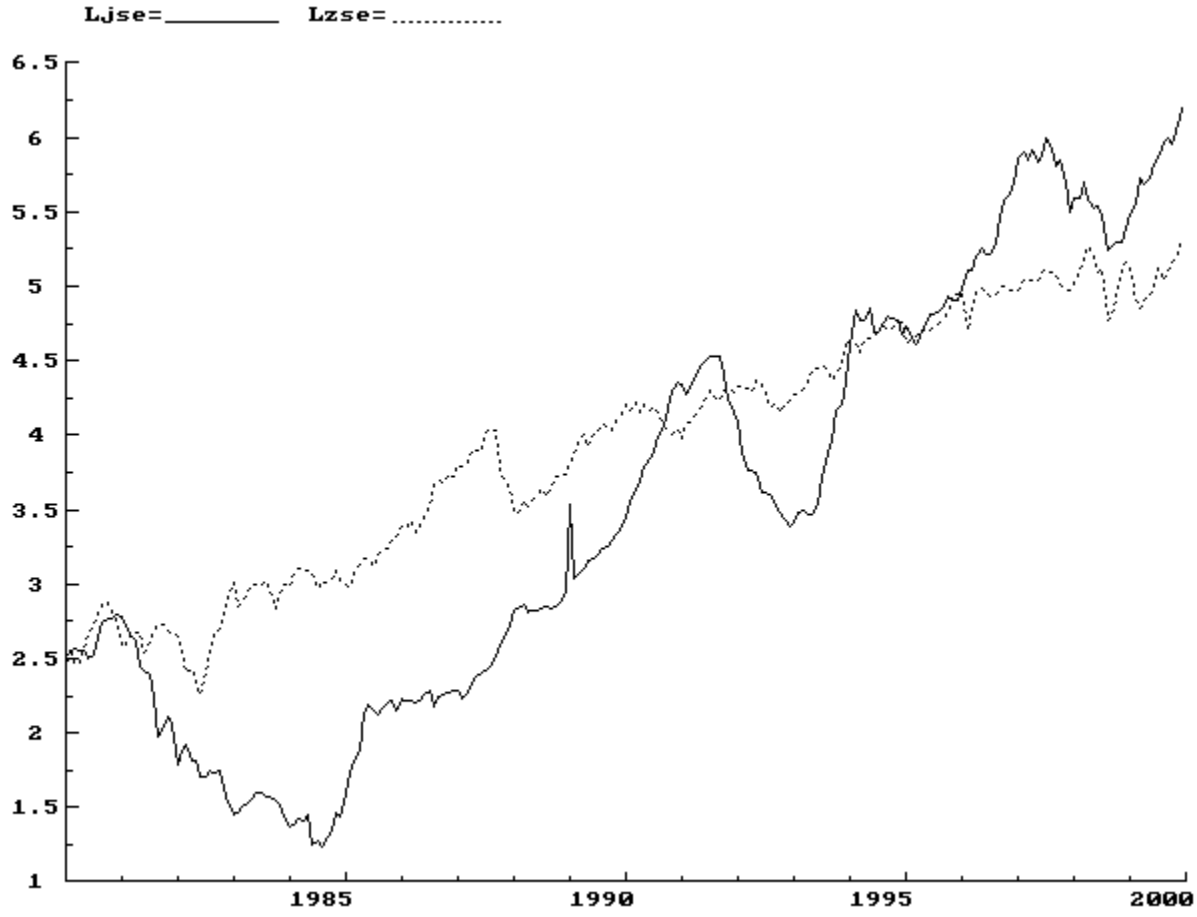
1.2 SAMPLE PERIOD ECONOMIC DEVELOPMENTS

From 1980-1990 the repressed period in Zimbabwe is reflected. During which in this time the economy was characterized by significant controls on the financial sector which really distorted the sector. There were high regulatory limitations on the rates of interest, credit management and extreme tax implications with greater stock market effects. Only domestic players, and no outside investors, could actively participate on the stock market. Therefore due to the lack of foreign investor involvement, domestic players dominated market trading. Listed companies significantly reduced from 74 to 65. The decrease translated to the amount of listed companies falling in which the decrease was a significant drop of 12%. Price movement in not so many large cap stocks dominated the market index (an example of this is the Delta Corporation, in which it collectively stands

for the 21.2% of the index; Barclays (7.5%), Meikles (6.3%) and Hippo (4.7%)). South Africa was under economic sanctions during the same period and the local players dominated the market.

1991-1999 portrays a time of financial freedom in Zimbabwe and becoming independent and the lifting of the economic sanctions in South Africa. This period was the most difficult time for most of the up and coming markets, especially in 1997-1998. Thailand was the first to experience financial instability that later spread across Asia, to Russia and South Africa. Zimbabwean economy was in such turmoil that the financial market was also affected by this economic upheaval. This can be seen is by the loss of value in terms of the ZWD and ZAR against the US Dollar. During which time, the ZAR lost value of approximately 7%, and the value of the ZWD falling by 40% instantaneously. In Zimbabwean financial markets the 14th of Nov. is also known as Black Friday. It is on this day that the Zimbabwe Stock Exchange lost 30% of its value, with the Johannesburg Stock Exchange index dropping by 16%. Both the performance of the Johannesburg Stock Exchange and the Zimbabwe Stock Exchange are shown in Figure 1.1.

Figure 1: Zimbabwe Stock Exchange AND Johannesburg Stock Exchange PERFORMANCE FOR THE PERIOD 1980(1) to 1999(12)



Source: Zimbabwe Stock Exchange

The crises that occurred in Asia in the year 1997 saw a huge outflow of capital from rising markets. Forbes and Chin (2004) argue that the Johannesburg Stock Exchange enjoyed temporal benefits from Asian countries' capital flight. Regardless of the change, with accordance to the Emerging Market Standards Zimbabwe Stock Exchange was a star performer. The Political system of foreign exchange regulations in 1993 resulted in a lot of people or money arriving at certain destinations of foreign investors on the Stock Exchange. The amount of foreign participation went up to the point that the traders could account for 78% of the total trading of the periods 1993 and 1996 respectively. South Africa was allowed to invest in countries within the SADC region in July 1997. The

distance of Zimbabwe to South Africa played a large role because the Zimbabwe Stock Exchange was well-diversified in the Southern Region, there was an increase in the flows of investment in which there were improved levels of liquidity.

There was total number of 8 companies with dual listings by the end of 1999. The table below shows those listed on the Zimbabwe Stock Exchange as well as the connecting exchanges in stock on which the stock was officially protected.

Table 1.2: Zimbabwean companies with dual listing in 1999

Company	Stock Exchange
ABC Holdings Limited	Zimbabwe Stock Exchange, Botswana Stock Exchange
CAFCA Limited	Johannesburg Stock Exchange, London Stock Exchange, Zimbabwe Stock Exchange
Falcon Gold Limited	Johannesburg Stock Exchange, Luxemburg Stock Exchange, Zimbabwe Stock Exchange
Meikles Limited	LSE, Zimbabwe Stock Exchange
NMBZ Holdings Limited	London Stock Exchange, Zimbabwe Stock Exchange
Old Mutual plc	London Stock Exchange, Johannesburg Stock Exchange, Namibia Stock Exchange, Zimbabwe Stock Exchange
Pretoria Portland Cement Limited	Johannesburg Stock Exchange, Zimbabwe Stock Exchange
Trans Zambezi Industries Limited	Lusaka Stock Exchange, Luxemburg Stock Exchange, Zimbabwe Stock Exchange
Hwange Colliery Company Limited	Johannesburg Stock Exchange, London Stock Exchange, Zimbabwe Stock Exchange

Source: Zimbabwe Stock Exchange (1999)

Evidently, between the period 1994-1999, some of these companies were protected on the stock market during the mentioned time, of which 5 of those were respectively on the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange. These companies can be identified as CAFCA; Falcon; Old Mutual; Pretoria Portland Cement (PPC), and Hwange Colliery, to name a few.

1994 saw South Africa holding its first free elections. Economic and political sanctions were lifted against the economic giant and business confidence increased as the country could now trade with the neighboring, mainly Zimbabwe, where Zimbabwe exported approximately 60% the total exports to South Africa. Apart from this, in 1995, reforms were put in place in 1995 that led to the performance of the Johannesburg Stock Exchange taking a knock. According to Jefferies et al. (1997), the reforms included the exemption of foreign investors from paying withholding tax on dividends, investor protection, and the introduction of electronic trading. This is however, a very interestingly important time as both favorable and unfavorable events that took place in both the Stock Markets.

1.3 PROBLEM STATEMENT

The idea of investing in up and coming markets has become common for portfolio diversification which is international since the early 1990s. This is due to investors, from both developed and developing countries, seeking better returns from stock markets. Emerging markets have steadily over the recent years been attractive to investors mainly due to the perceived high returns and growth prospects and partly to the Asian financial crisis. Some researchers (including Jefferis and Okeahalam (1999), Wang et al. (2003), Pierce and Hearn (2005) and Irving (2005)) investigated market integration in Africa. However, a few select have studied the relationship between the Johannesburg Stock Exchange and the Zimbabwe Stock Exchange. This is despite increased attention from international fund managers as an opportunity for portfolio diversification.

The researcher has been motivated to explore the degree of inter-connectedness between the relevant principal known markets in the SADC region, the Johannesburg Stock Exchange and the Zimbabwe Stock Exchange. This is imperative to the domestic and international investors that are hoping to manage the risk of portfolio.

1.4 RELEVANCE OF STUDY

Knowledge of the stock market linkages is of utmost relevance, more so in the South African and Zimbabwean context as well as the SADC. Detailed knowledge of the stock market linkages is very important due to the basis of the economic and political integration of the countries. The SADC region and the economic integration can, as a result, be further understood by the further study of the market linkages in that particular region. The economic integration in the SADC region can be further understood by analyzing stock market linkages in the region. Understanding in terms of the degree of stock market linkages is therefore of high importance to those influential enough to choose a plan of action, due to the possibility of financial integration.

Thus knowledge of stock market linkages can be utilized by separate investors to meet the different investment goals and investment diversification is one of the illustrations of the mentioned goals. Some of these investors include: insurance companies; retail clients; non-resident nationals. Policy makers also need to broaden their knowledge when it comes to the relationships that need to be made and therefore maintained, mainly because this has an impact on the consumption, thus investment and capital decisions thereof.

Ammer and Mei (2006) examined the issues of international economic integration and argue that the stock index coordination of movement is a good indicator of real economic integration. Dickinson (2005) adopted a viewpoint that was similar to this, but used a different approach, that is, co-movement in the national stock market indices is the major element of the increasing real economic integration. When their views are accepted, the

stock market integration knowledge is then imperative due to its effectiveness in assisting us in predicting the level of economic integration.

In the research, it was discovered that it contributes to the existing knowledge. This study can be used by other researchers as a document of reference. The academic knowledge of the researcher can however, be improved or increased with theories and processes being applied in a practical concept.

1.5 RESEARCH OBJECTIVES

The main purpose of this study objective is to assess and determine the degree to which the stock markets are linked between the two markets during the period 1980 to 1999.

The main objectives are as follows:

- Determine the existence or non-existence of short run linkages between Zimbabwe and South Africa, with the objective of examining correlation of stock prices across markets.
- To examine short run strength of the linkages between the markets.
- To examine price relationships of the two markets in the long run.
- To examine the changes on the strength of the linkages overtime (1980 and 1999).

