THE EFFICIENCY OF THE JOHANNESBURG STOCK EXCHANGE: AN EMPIRICAL STUDY OF THE IMPACT OF UNITED STATES SANCTIONS-ORIENTATED DRAFT LEGISLATION INTRODUCTION IN 1988.

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ABSTRACT

The Anti-Apartheid Act of 1986, which was passed by the United States Congress, did not force disinvestment, but does preclude any new investments by United States persons in South Africa. Pressure for intensified sanctions culminated in the introduction of the Dellums-Wolpe Bill in the House of Representatives and the Cranston Bill before the Senate in the United States in May 1988. The Bills were in the main identical, and the main provision of the Dellums-Wolpe Bill stated that *"a United States person may not, directly or through a foreign affiliate of a United States person, make or hold any investment in South Africa"*.

Although the impact of the Bills on share prices listed on the Johannesburg Stock Exchange could have been significant, it was argued for the purposes of this study, that the increasing likelihood of the introduction of the Dellums-Wolpe Bill, and its subsequent passage by the House of Representatives on the 11th of August 1988 had a negative impact on the share prices of the study group used in this study, and that the informational impact of the effective withdrawal of the Bill on the 19th of October 1988, and the subsequent veto by Bush as the President of the United States, had a positive impact on the study group. Moreover, it was argued that the share prices impounded the information gradually over the said two periods, and therefore the study tests the efficiency of the Johannesburg Stock Exchange in the semi-strong form, and uses the market model for this purpose.

The results of the study showed that the share prices of the study group reacted in the expected direction except that the study of the impact of the effective withdrawal of the Bill and the veto of Bush was abandoned, as a result of the probable presence of confounding variables. Although the negative impounding was largely completed by the time that the informational generating event occurred for the study group as a whole, and in the sub-groups formed in the further analysis by partitioning, scope was left in most instances for the generation of material abnormal returns. By implication the share prices of the study group did not on average adjust efficiently to publicly available information. It was, therefore, concluded that the Johannesburg Stock Exchange is not an efficient market in the semi-strong form. Nevertheless, this conclusion must be qualified by recognizing, that it was at no time absolutely certain that the Bills would be passed into

law; thus the information generating events of this study were not specific and unambiguous events such as takeover or dividend announcements.

DECLARATION

I hereby declare that this dissertation is my own unaided work save to the extent indicated in the acknowledgements and the list of references.

I further declare that this dissertation or any part of it has not been previously submitted, nor is to be submitted, for any degree or examination in any other university.

GIL JOSE DA SILVA

15th of January 1989

DEDICATION

To my wife and children, my father and mother, and my brother.

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CHAPTER 1

INTRODUCTION

1.1 PURPOSE OF THIS STUDY

The introduction of the Dellums-Wolpe Bill before the House of Representatives and the Cranston Bill before the Senate in the United States in May 1988, is evidence of the increasing pressures to prohibit investment in South Africa. The Bills are in the main identical and it is clear from the definitions that South African equity shares are affected by their provisions. At this stage there is no certainty that the Bills will eventually be passed by Congress, although this would have been more likely had Dukakis been elected as President. Nevertheless, the risk profiles of South African equities may realistically be assumed to have been adversely affected since the introduction of the Bills.

The purpose of this study is to test the efficiency of the Johannesburg Stock Exchange by examining the impact of the Dellums-Wolpe Bill (and thus the Cranston Bill) on mining share price behaviour.

Two-stage time-series methodology will be employed. The study should:

- indicate to management and the investing public the nature and extent of the impact of the Dellums - Wolpe Bill on mining share prices. The main provision of the Bill states that *"a United States person, may not, directly or through a foreign affiliate of that United States person, make or hold any investment in South Africa"*;
- provide investors with information regarding the likely impact of the Bill in the event of it being passed by the Congress of the United States; and
- test the efficiency of the Johannesburg Stock Exchange with specific reference to listed mining shares, in the semi - strong form.

Although it is expected *a priori*, that the Dellums-Wolpe Bill had a negative and adverse impact on mining share price behaviour, it is quite possible that the the impact was insignificant or contrary to expectations, in which case the informational efficiency of the Johannesburg Stock Exchange might be questioned. However that outcome may equally be the result of confounding variables, which were not identified in this study, particularly as the Dellums-Wolpe Bill cannot be regarded as a specific information generating event such as a takeover or a dividend announcement, firstly,

because its introduction took place as part of an ongoing political process and secondly, because the Bill itself pointed to possible legislation, but it was by no means certain, that it would inevitably be passed into law.

1.2 OBJECTIVES OF THE STUDY

MAIN OBJECTIVES

The main objectives of this study are to determine whether:

a) the Johannesburg Stock Exchange is efficient in the semi-strong form; and
b) the mining shares listed on the Johannesburg Stock Exchange reacted rapidly and accurately in (an expected) negative manner to the informational content embodied in the initial information generating events, namely the introduction of the Dellums-Wolpe Bill, and its subsequent passage by the House of Representatives, and in a positive manner to the subsequent effective withdrawal of the Bill, and the election of Bush as the President of the United States.