1.6 HYPOTHESIS

The study hypothesis is as follows:

- There is correlation between share prices changes in Zimbabwe and share price changes in South Africa.
- There is a long-term relationship between Zimbabwe and South Africa share prices.
- Since 1991 there has been an increase in the stock market linkages.

1.7 LIMITATIONS OF THE STUDY

Although evidence of linkages between the two stock markets is becoming stronger overtime, there are no clear reasons to support this, according to studies that examine this issue in isolation, beyond just the call for international portfolio diversification and deregulation. Therefore there is a need to look at the macro-economic variables that influence the movement of stock prices. Sources of stock index co-movement have to be evaluated so as to assess causes of relevant identified cohesion.

1.8 OUTLINE OF THE REST OF THE PAPER

This paper shall be structured as follows. Written review looks at both the theoretical and experiments or experience literature on stock market linkages in both emerging and advanced economies. Chapter 3 gives the detailed description methodology to be used in the research as to examine the linkages of stock markets. Chapter 4 presents the experimental results and the further illustration of these particular results as well as the interpretation of these results. The final chapter summarizes the whole research paper and at simultaneously provides some recommendations for further study and policy.

CHAPTER 2

LITERATURE REVIEW

2.0 INTRODUCTION

This part of the research paper will look at the theoretical literature as well as experimental evidence with particular reference to the linkages of stock markets. The first section, looks at the theoretical underpinnings while the second section, looks at the experimental evidence on stock market linkages.

2.1 THEORETICAL REVIEW

Integration is the process of combining two things or more so at to work cohesively as one and can be precisely defined by the degree to which markets are connected. It describes the degree to which those participating in any market are *obliged* and *enabled* to take notice of events that occur in other markets. They are *enabled* to do so when information about those events is supplied promptly and accurately in a form that permits its cohesion or unity, rather, into the decision making process of specific recipients. They are *obliged* to do so when it is supplied in ways that invites them to use it in order to achieve their own objectives- to maximize income. The responsiveness of an asset's price to selling in one and buying in another region is the best index of the degree to which the markets are integrated (Sercu and Uppal, 1995).

The law of a certain price, as mentioned in the previous paragraph, is used as the defining principle of market integration of two or more markets. Accordingly, the law clearly states that a price of an identical good/product in country A should fetch the same price in country B after including the differential of the exchange rate. Theoretically, two markets are perceived to be perfectly linked when prices are the same in both markets and when prices move in the same direction. If this doesn't happen then this means there are barriers and integration is weak. However, this approach is not sufficient. It would be appropriate to study the two markets having the same underlying asset; otherwise there is no guidance to reasoning when the assets are not identical at all. When the assets

different in any way that is noticeable to the purchases, then there is no justifiable reason why prices for the two markets should remain same, and thus the law of one price cannot be used as the standard for perfect integration. Price differences can therefore not be applied to the identification of margins from integration that is perfect.

In addition, the law of a singular price would have been a lot more suitable in the case of the two stock markets having a significant number of fungible shares. In the strictest sense of the word fungibility requires that we compare price movements of the goods that are capable of mutual substitution in two different markets. The rare transpiring of events is quite an unusual occurrence for the Zimbabwean and South African stock exchanges with only the Old Mutual shares being fungible ones. Alternative counters with dual listing such as PPC, Falcon, M&R, Wankie and BICCAF are not in any way fungible as their shares are not substitutable or interchangeable.

Portfolio theory (Markowitz, H., 1991) stresses the point that diversification through the amalgamation of investments has less risk implications that investing only in a single asset. Diversification implies investing in across a significant number of shares thereby spreading risk and avoiding the risk of investing in one asset. When the mentioned statement is further illustrated as to international markets, it implies that risk is spread between countries, currencies and markets. Diversification allows for investors to gain from such global opportunities as they come. The theory, as it can be applied globally strongly predicts that the act of investing in numerous industries in one country is riskier than investing in one industry abroad. This is between foreign and domestic securities compared to domestic securities which tend to be different. Risk management's success depends on how asset returns move together. Correlation coefficient of +1 means that return on assets moves in the same direction, there buying both assets would be unnecessary. The best strategy would be to buy assets that are negatively correlated. Generally investors are risk averse and by all means they would try to hedge their portfolios against risk through diversification. Investors have also been known for holding a global portfolio that is diversified as compared to the domestic portfolio. This has been proved to be not risky than domestic portfolio. The most important conclusion

that can be deduced from this is that diversification through investing in international counters yields more return because of small correlation coefficient between international markets compared to diversification across industries in one country.

(Masih and Masih, 1994) argue that portfolio theory is based on stock market interdependence and integration hence asset diversification. As explained by fungibility if two markets are expected on average to have the same yield in return they are termed perfect substitutes; investors thus will bear no advantages in trying to increase income or reduce risk by simultaneously holding assets, that is, there are as a result no diversification benefits. Therefore this theory purports that diversification only yield when stock markets are not integrated. If the correlation is low in the two markets then at the level of risk, the return that is to be expected will be higher. This means that the benefit from diversification increases as the correlation coefficient falls (Grubel, 1968).

The Multi-Factor International Arbitrage Pricing Model (IAPT) and its international extensions (Ross 1976) also try to explain linkages through international portfolio diversification. The theory implied that segmenting the stock market prevented the risk price from being the same in the markets that were different or had no similarities whatsoever. Growth rates and investment decisions can in the future be influenced by investments in a portfolio of international diversified stocks. Globally, risk diversification can be affected by factors such as that of sovereign risk, regulatory restrictions, taxes, and information inequalities. The mentioned factors reduce linkages in stock markets, which in turn affects risk diversification strategy where internationally arbitrageurs are therefore failing to equate the risk price. The flow of IAPT approach is reliant on the asset pricing model specification details. Pricing errors can be noted when the asset-pricing model is incorrect, whether market integration exists or not. The law of one price can be differentiated when economy regime (such as segmented to integrated) changes. The changes will result in changes in prices of assets.

According to capital markets and portfolio theories, if markets are completely correlated then to achieve optimal portfolio diversification investors have to hold a significant

number of assets in international markets rather than limiting diversification by holding assets in a national market. Market segmentation enhances investor potential gain as market price movements will not be perfectly correlated. This is the best way investors can diversify systematic or rather non-diversifiable risk of each domestic market by investing in global markets. Prices of similar assets between countries would be identical through cross-border arbitraging in the case where there are no significant trade barriers to investment and capital flows. If this was the case then assets with similar characteristics in international markets would have their prices move in the same direction, even if they are denominated in different currencies (Sharpe W.F, 1964).

Choudry T. notes that that counters listed in international markets and trading in these shares globally often lead to stock market integration. This considerably means that cross-listed stocks are arbitraged perfectly, that is, stock prices would be as equally as important in those markets. However, Eun and Janakiramanan (1992) argue the of part this being possible if stock brokers can have accessibility to both Zimbabwean and South African markets with transaction costs which are low. However, this is not the case between the two markets discussed due to significant barriers to trade, for example, different tax rates between the two countries.

Old Mutual is relevant to this study, which trades in Zimbabwe, South Africa and UK. The shares of the company are believed to be fungible. Froot et al, (1995) argue against the incumbent firm's stocks show the stock market linkages as well as cross border arbitrage existence which follows the law of single price. The stocks will be highly correlated and move at the same pace and in the same direction in the markets where they tend to be actively and extremely traded.

Dual listed companies have risk arbitrage; this assumption is shared by a number of market professionals. This can be seen by the thin trading of dual listed stocks, although this school of thought has not been thoroughly tested. However, this argument is not always true in markets with, for instance, high transaction cost, like Zimbabwe. The

argument is usually true where markets have the same level of transaction costs, which seems to be a whole different scenario between Zimbabwe and South Africa.

Pritsker (2000) hypothesises that due to hedging across markets co-movements in stock can be found. In light of this view, it was presumably dependent on the assumption that domestic stock index values can be broken down in the long run based on country specific macroeconomic factors. Also, in short run, information availability relating to the country can be received. Information availability was referred to as information shock thereof. Given the information the investors should act accordingly in the adjusting of investment portfolios. Resultant exposure to risks pertaining to macroeconomics can be hedged through portfolio rebalancing. The re-balancing aspect results in a non-systematic shock across markets in all parts and, hence short run correlation of the stocks. Thus country specific shocks generate return co-movements across countries in particular. Karolyi and Stulz (1996) had earlier suggested that co-movements in stock market returns result when interest in market A generates interest in market B. That eventually increases the demand for shares thereby increasing the share prices. This considerably suggests a positive relationship between stock market indices.

Dornbusch et al. (2000) argues that contagion and cross-market linkages are closely related. The researchers explicably argued that the contagion is a result of individual country shocks measured through financial flows which are relative to co-movements in best times. Shock in one country forces a reaction from investors in other countries to therefore, due to the unforeseen conditions, to act accordingly. For example liquidity constraints in country 1 can cause a certain reaction by investors through funds withdrawals. This has led to the concluding that liquidity and incentive problems trigger stock market co movements. In illustration of the liquidity effect, some researchers argue that a point in change in share prices in one country causes a significant capital base change for international institutional investors. Capital base changes incentivize investors to buy or sell investments in other markets as a form of hedging mechanism. Risk exposure is managed through movement from high risk areas to low risk areas of investment. This is reference to the events that happened in Southeast Asia during the

"Asian Crisis". King and Wadhwani (1990) argue that contagion in markets vastly spreads through the various markets. This results in a correlation between the stock markets in the world.

The incentive structure for the investors' agents can create price co-movements when the agents dispose of stocks in several markets simultaneously. A crisis can influence the investors' decision to dispose of investments in markets that are starting up, mainly due to the need to continue at the same level, a proportion of a portfolio in the region. Unfortunately, equity and the assets of these surviving markets would all lose value and the currencies will depreciate significantly at the same rate. This is precisely what transpired in 1997-1998 when the currencies in both Zimbabwe and South Africa plummeted during the time of the financial crisis in the Asian market. The Zimbabwe Stock Exchange and the Johannesburg Stock Exchange also lost some value during this time. Country funds can be used as an alternative vehicle to invest in the equities when foreign restrictions exist (Bekaert and Harvey, 1995). The argument being institutionally managed funds during crisis linkages can be prompted with portfolio rebalancing**.**

With stock market linkages, psychological factors also have an effect. Information unavailability results in panic from investors. Stocks disposal by an investor can be seen as a need to sell the stocks at hand. Information inequality results in different actions and also influences the way in which the investors react.

When two stock markets are independently connected, the next day their closing prices would be their opening prices, appropriately corrected for the changes in local factors. However, if markets are perfectly linked, it often means that the Zimbabwe Stock Exchange closing price will be the same as the Johannesburg Stock Exchange opening price, which closing price will as a result be the Botswana Stock Exchange's opening price and so on. Thus, as a result to the existing linkages, today's closing price will no longer be utilized in tomorrow's opening price for the markets in question (Blackman et al., 1994).

Masih and Masih (1994) suggest that evidence of bivariate co-integration suggest that fluctuations in the future of market prices in one market can be predicted using information from another index. Blackman et al. (1994) shares this same view. They continue to argue stating that if that if share prices in the two countries are co-integrated, then, as time passes, the two series move together in one accord and do not drift apart. In the long run, stock markets price indices will move in the same direction. The stock prices in one market will adjust towards the future value in the other market. The benefits of an internationally diversified portfolio would appear to be restricted if stock markets are co-integrated. The extent of variation can be limited by the availability of common factors. Co-integration between stock markets means fewer assets available to portfolio holders.

The theory of co-integrated processes is well suited for analysing the co movement of variables that economic theory suggests should not move away from each other for extended periods of time. In testing the long run relationships between stock market prices, this theory can be used in a practical manner.

Sharpe (1964) and Lintner (1965) developed a model that analyses the variation of expected security returns cross sectionally. The international existence of the model allows investors to have a wide choice on stocks from many countries, with the portfolio including all the assets in the world. The theory predicts that the degree of stock market integration depends on the intensity of barriers to capital flows. When integration of markets happens then stocks in different markets with same risk profile are assumed to have the same expected returns. The two concepts of diversification and connectedness are the same in this theory. Stulz (1992) and Solnik (1991) also argue that in a world with one source of risk (measured by a benchmark portfolio that can be observed; the world index), market linkage examination and diversification benefits are both identical as stocks of portfolios in individual countries are priced relative to a national stock market index. Difference in prices due to the lack of integration is attributed to the diversification benefits that are not yet exploited. The ICAPM relation should grow from the investors' efforts to diversify the risk. Using ICAPM, a portfolio or stock is connected with the

defined market if its returns are consistent with the model. In the context of ICAPM, the approach has been to evaluate the sensitivity of individual assets to the international market portfolio. The more sensitive they are, the more linked they are believed to be and a versa.

The model assumes independent and similarly distributed returns and ignores the presence of serial correlation. Given serially correlated returns, most investors would likely prefer a more complicated inter-temporal strategy to the ICAPM. Additionally, the testability of the model can prove to be of a challenge as the composition of the market portfolio should be known. This approach has proved to be not much of a reliable source due to non-existence of internationally accepted model of asset pricing. The world index is uniquely identified if purchasing power parity holds. This is only possible for static ICAPM (Dumas and Solnik, 1992). According to Harvey (1991), emerging markets do not obey this standard asset-pricing paradigm.

Connolly and Wang (1998) argued that domestic economic factors have an effect on the stock prices of the domestic market. Hence, any news relating to the domestic market, lead to portfolio rebalancing by investors who are diversified. Rebalancing can result in stock prices changes based on the elasticity and volume of shares traded. Share prices respond to the news in different countries hence affecting cashflows. Existence of global factors in the pricing of the equities can be shown through the share price movements in the countries the shares are listed. Information regarding the Zimbabwe Stock Exchange can have an effect on the movement of the Johannesburg Stock Exchange share price.

2.2 EMPIRICAL REVIEW

Recent studies of international equity market integration have produced somewhat mixed conclusions. A large amount of research suggests that, for the period before 1980, international share markets were segmented in nature with asset prices determined mainly by national factors. Dwyer and Hafer (1988) using data for stock markets in Germany, UK, USA and Japan during 1987 crash of stock markets, examined their correlation coefficients. The study found that high correlations exhibited although they were

unstable. Unstable correlations change in the indices remained positive and importantly different from zero. The results were consistent with the indices movement changes being related and moving in the same direction. The result of this was that buying ensures that the expected rates of returns for investors in different markets are equalized in the restrictions not being in place to international capital flows. Another study was done from the period 1957 to 1987 using data for major currencies which in turn yielded to higher correlations using the floating method rather than the fixed method. The result of this was that those markets were more closely linked in the post floating time of the exchange rate. The study also made it clear that the variations in the stock markets were more important over a period of time, but were weakly related to the capital market and macroeconomic factors thusfar. King and Wadhwani 1990 (as cited in Korajczyk 1995) investigated the October 1987 crash and revealed the contagion effect of the markets. They found out that regardless of the different economic conditions all markets moved in the same direction nonetheless. They discovered that a "mistake" in one market was inevitably transmitted to another market through contagion.

A Canadian study market from 1963–1982 (Jorion and Schwartz, 1986) found that international influences were not in place not only for domestic stocks but for securities that were listed in both Canada and The United States of America as well. Other researchers also looked at the same feature from the standpoint of view of benefits for investors by way of risk reduction obtained by international diversification. In a study by Lessard (1973) of 16 countries for the period 1959–1973, they found that on average 22% of the variance in national share indices was reiterated by a world portfolio index, leaving a large element to be accounted for by national factors. Non-world risk could therefore be reduced by international diversification. The segmented nature of the share markets in this period can be explained by the existence of barriers that were imposed which prevented the free flow of capital, along with the presence of market imperfections in the form of high costs and difficulties in the relaying of information. These controls prevented institutional and other investors from achieving greater portfolio diversification (Tew, 1978). Transaction costs served as disincentive because of high incurred commission charges for international securities.

Borner-Neal et al. (1990) studied the effect of investment controls and close-end country fund prices. Their results showed that capital market restrictions introduced new rules by governments that have effectively divided the international capital markets. They conclude that a lot can be gained by international diversification.

Korajczyk (1995) and Bekaert and Harvey (1995), found – based on asset pricing models – that stock market integration is larger for developed countries than for emerging markets. Chou et al. (1994) studied a long run relationship among six stock markets. In the study weekly data was utilized from 1976 to 1986 and it included samples from countries such as Canada, France, UK, Japan, USA and Germany stock markets in which the multivariate co-integration technique was applied. They split the period into two sub-periods, 1976-83 and 1983-89, and found that co-integration relationships were stronger, due to them to being cultivated, over a period of time, which served to be consistent with the financial markets liberalization and globalization. On the same note but different sets of data for 14 European stock markets, Smith K.L et al (1993) found that since 1990 stock market integration arose with an increase in the economic integration.

Bekaert and Harvey (1995) revealed that based on having knowledge regarding ownership and taxes regulations, other markets were connected, which was the contrary of the above mentioned statement. Phylaktis and Ravazzolo (2000) showed that for Pacific-Basin markets there existed no index co-movements for Singapore and Hong Kong markets during the 1980s, in a bid to analyze the linkages between the exchange rate and stock prices thereof. Under same study the same researchers found intimate linkages in Thailand and Indonesia which had restrictions to capital movement. This was enough evidence that for close international financial market linkages capital market liberalization has limited or no effect at all (Bekart, 1995). He cited other factors like accounting standards; the availability of information; protection of investors and risks relating to liquidity, political as having caused the linkages.

Jefferies, K.R et al (1997) stock market linkages of Botswana, South Africa and Zimbabwe were examined. For the study to be a success and yield the required results they used weekly closing value data which dated from July 1989-December 1995. The methods of analysis, they applied both the correlation and co-integration methods. However, for South Africa and Botswana they used the overall market index while for Zimbabwe, only the industrial index was used as the preferred method of analysis. They found correlation of returns to be very low (less than 5%). The correlation of stock market returns in South African Rands was 0.035 (June 1989-December 1996 period); 0.081 for the period June 1989-December 1993 and -0.032 for the period June 1994-December 1996. In US dollar terms, the correlation was 0.082 for the entire period; 0.145 for June 1989-December 1993 and -0.013 for January 1994-June 1996. Only the period June 1989 - December 1993, the correlation was found to be largely different from zero at 5% level.

Zimbabwe and South Africa indices were therefore connected of order one in national currency and USD whereas the Botswana index was integrated of order zero. Among the three SADC countries, no long-term relationship was found to be existent or was ultimately deemed to be that of weak relationships. Weak evidence of weak long run relationships existed among the US, SADC and UK financial markets. The use of high frequency data affected their study, weekly stock market indices, which are more volatile and subject to momentary noise behavior by investors. Changes in stock prices are closely related only over longer periods of time.

Dickinson D.G. (1995) studied the stock markets of UK, Frankfurt, Paris and US for the period 1980(1) – 1995(12). He implemented the co-integration technique as to test the linkages of these markets using monthly stock indices. The performed co-integration tests were the standard Johansen type. The sample was divided into two parts, 1980(1) – 1987(12); 1988(1) – 1995(12) as well as the whole period ranging from 1980(1) – 1995(12). Their results indicated a rising degree of integration (as represented by co movements of the indices) between the two sub periods. They inexplicably failed to reject the null hypothesis of co-integration, which suggested existence of equilibrium in long

run relationship with the European markets. USA had an influence on the German and UK markets. The French index was discovered to be influenced by German and US markets. For the German index, a long run relationship existed being positively affected by the US index. International stock market linkages seemed to be on the rise between the two periods.

Seabra (2000) used a co-integration technique as to study linkages between other international stock markets and Mercosur. He experimentally examined the existence of long run relationships among the 2 most imperative Mercosur stock market indices (Argentina Merval and Brazilian Ibovespa) and 2 major international stock price indices (the Japanese Nikkei and the US Dow Jones). He used multivariate co-integration and standard bivariate techniques and the bivariate and multivariate tests that were carried out using maximum likelihood methodology also the two step procedure was implemented. Co-integration tests had a way or particular habit and were not likely to change an order one integration of all market indices. After the consideration of the Argentina stock price indices as the dependent variable, co-integration hypothesis was accepted in three cases: Argentina and Japan, Argentina and the USA; and Argentina, Japan and the USA. Based on the Johansen technique, the hypothesis of co-integration was not rejected between the US and Brazil stock exchange markets. The results signified existence of a common trend within the stock indices. It was visible that regardless of the long run relationships of the Argentine and Brazilian stock markets with the US stock market, no common significant trends between the two Latin American markets could as a result be traced. The short run estimation equation was as below:

$$\Delta lsto_{it} = y_0 + y_1 \Delta isto_{it-1} + y_2 \Delta iso_{it} + y_3 (iso_i - iso_j)_{t-1} + \omega_{it}$$

The error correction variable $(l\ ARG - l\ USA)_{t-1}$ and $(l\ Bra\text{-}l\ USA)_{t-1}$ were found to be negative and statistically significant, which indicates changes towards the long run relationship and therefore reinforces the acceptance of the co-integration hypothesis. The results were:

$$\Delta l\,\mathrm{arg} = -0.48^{*} + 0.09\Delta l\,\mathrm{arg}_{t-1} + 1.51^{*}\Delta lUSA_t - 0.19^{*}(l\,\mathrm{arg} - lUSA)_{t-1}$$

$R^2 = 0.342$ DW = 2.05

*This was tested at 5% significance level

The study verified existence of long run relationships linking stock price indices in 2 Latin American countries (Brazil and Argentina) and in the two main international markets (Japan and USA).

2.3 CONCLUSION

We have come to discover and conclude from the above review that stock markets tend to move in the same direction which implies a positive relationship between markets since there is an upward and downward movement in the same direction over time. It is also believed that after removal of barriers from the stock markets and financial liberalization the markets trend upwards together overtime. We therefore expect integration after the removal of barriers and the liberalization of the stock market. Levels of stock prices have been confirmed to be non-stationary in the financial literature. Non-stationary variables, time series and regression analysis can be used in analyzing short term linkages. The problem of non-stationary can be overcome through the use of co-integration techniques and allowing stock prices levels and differences investigation.

CHAPTER 3

METHODOLOGY

3.0 INTRODUCTION

This chapter describes the research methodology to be used in this study, furthermore, to the methods to be used in data analysis. The data will be cleaned in order to meet the requirements of the researcher and methodology to be applied. The method of analysis used in this study is also explained in this chapter.

3.1 DATA CLEANING

This research uses the Zimbabwe Stock Exchange and Johannesburg Stock Exchange indexes in their own currencies. Converting the indices to common currency creates fluctuations which can be related to the exchange rate movements rather than movements in the stock market. Using the indices will assist as they are assumed to be currency free.

Data will be obtained from the Zimbabwe and South Africa stock markets. In Zimbabwe, the combined index of Zimbabwe Stock Exchange will be used, mining and industrial, while in South Africa the Johannesburg Stock Exchange all share index will be utilized (please note that the combined index of ZSE, mining and industrial, is equivalent to the JSE all share index as the ZSE industrial index is inclusive of the financial index). The data will be complemented with that from International Financial Corporation Emerging Markets Price Index, Reuters and Bloomberg. Monthly stock market index will be used covering the study, 1980(1) to 1999(12). The employs monthly data from the stock indices to have a comprehensive time series for testing the normality of the data distribution and the stationarity of the time series data. To have a common base, the data will be converted into logs.

Since the Johannesburg Stock Exchange and Zimbabwe Stock Exchange use different base years to calculate their indices, we will recalculate the base indices using the same base year. This research is going to utilize the splicing method to change the indices to

the same base year. With only the information of the two respective markets in their different base years, studying the overall price progression and comparing market performance of the two markets becomes difficult. We have therefore obtained a spliced index to put the two markets on the same footing for comparison. In the new spliced index we setting year 1994 as the base year and setting the index for the year at 100. To transform this to 100, we divide by 1967 value and multiply by 100. We also do the same to the other index numbers based on 1997, converting them to the base year, 1994, by dividing each by the value in 1967 multiplying the result by 100. January 1994 was chosen as the base year. The base year was chosen on the basis that in 1994 South Africa had its first democratic government elected together with the lifting up of both formal and informal financial sanctions. There were major financial reforms happening in both countries around 1994, resulting in increasing international investor trading on both stock markets.

3.2 MODEL SPECIFICATION

The study will be based on the model to be estimated as follows:

Where

$$SPI_Z = \beta_0 + \beta_1 SPI_{SA} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

SPI_Z is the Zimbabwe Stock Exchange index log

SPI_{SA} is the Johannesburg Stock Exchange

index log

$\beta 0$ is the intercept

$\beta 1$ shows the relationship between the Zimbabwe Stock Exchange and Johannesburg Stock Exchange

ε is the error term

3.3 JUSTIFICATION OF VARIABLES

SPI_Z and SPI_{SA} represent the sum of the weighted individual stock prices, where the weights reflect market capitalization. This reflects the behavior of prices in whole of the two stock markets, as well as providing relevant information about their economic environments respectively.

In using the stock prices from different countries, problems arise on the conversion aspect to the same base. Taylor and Tonks (1989), Ohno (1999), and Kasa (1992) support the conversion into common currency while Shiller (1989) differed by preferring local currency. Arguments were based on the dominant cause of the price movements. Technical issues arise from the currency conversions. Conversion into USD may not present the correct view from the Zimbabwean investor but appeals to a US investor. This is because shares are traded in the respective country`s local currency.

With higher chances of changes in exchange rate affecting domestic economy movements, we will take the respective indices in their local currencies to avoid this. This has been proposed by Dickinson et.al (2005) who recommends that indices should be taken in their own local currencies to avoid unnecessary and unintended fluctuations which in turn tend to distort the long run behavior of the indices.

3.4 ESTIMATION METHOD AND PROCEDURE

We will to utilize the regression analysis to assess the relationship of the two respective variables as we have time series data. As mentioned earlier, the share price index function for Zimbabwe will be estimated against that of South Africa by utilizing the co-integration and the error correction techniques. Below is the estimation procedure:

(a). Stationarity variable testing. This is to determine integration order variables that are relevant, by carrying out Augmented -Dickey Fuller tests (ADF). A combination of methods is normally used for robustness checks because many of these unit root tests typically have weak power.

(b). When the two indices have been integrated in same order, Engle and Granger (1987) then estimates relationship in the long run. The standard Johansen (1988) maximum likelihood and the Engle and Granger two-step estimation techniques will be used to carry out co-integration tests.

(c). if we cannot reject co-integration hypothesis, then the error correlation mechanism (ECM) can help us construct an adjustment model in the short run – which means

considering deviations from relationships in the long run. Lastly the ECM is constructed and estimated for the first difference of the co-integrated series. Therefore we estimate the short run responses of Zimbabwean and South African markets as follows:

$$\Delta SPI_Z = \alpha_0 + \alpha_1 \Delta SPI_{Zt-1} + \alpha_2 \Delta SPI_{SAt-i} + \alpha_3 (SPI_Z - SPI_{SA})_{t-1} + \omega \ldots\ldots\ldots\ldots (2)$$

Where $(SPI_Z - SPI_{SA})_{t-1}$ denotes long run relationship deviations.

$\acute{\alpha}_o$ intercept

α_3 is the long run equilibrium adjustment speed.

ω is the stationary disturbance term.

3.5 METHODS OF ANALYSIS

Multi-factor or single asset pricing models are commonly used when testing for market integration. Here we are assuming market efficiency and hypothesizing the integration of markets and believing the correctness of the asset-pricing model. Thus we must interpret the results a bit cautiously. The absence of an internationally accepted asset pricing model made the two approached to be unsatisfactory. This has led to most recent work on international stock market linkages utilizing the correlation and co-integration methods of analysis, effectively analyzing the short run and long run relationships. Most recent studies on stock market integration utilize these methods of analysis.

3.5.1 Correlation Analysis

The construction of stock market correlation coefficients is the oldest and most simplest of approaches of analyzing stock market linkages. This paper will look at the indices of the two stock markets by examining the correlation coefficients. A high correlation will entail the existence of short run market linkages and a low correlation will mean weak or non-existence of short run market linkages. Market indices would be perfectly correlated if there was only one risk and markets were perfectly integrated (Cumby and Hilizinga

1992, as cited in Cheung Y, L et al, 1992). The correlation measures the two market indices common component and therefore market linkages, indirectly. The advantage of this method is that it assesses the strength of the linkages and how the linkages change over a period of time. The higher the correlation the stronger the short run linkage and vice versa (Dwyer and Hafer, 1988). If the correlation coefficient of the two markets changes between two periods the change will be attributed to a change in integration overtime.

Data will be divided into two segments: 1980(1) – 1990(12) and 1991(1) – 1999(12). For all the sub-periods correlation coefficients will be calculated and these will be compared to assess and change in the strength of linkages between the two stock markets. However, based on the balance of opinion, the use of correlation is not a favorable method to empirically analyze stock market linkages. Allen et al (2010) posit that financial return rates exhibit random walk. To rectify this problem, we difference the series to make them stationary and we compare correlation coefficients on the differenced data. To determine correlations we look at trading noise in the short term and long term market relationships (Chou et al, 1994).

3.5.2 Long-Run Relationships Co-integration Tests between Markets

The theory of co-integrated processes is well suited for analysing the co-movement of variables that is suggested by the economic theory should not deviate from each other for extended periods of time. This method can also be used to test the long run relationships of different stock market indices. In the case where two stock markets are connected, their stock price indices tend to follow each other in the long run. The index stock price of one market will tend to move towards the equilibrium level of the stock price of the two stock markets of interest. Therefore two co-integrated markets tend to have the same common trends in the long run. If we cannot reject the co-integration null hypothesis, then following the Error Correlation Model, we construct the correction, better known as the adjustment model in the short run, considering long run relationship deviations. We therefore can estimate how the two markets respond in the short run. We use Engle and

Granger (1987) to test bivariate co-integration. For co-integration the pre-requisite is the same order of integration for the non-stationary series. Firstly we use the ADF and the DF tests in determining integration order of the stock market indices. According to Chan and Lai (1993), the null hypothesis suggests no co-integration in different stock markets' prices.

3.6 PERIOD OF STUDY

1980(1) – 1999(12) is the sample period with co-integration tests carried out for the periods 1980(1) – 1990(12) (period of apartheid in South Africa and attainment of independence in Zimbabwe but still with some economic controls); 1991(1) – 1999(12) (end of apartheid in South Africa and financial market liberalization in Zimbabwe). We attempt to identify any changes in stock market linkages over time.

The dawn of new millennium so complex political and economic dynamics in Zimbabwe, experiencing unprecedented levels of inflation (79 billion percentage at its highest in 2008), cutting of three to ten zeros on the Zimbabwean dollar from period 2006-2009, and changing of currency from Zimbabwean dollar to US dollar in 2009. This made it difficult for the researcher to extend the period of study into the new millennium because of these complexities and thus the period 1980(1)-1999(12) is more efficient.

CHAPTER 4

ANALYSIS OF RESULTS

4.0 INTRODUCTION

The main purpose of this chapter is to present the results from correlation and co-integration tests, estimated equations and the accompanying interpretation of the results. Section 4.1 of this chapter presents the results for the correlation matrices in change rates. This is followed by a presentation of the stationary and co-integration test results which are based on the Dickey Fuller, Engle-Granger and Johansen techniques in section 4.2. Finally, section 4.3 will lastly report the regression results and proceed to give an interpretation of the given results. Note that the charts for summary statistics are presented in Appendix C.

4.1 CORRELATIONS BETWEEN MARKETS

Table 1: CORRELATION MATRIX 1980(1) - 1990(12)

	DLZSE	DLJSE
DLZSE	1.00	0.02172
DLJSE	0.02172	1.00

Table 2: CORRELATION MATRIX 1991(1) - 1999(12)

	DLJSE	DLZSE
DLJSE	1.000	0.1187
DLZSE	0.1187	1.000

In table 2, the correlation between the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange for the period 1980-1990 is 0.02172. This is lower as compared to that of table 3 for the period 1991-1999, where it is 0.1187. There is an improvement in the correlation between the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange. This shows that the correlation has doubled during the 1991-1999 period as

compared to the sub period 1980-1990. The important thing to note here is that in both periods, the correlation coefficient is positive, although it is significant only for the period 1991-1999. The lower correlation in the period 1980-1990 suggested that there were weak linkages between the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange. This weak short run linkage is of no surprise since conditions necessary for indices co-movements were not yet in place. However, the positive coefficient suggests that the two markets move in the same direction. This is consistent with theory. For the period 1991-1999, the coefficient has increased greatly. Which means that the extent of linkages has increased significantly since 1991. The short run linkage has improved, confirming our prior expectations that the developments that took place since 1991 have the relationship between the two principal stock markets in the region stronger overtime. The extent of stock market linkages has therefore increased over time.

4.2 LONG - RUN RELATIONSHIPS BETWEEN MARKETS

4.2.1 Unit Root Tests

Since we are dealing with time series data, it is important to remember to test for the stationarity of the variables in order to avoid spurious regressions. The ADF test is used throughout for unit root testing and the choice of the lag length is based on the Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC). The results of the unit root tests for the variables are presented in tables below:

Table 3: TESTS FOR UNIT ROOTS IN THE STOCK PRICE INDICES IN LEVELS 1991(1)-1999(12).

Critical values: 5% = -3.453 1% = -4.049

Country	t-adf (AIC)^
LZSE	-2.4019(3)
LJSE	-3.3114 (0)

^ In parentheses, optimal lag according to Akaike Information Criterion (AIC)

In testing for stationarity, the null hypothesis is that there is a unit root. Since the t-caclculated is exceeded by the t-critical, we do not reject the null hypothesis of a unit root. We can conclude that the variables are non-stationary at both 1% and 5%.

Table 4: TESTS FOR UNIT ROOTS IN THE STOCK PRICE INDICES IN FIRST DIFFERENCES 1991(1)-1999(12)

Critical values: 5% = 1.943 1% = 2.585

Country	t-ADF(AIC)^
DLZSE	-6.7562**(3)
DLJSE	-9.5422**(0)

** means significant at both 1% and 5%.

^ In parentheses, optimal lag according to Akaike Information Criterion (AIC)

Table 5 tests the stationarity of the variables in their first differences. DLZSE is the differenced log of the Zimbabwe Stock Exchange index while DLJSE is the differenced log of the Johannesburg stock exchange index. The null hypothesis of a unit root is rejected at both 1% and 5%. This therefore means that the variables are stationary at first difference, and hence are integrated of order one I (1). Since both the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange indices are I (1), one can safely proceed to test for co-integration because one of the necessary conditions for co-integration is satisfied (that is, for co integration to be there, the variables should be of the same order of integration).

4.2.2 Co-integration Test for Country Stock Indices

In investigating the degree of stock market linkages, we approach the problem from the traditional standpoint of co-integration. The co-integration tests performed are both the Engle- Granger and the standard Johansen type.

4.2.2.1 Engle-Granger Methodology to Co-integration Analysis.

The model estimated is:

$$SPI_Z = \beta_0 + \beta_1 SPI_{SA} + \varepsilon \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Tests for the stationarity of the error term, e, is carried out. The results for the period 1991(2)-1999(12) are as shown below

Unit root tests 1991(2) to 1999(12)

Table 5: CO-INTEGRATION RESULTS BASED ON ENGLE-GRANGER TWO-STEP PROCEDURE

Critical values: 5% = -1.943 1% = -2.585

	t-adf
E	-3.392

Where: Residual values = e

The error term is stationary at 1% and 5%. According to Engle and Granger (1987), this signifies that there is co-integration.

4.2.2.2 Johansen Technique to Testing Co-integration 1991(2)-1999(12)

Table 7 below presents the co-integration tests based on the Johansen technique. It is based on the maximal Eigen value and trace.

Table 6: CO-INTEGRATION TESTS (1991(2)-1999(12)) BASED ON JOHANSEN TECHNIQUE

Based on maximal Eigenvalue

Null	Alternative	Statistic	5%	10%
R= 0	R > = 1	19.1674	18.33	16.28
R = > 1	R = 2	2.6446	11.54	9.75

Based on Trace

Null	Alternative	Statistic	5%	10%
R = 0	R > = 1	21.812	20.18	21.23
R = > 1	R = 2	2.644	9.75	11.54

As can be seen on tables 7 and 8 above, both the maximal Eigen values and the Trace rejects the null hypothesis of no co-integration between the two indices, but could not reject the null hypothesis that there is one-co-integrating vector (r = 1) against the alternative of two at both 5% and 10% level of significance.

Both tests give the same result that the two stock indices are co-integrated for the period 1991(2) - 1999(12). The existence of co-integration gives us a go-ahead to estimate an error correction model, equation 2. We first estimate equation 1 to get the error correction term, e and then lag it once.

Table 7: ERROR CORRECTION MODEL 1 (ECM 1)

Modeling DLZSE by OLS.

Variable	Coefficient	Std.Error	t-value	t-prob
Constant	0.0009	0.008089	0.112	0.9111
DLZSE_1	0.29745	0.086	3.459	0.0008
DLZSE_3	0.3595	0.0878	4.208	0.0001
DLJSE	0.205	0.105	1.948	0.0543
E_1	-0.0846	0.024606	-3.44	0.0009

$R^2 = 0.32$ F (4, 98) = 11.542 (0.0000) DW = 2.06

RSS = 0.5999

Where: E_{-1} is the error term lagged once or the error correction term.

DLZSE is the differenced log of Zimbabwe Stock Exchange index

DLJSE is the differenced log of Johannesburg Stock Exchange index

The above tests have emphasized on the full sample characteristics of the model and its parameters thereof. Interpretation of these results from the equation presumes stability of the full sample coefficients. If this is not the case, then inferences drawn from this equation will be void. Constancy is therefore an additional, crucial statistical property of the model. Recursive Least Squares (RLS) and the associated sequences of test statistics provide incisive tools for analyzing constancy. In order to test the constancy of the

parameters over the period, we re-estimate the ECM using the Recursive Least Squares (RLS) estimator. The resulting series of recursive estimators can therefore be analysed for their stability. Recursive estimators are calculated for every variable in the model and plotted in appendix D.

A plot of the e_1 in figure 3, appendix D, is relatively steady and any movement in its value is not of much significance, that is, at no point in the period did the feedback to the long run equilibrium differ from 9%. Whereas, plots of the recursive residuals of the equation in figure 3, appendix D, indicate a marked significant break in Jun. 1993, Jan. 1998 and Aug. 1998. The one step chow tests for the entire sub-period in appendix D figure 4 also indicate that over the period, there were significant breaks during the same time. The break in Aug. 1998, which is significant and worth our attention, might be explained by the aftermath effects of the black Friday of November 14 1997 that saw the biggest fall of the Zimbabwe dollar since the managed currency devaluation of the early 1990s. The stock market did not react hastily to this devaluation, but when the list of nearly 1500 commercial farms to be compulsorily acquired for resettlement was released and interest rates hiked twice in quick succession, the announcement of massive and unbudgeted payments to ex-combatants therefore shattered businesses and confidence of the investors. As a result, the market went into a free fall. 1998 was also characterised by two collapses of the dollar in August as a result of the substantial importer demand fueled by a weak South African rand, and press reports that the IMF had suspended its support program. At the same time, the either up and coming or surviving markets worldwide were in turmoil as Russia began its meltdown. With all these problems, Zimbabwe decided to enter the DRC war. With little regard for the underlying performance of blue chips like Delta, Meikles and Zimsun, foreign investors tried to sell large volumes of shares into a thin market which proved to have disastrous consequences. Many shares traded below their net asset values and others well below their net current asset values. The index was in 28-month trough and many companies' price earnings ratios were at near record lows. In 1994, South Africa removed lifted the exchange controls.

To get around this problem, the paper introduced one dummy Aug. 1998 to capture the break in Aug. 1998 since this dummy was found to be of very high importance. Dummies for Jun. 1993 and Jan. 1998 were not as important. The results obtained are shown in the table 9.

Table 8: ERROR CORRECTION MODEL 2 (ECM 2)

Modeling DLZSE by OLS after adjusting for a structural break, s1998 (8)

Variable	Coefficient	Se	t-value	t-prob
Constant	-0.00377	0.0087	-0.431	0.6672
Dlzse_1	0.294	0.0856	3.437	0.0009
DLJSE	0.20888	0.10487	1.992	0.0492
E_1	-0.0855	0.02435	-3.513	0.0007
S1998 (8)	0.036989	0.0212	1.745	0.0842
Dlzse_3	0.35225	0.0863	4.078	0.0001

$R^2 = 0.328$ F (5, 98) = 9.5738 (0.0000) DW = 2.1 RSS = 0.5937

Diagnostic tests

AR 1-3 F (3, 95) = 0.501 (0.2193)

ARCH 2 F (2, 94) = 2.137 (0.1237)

Normality chiy (2) = 0.28219 (0.8684)

Reset F (1, 97) =1.0879 (0.2995)

Test of functional form

CHIY (2) = 34.286 (0.0459) and F-form (22, 73) = 1.6556 (0.0570)

AR – test for autocorrelation

ARCH – test for the autoregressive conditional heteroscedasticity

Reset – test the specification of the model

A host of these diagnostic tests suggest that the model used in the study does not violate the classical assumptions and that the model is well specified.

4.3 INTERPRETATION OF RESULTS

It is in this study evidenced that linkages between the two stock markets under review have increased over time, given that co-integration was not found in the first period (1980 -1990) but was found in the second period which is the time from 1991-1999. This serves as an interest in the fact that it indicates an increasing degree of co-movements of stock indices between the two markets. The two markets have thus exhibited a common trend during the period 1991-1999 as compared to the period 1980-1990. What this implies is a long run relationship between stock market indices in the two countries. If two markets are co-integrated, stock prices in the two markets will tend to follow each other. The stock price index in Zimbabwe thus consistently corrects towards the long run equilibrium value of the relative stock price in South Africa. Future fluctuations of the Zimbabwe Stock Exchange index are now determined or forecasted to some extent, using part of the information set provided by the Johannesburg Stock Exchange index. Benefits from an globally diversified portfolio appear restricted by this co-integration result, since there are now fewer assets available to portfolio holders than a simple count of the number of stocks would suggest. From a long-term investor's perspective, if prices set in the two national stock markets share a single common trend like this, no long-term gains can be made from international diversification. Furthermore, such results would mean that the local responses to a single international common factor would tie the two equity markets together. However, this is not to say that short-term international diversification gains are impossible, but such gains would be subject to the magnitude and enduring nature of any transitory deviation from the stochastic trend as well as the time horizon of the investor.

The co-integration relationship between Zimbabwe Stock Exchange and the Johannesburg Stock Exchange indices allows us to apply the Granger representation theorem, which leads to an ECM model of the data in Table 9. According to the ECM, a relationship such as equation 1 expresses a complex equilibrium path. A deviation from this equilibrium path is regarded as an error correction term reflecting the current error in achieving the equilibrium. The error correction term is negative and highly important

which indicates the importance of the long run relation between the Zimbabwe Stock Exchange and the Johannesburg Stock Exchange indices. Other methods from the long run equilibrium path immediately lead to corrections in the following period. If for example, the Zimbabwe Stock Exchange index was too high as compared to the long-term equilibrium level, it will lead to a downward correction in the following period. The long run causal relationship is implied through the significance of the "t" test of the lagged error-correction term. This indicates changes towards the long run relationship and therefore reinforces the acceptance of the co-integration relationship. The error correction term shows that about 9% of the long run dis-equilibrium is corrected within a month. This is reasonably low and suggests that there is a slower adjustment rate to the long run equilibrium. The implication of this is that in the short term, deviations from the long run equilibrium will feed back, but at a slower rate, on the changes in the Zimbabwe Stock Exchange index in order to force the movement towards the long run equilibrium. Since the Zimbabwe Stock Exchange index is directly driven by this long run equilibrium error, it responds to this feedback.

The estimated short run elasticities show that the impact of changes in the Johannesburg Stock Exchange index is relatively low. The short run elasticity of the Zimbabwe Stock Exchange index with respect to Johannesburg Stock Exchange index was found to be positive at 21%. This implies that a 1 % increase (decrease) in the Johannesburg Stock Exchange index will cause a 21% increase (decrease) in the Zimbabwe Stock Exchange index. This responsiveness of the Zimbabwe Stock Exchange to changes in the Johannesburg Stock Exchange index, although relatively inelastic, is reasonably high, showing that a crisis in South Africa is most likely to be transmitted to Zimbabwe. The sign of the coefficient also shows that the returns of the Zimbabwe Stock Exchange stocks are largely positively related to those of the Johannesburg Stock Exchange. There is therefore a risk of contagion in Zimbabwe. The sign is consistent with theory and some experiment work done before this study, which says that markets tend to move together in the same direction over a period of time. The co-movements between the South Africa and the Zimbabwe stock markets are fairly high. The R^2 was found to be approximately 33%. This low R^2 was the expected given that the data is cross-sectional; indicating that

the Johannesburg Stock Exchange index movement explains not all of the movements in the Zimbabwe Stock Exchange index. The movement in the Johannesburg Stock Exchange index further elaborates only about 33% of the variation in the Zimbabwe Stock Exchange

4.4 DISCUSSION AND CONCLUSION

The empirical analysis has shown that:

(i). A downward movement in the Johannesburg Stock Exchange will generally exert the same downward influence on the Zimbabwe Stock Exchange index, and vice versa.

(ii). The Zimbabwe Stock Exchange index has a tendency to make up for any losses or gains in the next month.

The two points above as a result suggest that the two markets are now linked, although this link is not very strong. The finding of bivariate co-integration between the two markets for the time ranging from 1991(1) – 1999(12) proves this. A reference to the correlation analysis also suggests that the correlation coefficient between the two markets has drastically increased between the two sub-periods. This reiterates the idea that the strength of linkages has increased overtime between the two sub-periods.

Strategically, if one perceives an established trend in the South African market, one has a tendency to imply a similar pattern in the Zimbabwean market even if the Zimbabwean domestic fundamentals are not entirely in support of the trend. Evidence of bivariate co-integration suggests the future fluctuations of prices of one market can be determined or to some extent, using part of the information set that is provided by the other stock price indices.

This is in sharp comparison to the results by Jefferies et al 1997 who failed to find any co-integration relationship between the three Southern African stock markets (Botswana, South Africa and Zimbabwe). Although the stock market indices were integrated of order one, co-integration was still not found. This might have been due to the fact that they used high frequency data (weekly stock market indices) that are more volatile and subject to momentary noise behavior by investors. Their time of study also differs from this study. Although they also segmented their sample into two (pre and post liberalisation), the length of their sub-samples was relatively short that it is possible to assume that this is a very strong reason that they might have led to the results that were found. A brief analysis of the correlation coefficient results by Jefferies et al shows that they were even

falling over time. In contrast to the macroeconomic events that took place since 1991, which are necessary conditions for financial market linkages, their results suggest that the extent of linkages has been decreasing over time. However, this study got the reverse result. It found that linkages have been increasing over time.

CHAPTER 5

CONCLUSION AND POLICY IMPLICATIONS

5.0 CONCLUSION

The tests of the long run relationship between markets were analyzed and it was found that the in the second period, 1991(1) – 1999(12), the markets were integrated. This verifies the existence of long run relationships linking stock price indices in the two South Africa Development Community (SADC) countries in the post financial liberalization period as compared to the pre financial liberalization period. The hypothesis of Co-integration between the two markets - which would imply that both markets share common trends and react similarly to exogenous shocks - cannot be rejected, based on both the Engle and Granger procedure, and the Johansen technique. The reason for that is the significant liberalization of the two markets, coordination of stock market policies in the SADC, rapid expansion of trade between the two countries, technological advancement, free capital mobility and the macro economic coordination between these two markets since the acceptance of South Africa into SADC. It was then possible to estimate the short run effects of changes in the South African stock market over the Zimbabwean market. Using the ECM, the estimated elasticity shows that the Zimbabwe Stock Exchange index is fairly responsive to the Johannesburg Stock Exchange index.

This paper provides new empirical evidence on the international stock market linkages between the ZSE and the JSE. The results show that the degree of stock market linkages has increased over time.

The results have very important results for international portfolio diversification. If stock markets share a common trend, it means that the markets move together and any market will be representative of the behavior of the other market. This means that investing in the Zimbabwe Stock Exchange and Johannesburg Stock Exchange will provide no long-term rewards to portfolio diversification. Such diversification is prospectively ineffective,

as gains from it are limited because some of the unsystematic risk cannot be diversified away. This is very unfortunate to investors with long run international diversification horizon. The finding of co-integration between the two markets also implies that the risk of contagion is now high since the spread depends on the degree of financial market integration. Since the two markets' linkages have improved, asset prices tend to move together. The higher the degree of linkages, the more extensive could be the contagious effects of a common shock or a real shock to another country.

Asset prices on the Zimbabwe Stock Exchange are no longer determined wholly by national factors. International factors are now important in determining the direction of the Zimbabwe Stock Exchange. Some analysts have been arguing that activities that have transpired on the Zimbabwe Stock Exchange defy logic since they do not reflect the fundamentals of macroeconomics. This co-integration relation found between the two markets can partly explain the weak relationship between the domestic macroeconomic fundamentals and the performance of the Zimbabwe Stock Exchange. The South African stock market helps explain the movements of the Zimbabwe Stock Exchange.

A review of institutional and technological changes, which occurred in the 1990s, suggests that, while such relationships were unlikely before 1990, the two markets being examined, will now be expected to move together. The increase in the extent of integration can be explained by the removal of barriers, which were preventing free capital flows in the 1980s, along with the disappearance of market flaws in the form of high costs and information acquisition difficulties. Before 1991, considerable barriers prevented capital mobility. After 1991, the barriers to capital flow were removed leading up to the increased flow of capital across local boundaries, globalisation of financial markets, relaxation of capital movements and the increasing importance of cross border equity flows. This growing linkage of stock indices may be a reflection of increasing policy coordination across the SADC region and national stock markets. Our expectations that in the early period (1980-1990) there is no evidence of co-integration, stating that the stock markets were relatively unrelated, and that in the latter period there is evidence of co-integration has been confirmed.

The increasing international character of Zimbabwean and South African stock markets is now seen in the number of international securities on the two stock market exchanges. In the early 1980s, the number of listed multinational companies was insignificant. While only a small proportion is of sufficient size to lend them to active international trading, these companies represent approximately 70% of the market capitalization. Accordingly, their influence on turnover and price largely exceeds their number. In general terms if prices of the leading international shares change then other sectors of the market are most likely to be affected.

5.1 RECOMMENDATIONS

5.1.1 Policy Recommendations

The results clearly state that it is no longer a possibility for monetary authorities in the region to formulate and implement their policies independently. There is now a need for them to harmonize their general economic policies since their markets are now interdependent. Increasing the stock market co-movements facilitate the gradual, progressive connection of the financial system in the region. The time has come for an acceleration of merger activities among the SADC stock markets.

Potentially, the findings introduce new laws, rules and taxation which could prove to have dramatic challenges to asset managers. The ever changing correlation pattern makes it very difficult to select ex-ante optimal investment strategies. Furthermore, the observed general increase in correlation gradually does away with the advantages of international risk diversification more and more. Last but not least, since there is a positive link between correlation and volatility, investors and risk managers do not get the full benefits of international risk diversification in exactly those situations when most desired, namely in high volatility regimes associated with very high negative returns. The positive side of this unpleasant situation is that inter-market spreading; simply a broader form of diversification becomes more effective in this situation. An inter-market spread combines offsetting exposures in the two stock markets, and a high correlation between the two

markets implies the spread is much less volatile than outright exposures. There is therefore need for a prudent investment analysis and management.

5.1.2 Future Research Implications

Although studies of bivariate relationships may provide further details, they are not entirely useful for SADC policy making and at best act as a pre requisite for a more completely attentive analysis of relationships among the stock markets in a multiple setting. What is clear from this paper is that elaborating on the international stock market linkages requires a system-wide approach in order to disentangle what is in actual fact behind the observed relationships. This paper's examination of the co-integration properties of the two stock indices, whilst useful as a first step, does not in essence provide any explanation for the underlying forces, which are generating the linkages that are observed. For this analysis to be taken further, analysis of similar systems is required, with other countries included thusfar.

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APPENDICES

APPENDIX A: EQUATIONS FOR IAPT AND ICAPM

International Arbitrage Pricing Theory (IAPT)

The case without diversifiable risk

This assumes that the linear factor model gives the realized returns on securities as:

$$R_{IT} = U_{IT} + \beta_{I1}\delta_{1T} + ... + \beta_{IK}\delta_{KT} .....(1)$$

Where: R_{it} is the realized returns on asset I

$\beta_{t\,1}$ is the beta factor (the sensitivity of asset I to the ith source of risk)

$\delta_{I\,t}$ is the realisation of risk factor I in period t

$U_{I\,t} = E_{t-1}(R_{I\,t})$ is the expected return on asset I

In this case, where there is no asset specific risk; there could be a riskless, costless arbitrage opportunities unless:

$U_{I\,t} = \lambda_{0\,t} + \beta_{i\,1}\lambda_{1t} + \ldots + \beta_{i\,K}\lambda_K$ …….. (2)

Where:

$\lambda_{0\,t}$ is the return on a riskless asset

λ_{1t} is the risk premium on the ith source of risk.

More generally, expected returns could be expressed as:

$U_{I\,t} = \alpha_j + \lambda_{0\,t} + \beta_{j\,1}\lambda_{1t} + \ldots + \beta_{jK}\lambda_{K\,t}$ ……..(3)

Where α_j is the pricing error or deviation of expected returns from the predictions of the multi factor asset-pricing model.

In this case, $\alpha_j = 0$ for all j so that no arbitrage opportunities are possible. If not, then this portfolio is riskless and costless and has strictly positive returns. This is an arbitrage opportunity that can be exploited and therefore leading investors to buy foreign and domestic shares.

The case with Diversification Risk.

Equation 1 for asset returns assumes that there are only k worldwide factors affecting all asset returns. This equation is generalized to include uncertainties that are asset specific or diversifiable as:

$$R_{Jt} = U_{Jt} + \beta_{j1}\delta_{it} + ... + \beta_{jk}\delta_{kt} + \mathrm{E}_{jt} \quad \text{.....(4)}$$

Where the new variable $E_{j\,t}$ is the uncertainty in asset J's returns that is not explained by the worldwide factors.

International Capital Pricing Model (ICAPM)

The ICAPM assumes that the expected returns of a stock is linearly related to its systematic risk, where systematic risk of a security is defined to be the covariance of the asset return with the return of the market portfolio divided by the variance of the market portfolio return.

$$E(R_{IT}) = R_{ft} + \beta_j \left[E(R_{wt}) - R_{ft}\right]$$

$$= \frac{\mathrm{cov}(R_{wt}; R_{it})}{\mathrm{var}(R_{wt})}\left[E(R_{wt}) - R_{ft}\right]$$

Where Rw_t is the world return

R_{ft} is the risk free return

$E(R_{i\,t})$ is the expected return on any asset

Cov is the covariance

Var is the variance

APPENDIX B: COINTEGRATION TESTS

Table 9: COINTEGRATION TESTS 1980(1) - 1990(12)

Based on Maximal Eigenvalue

Null	Alternative	Statistic	95%	90%
R=0	R=1	5.6255	18.33	16.28
R<=1	R=2	0.41319	11.54	9.75

Based on Trace

Null	Alternative	Statistic	95%	90%
R=0	R>=1	6.0387	23.83	21.23
R<=1	R=2	0.41319	11.54	9.75

No cointegration was found here.

Table 10: COINTEGRATION TESTS 1980(1) - 1999(12)

Based on maximal Eigenvalue

Null	Alternative	Statistic	95%	90%
R=0	R=1	14.2534	18.33	16.28
R<=1	R=2	5.1856	11.54	9.75

Based on Trace

Null	Alternative	Statistic	95%	90%
R=0	R>=1	19.439	23.83	21.23
R<=1	R=2	5.1856	11.54	9.75

No cointegration was found.

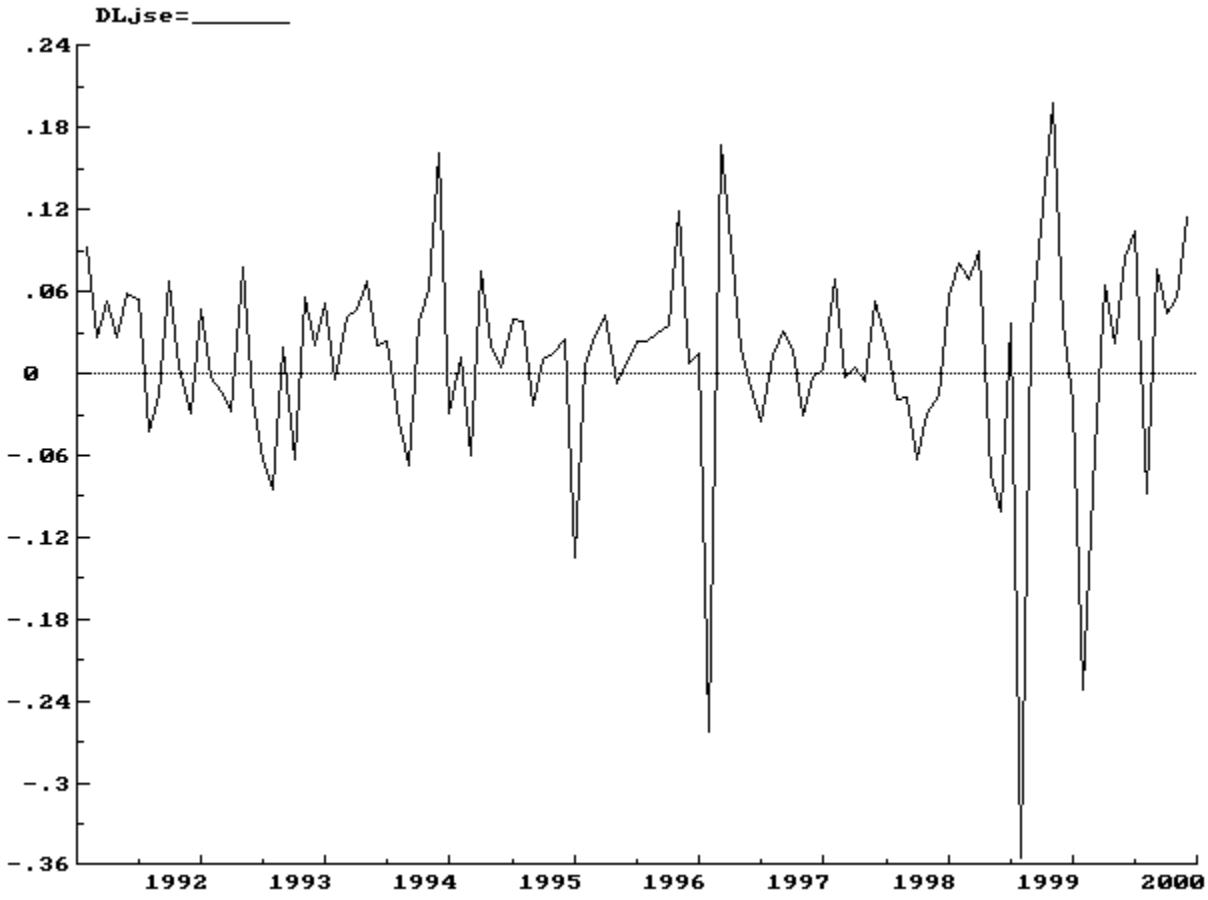
APPENDIX C: SUMMARY STATISTICS

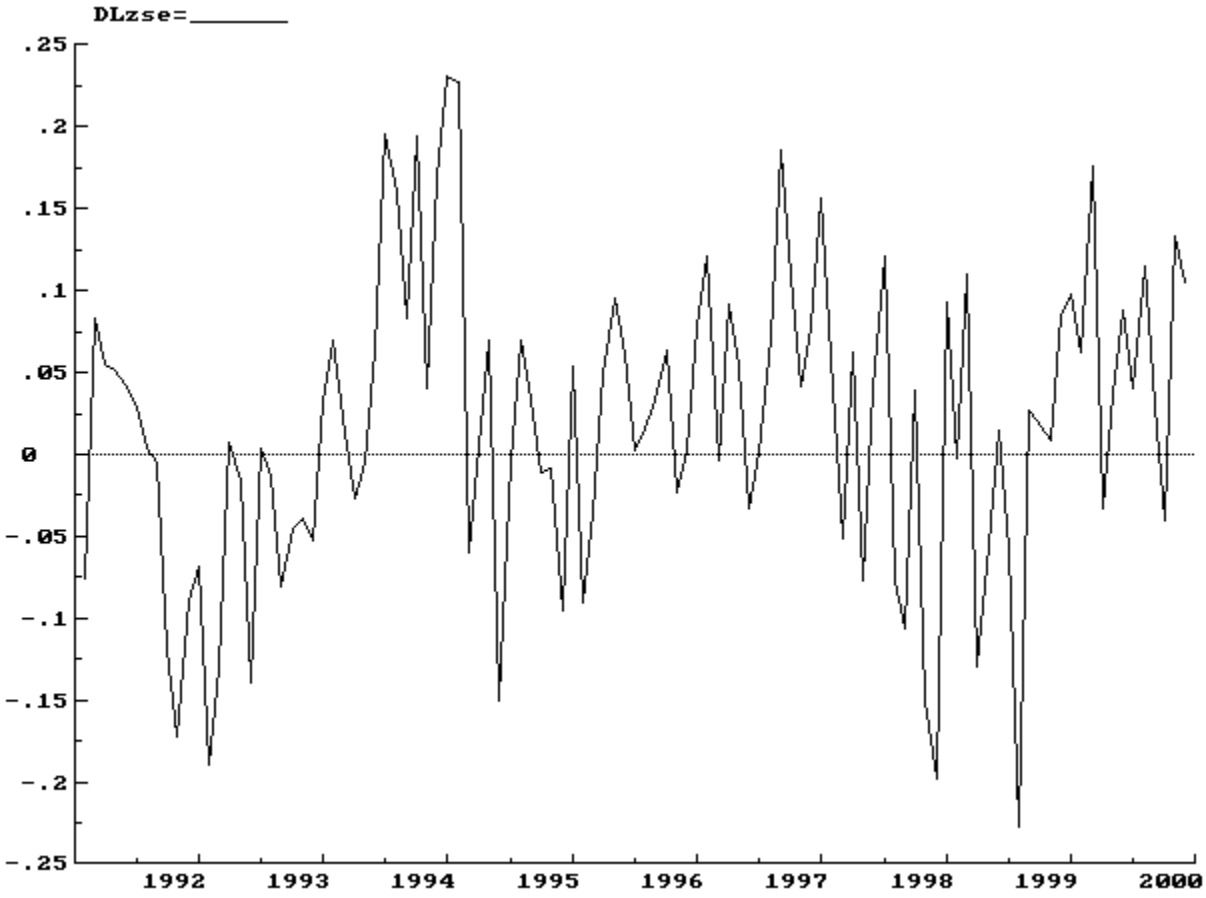
Figure 1: STOCK MARKET INDICES (LOGS) IN LEVELS; IN ZIMBABWE DOLLER TERMS



Figure 2: STOCK MARKET INDICES IN FIRST DIFFERENCES: 1991(1)-1999(12)

JOHANNESBURG STOCK EXCHANGE (DLJSE) AND ZIMBABWE STOCK EXCHANGE (DLZSE)




DLzse=_____
.25
.2
.15
.1
.05
0
-.05
-.1
-.15
-.2
-.25
1992
1993
1994
1995
1996
1997
1998
1999
2000

APPENDIX D: RECURSIVE GRAPHICS

Figure 3: RECURSIVE GRAPHICS

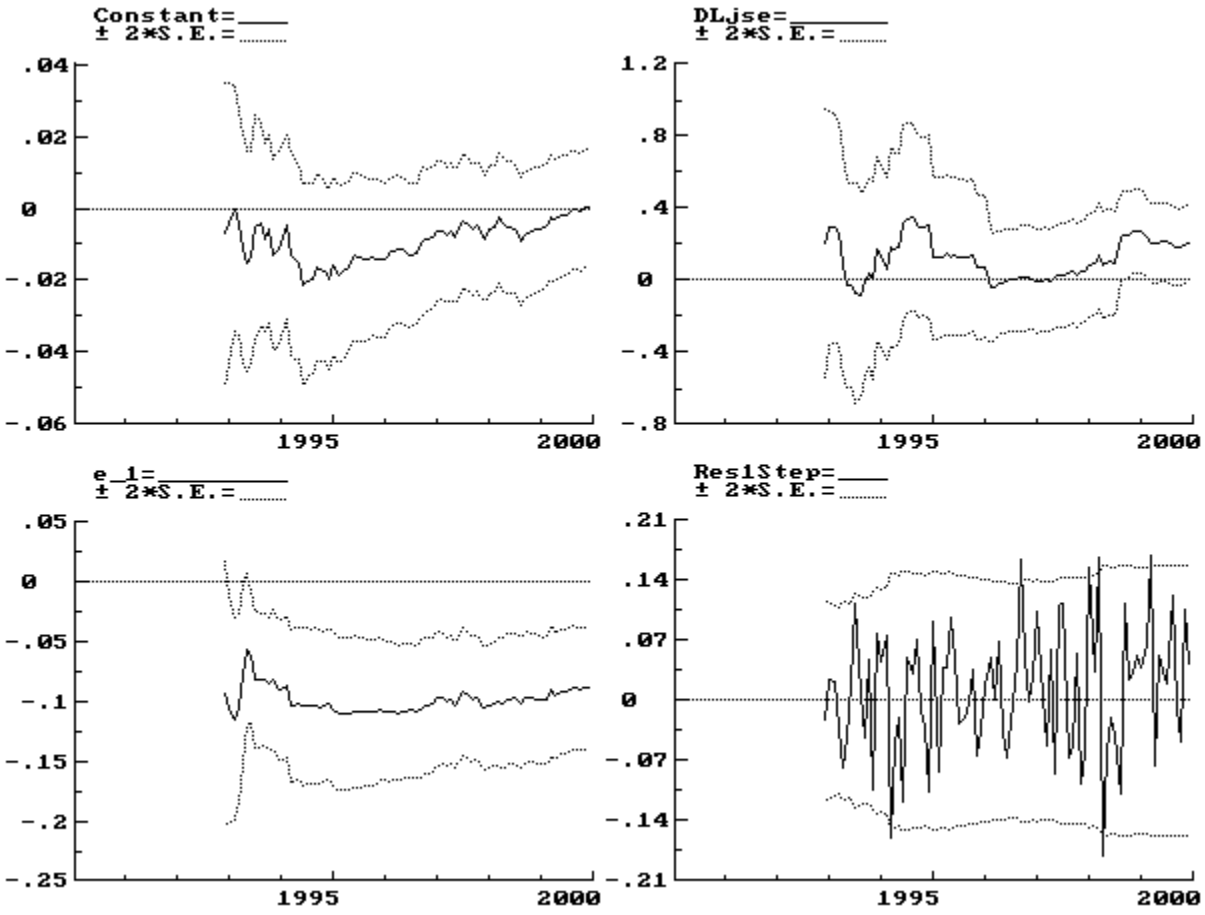
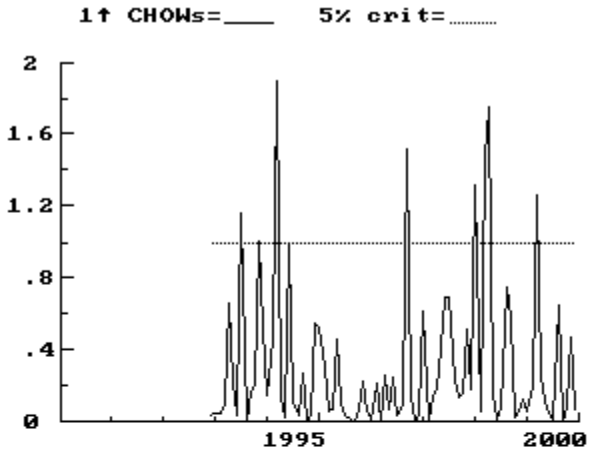


Figure 4: CHOW TEST FOR STABILITY



APPENDIX E: DATABASE

	zse index 1967=100	mark cap: zim	zse: index 1994=100	Market cap: SA	jse index 1967=100	jse INDEX 1994=100
1991-1	2254.89		76.97735629		2,555.5	53.74794935
1991-2	2090.96		71.38111966		2,803.4	58.96184747
1991-3	2271.39		77.54063271		2,877.1	60.51192529
1991-4	2399.54		81.91541295		3,033.1	63.7929584
1991-5	2525.01		86.19870344		3,114.8	65.51129433
1991-6	2636.86		90.01703484		3,305.9	69.53055988
1991-7	2713.01		92.61664089		3,491.4	73.43204476
1991-8	2723.39		92.97099297		3,348.6	70.42863753
1991-9	2710.45		92.5292477		3,297.0	69.34337273
1991-10	2408.74		82.22948223		3,525.5	74.14924494
1991-11	2027.06		69.19970368		3,541.8	74.49207084
1991-12	1853.61		63.27847362		3,440.3	72.35729609
1992-1	1731.98		59.12627292		3,604.7	75.81500021
1992-2	1433.46		48.93540756		3,597.1	75.65515501
1992-3	1257.78		42.93804983		3,549.6	74.65612249
1992-4	1267.69		43.27635707		3,453.8	72.64123165
1992-5	1247.97		42.6031564		3,731.7	78.48609767
1992-6	1085.75		37.06529569		3,655.1	76.87502629
1992-7	1089.67		37.19911651		3,431.0	72.16169604
1992-8	1075.75		36.72391603		3,150.1	66.25373323
1992-9	992.49		33.88158905		3,211.4	67.54301098
1992-10	948.7		32.38668756		3,016.7	63.44802928
1992-11	912.17		31.13962769		3,192.2	67.13919152
1992-12	865.55		29.54811576		3,258.8	68.53994027
1993-1	893.69		30.50875809	598,354,334,813	3,432.8	72.19972027
1993-2	957.81		32.69768442	597,705,428,008	3,418.1	71.89125268
1993-3	971.03		33.14898832	617,021,770,222	3,560.0	74.87429016
1993-4	945.22		32.26788744	641,631,442,173	3,733.0	78.51319775
1993-5	940.93		32.12143557	680,889,215,243	3,992.5	83.97109326
1993-6	1002.82		34.23423423	694,139,132,647	4,077.9	85.76814874
1993-7	1219.39		41.62749335	706,665,436,362	4,176.7	87.84472721
1993-8	1430.35		48.82923848	682,270,567,231	4,034.3	84.850978
1993-9	1553.39		53.02957372	652,155,580,545	3,770.4	79.29991166
1993-10	1887.19		64.42482649	672,048,548,087	3,916.2	82.36722753
1993-11	1964.39		67.06027741	700,812,085,382	4,164.3	87.58405544
1993-12	2325.26		79.3796449	800,910,217,858	4,893.0	102.9105792
1994-1	2929.29	12810	100	785,960,455,246	4,754.6	100
1994-2	3678.14	16020	125.5642152	795,386,127,752	4,845.7	101.1992553
1994-3	3465.4	15244	118.3017045	749,433,201,674	4,939.1	95.3525329
1994-4	3483.09	15463	118.9056051	807,448,726,889	5,359.1	102.7340144
1994-5	3733.85	16725	127.4660413	824,651,529,846	5,396.1	104.9227762
1994-6	3211.48	14597	109.6333924	828,398,069,635	5,404.1	105.3994592
1994-7	3200.82	14632	109.2694817	862,402,463,577	5,651.9	109.7259357
1994-8	3432.8	15730	117.1888068	895,948,457,352	5,833.8	113.9940886
1994-9	3548.74	16828	121.1467625	875,555,886,116	5,676.1	111.3994833
1994-10	3509.01	16869	119.7904612	885,359,013,255	5,724.0	112.6467632
1994-11	3477.3	16710	118.7079463	898,661,833,571	5,756.3	114.3393192
1994-12	3160.8	14087	107.9032803	920,941,565,464	5,866.9	117.1740333
1995-1	3335.84	16498	113.8787897	804,795,455,372	5,054.1	102.396431

1995-2	3048.2	14917	104.0593454	810,232,011,483	5,147.1	103.0881396
1995-3	2942.03	16637	100.4349177	833,538,710,916	5,281.9	106.0535178
1995-4	3089.7	14845	105.476071	870,412,485,617	5,479.1	110.7450737
1995-5	3397.77	16211	115.9929539	863,911,998,482	5,471.4	109.9179981
1995-6	3614.1	17257	123.3780199	872,285,798,834	5,420.7	110.9834207
1995-7	3624.7	17452	123.7398824	893,558,962,025	5,438.5	113.6900662
1995-8	3683.78	17816	125.7567533	915,125,562,330	5,543.4	116.4340466
1995-9	3808.38	18166	130.0103438	942,420,647,475	5,657.3	119.9068784
1995-10	4056.9	19874	138.4943109	975,897,855,398	5,789.1	124.1662795
1995-11	3963.78	19396	135.3153836	1,099,853,446,473	5,972.1	139.9375044
1995-12	3972.62	19598	135.6171632	1,108,425,077,506	6,228.4	141.0280975
1996-1	4297.48	20894	146.7072226	1,125,420,343,805	6,870.9	143.190454
1996-2	4849.18	24925	165.541138	865,743,017,035	6,705.1	110.1509639
1996-3	4828.69	23509	164.841651	1,023,355,452,008	6,748.6	130.2044454
1996-4	5290.71	25864	180.6140737	1,126,131,722,615	6,976.3	143.2809647
1996-5	5584.2	27158	190.6332251	1,145,932,044,081	6,818.5	145.8002163
1996-6	5404.42	25801	184.4959017	1,134,818,800,359	6,878.7	144.3862465
1996-7	5408.77	39770	184.6444019	1,095,452,187,459	6,606.9	139.3775196
1996-8	5808.2	43049	198.2801293	1,110,510,337,266	6,689.4	141.2934111
1996-9	6992.15	49919	238.6977732	1,146,140,205,713	6,878.0	145.8267013
1996-10	7794.98	53999	266.1047558	1,167,472,827,117	6,975.3	148.5409119
1996-11	8125.48	54196	277.3873532	1,132,946,430,077	6,713.9	144.1480195
1996-12	8786.26	52362	299.9450379	1,130,551,336,699	6,657.5	143.8432849
1997-1	10276.12	58546	350.8058267	1,134,052,842,055	6,676.1	144.2887914
1997-2	10699.79	63193	365.2690584	1,215,543,795,970	7,145.2	154.6571189
1997-3	10169.97	62619	347.1820817	1,211,685,666,066	7,094.8	154.166238
1997-4	10825.82	67649	369.5714661	1,216,415,460,854	7,130.5	154.7680233
1997-5	10022.24	64968	342.1388801	1,208,932,500,335	7,021.7	153.8159448
1997-6	10437.4	64961	356.3115977	1,275,313,229,254	7,420.0	162.2617551
1997-7	11784.53	68585	402.2998747	1,304,814,604,933	7,484.5	166.0152997
1997-8	10905.34	63299	372.2861171	1,280,977,494,996	7,307.0	162.9824359
1997-9	9804.02	56940	334.6892933	1,259,218,154,242	7,123.4	160.2139326
1997-10	10192.41	50895	347.9481376	1,182,168,439,070	6,589.1	150.4106767
1997-11	8773.61	44460	299.5131926	1,148,632,347,152	6,326.3	146.1437836
1997-12	7196.43	35593	245.6714767	1,129,804,865,203	6,202.3	143.7483092
1998-1	7895.69	39708	269.5427902	1,196,141,086,020	6,550.3	152.1884566
1998-2	7879.47	39722	268.9890724	1,296,577,757,911	7,095.7	164.967302
1998-3	8795.71	43666	300.2676416	1,390,325,198,535	7,578.9	176.8950574
1998-4	7724.7	38505	263.7055396	1,521,214,390,703	8,235.5	193.5484642
1998-5	7307.72	36331	249.4706909	1,411,995,106,708	7,629.6	179.6521819
1998-6	7417.93	37681	253.233036	1,275,863,742,823	6,771.6	162.3317985
1998-7	7003.08	35470	239.0709011	1,324,460,234,997	7,020.4	168.5148694
1998-8	5577.74	29406	190.4126939	928,260,557,214	4,923.4	118.1052496
1998-9	5730.73	31371	195.6354612	956,557,342,915	5,098.6	121.7055307
1998-10	5832.5	32238	199.1096819	1,081,217,347,661	5,828.3	137.5663801
1998-11	5883.72	32681	200.8582284	1,317,575,311,448	5,620.9	167.6388809
1998-12	6408.4	35581	218.769736	1,366,623,850,142	5,430.5	173.879467
1999-1	7068.28	39304	241.2966965	1,336,666,106,772	5,799.1	170.0678575
1999-2	7524.34	42214	256.8656569	1,059,710,453,432	5,914.6	134.8299964
1999-3	8975.3	50830	306.3984788	1,001,556,459,840	6,382.5	127.4308972
1999-4	8679.71	48487	296.3076377	1,067,747,118,508	7,064.7	135.8525243
1999-5	9003.32	51080	307.3550246	1,090,936,155,984	6,488.8	138.802932

1999-6	9829.47	56816	335.5581045	1,188,092,728,132	7,048.0	151.1644409
1999-7	10229.46	65738	349.2129492	1,318,940,415,865	7,095.9	167.812567
1999-8	11476.82	74966	391.7952815	1,208,848,726,224	6,938.1	153.805286
1999-9	11825.41	77558	403.6954347	1,304,221,316,798	6,855.5	165.9398139
1999-10	11364.69	74542	387.9673914	1,364,058,546,893	7,153.1	173.5530761
1999-11	12988.39	86693	443.3972055	1,442,155,524,994	7,552.6	183.4895783
1999-12	14426.64	90383	492.4961339	1,616,207,006,873	8,542.8	205.6346469