SUB-OBJECTIVES

The sub-objectives of this study are to determine whether:

a) the residual returns of South African mining shares have increased since the introduction of the Dellums -Wolpe Bill in May 1988;
b) the market had anticipated the introduction of such proposed legislation significantly prior to May 1988;
c) the mining share prices reacted negatively as would be expected;
d) the negative impounding or absorption of information occurred rapidly or slowly;
e) the passage of the Bill by the House of Representatives on the 11th of August 1988 led to an increase in the expected negative residual returns;
f) there was a differential market reaction to high risk (high beta) shares;
g) there was a differential market reaction to mining shares in which United States persons hold a larger percentage of the issued share capital, or alternatively where the Rand value of a holding is larger (it may be argued that because of potential

substitution effects, all mining shares should be affected equally); and

h) whether the effective withdrawal of the sanctions legislation on the 20th of October 1988 (as a result of an announcement by Senator Alan Cranston) led to a decrease in the (previously expected) negative residual returns, and whether Bush's victory on the 9th of November gave momentum to this process.

1.3 SCOPE AND LAYOUT OF THE STUDY

This dissertation covers a specific area of modern financial theory, namely the Efficient Market Hypothesis, and specifically seeks to test its semi - strong form on the Johannesburg Stock Exchange with particular reference to mining share data. Chapter 2 sets out a review of the recent history of United States *"sanctions"* legislation. Chapter 3 provides an exposition of the background theory (of the Efficient Market Hypothesis), while Chapter 4 reviews the empirical research conducted on the Efficient Market Hypothesis in its various forms. Chapters 5 and 6 explain the research methodology used, and the source and nature of the data employed in this study, respectively. Chapter 7 shows the results of the research conducted, while Chapter 8 sets out the conclusions reached.

1.4 RESEARCH JUSTIFICATION

Overseas research has indicated in the main that the Efficient Market Hypothesis is applicable to the exchange where the research was primarily carried out, namely the New York Stock Exchange (Brown, 1987: 15). Subsequent studies have indicated that the London Stock Exchange and the Tokyo Stock Exchange are also efficient (Seneque, 1979: 18). Although inefficiencies have been identified, where information has been available to only a few insiders, in general inefficiencies are of an insufficient magnitude to generate abnormal gains. It remains unclear, however, as to the extent to which the Efficient Market Hypothesis holds.

In contrast recent studies on the Johannesburg Stock Exchange (Gilbertson & Vermaak, 1982; Knight & Affleck - Graves, 1983) have provided evidence of serious inefficiencies with reference to the semi - strong and strong forms of the Efficient

Market Hypothesi . The studies of the weak form (Gilbertson & Roux, 1977; Strebel, 1977) indicate evidence of dependence, and while this conforms to the results of overseas' studies, trading rules, which allow an investor to consistently outperform the market, are as yet undiscovered.

A recent study by Kana (1986) concluded that the Johannesburg Stock Exchange is efficient in the semi-strong form, in so far as the impounding of information relating to take-overs and mergers is concerned. The contradictory and relatively limited body of evidence regarding the efficiency of the Johannesburg Stock Exchange suggests that further tests of efficiency are required. This study seeks to test further the applicability of the Efficient Market Hypothesis in its semi-strong form to the Johannesburg Stock Exchange, in order to contribute empirically to the determination of the potential limits to the efficiency of the Exchange.

CHAPTER 2

HISTORICAL BACKGROUND

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HISTORICAL BACKGROUND

2.1 A BRIEF HISTORY OF THE US SANCTIONS THREAT

The preceding efforts to promote legislation in the United States to enforce sanctions on South Africa culminated in the passing of the so-called Anti-Apartheid Act of 1986 by the United States Congress in October 1986. The Act did not force disinvestment, but does preclude any new investment by United States citizens in South Africa. As a result new shares issued by South African companies after the 2nd of October 1986 may not be subscribed to by United States citizens or persons, and such new shares were denoted as S-shares, in order to be separately identifiable, although shares issued before that date could continue to be freely held and traded.

In May 1988 the Dellums-Wolpe Bill was introduced before the House of Representatives in the United States. The Cranston Bill was simultaneously introduced before the Senate. The Bills are largely identical, and have as their main objectives the prohibition of any United States investment in South Africa, the prohibition of all exports to and imports from South Africa, except for strategic minerals certified by the President as essential to the United States for military purposes, the specific prohibition of the importation of Krugerrands, and the authorization of the President *"to limit the importation into the U.S. of any product or service of a foreign country to the extent to which such foreign country benefits from, or otherwise takes commercial advantage of, any prohibition"* imposed under the proposed legislation. It is clear from the definitions in the Bills that their provisions would apply to all South African equity shares, and short of forming nominee companies offshore, there is little room for United States investors in which to manoeuvre. Penalties for violation are in any case severe. In terms of the draft Bill, the effective date of the Act would have been implemented 180 days after the date of enactment.

There is, at this stage, no certainty that the Bills will eventually be passed by Congress, although this would have been more likely to have occurred had Governor Dukakis been elected as President (in the 1988 Presidential elections in the United States held on the 8th of November 1988). Dukakis, the Democratic candidate, had endorsed the Dellums-Wolpe Bill, and had made a specific pledge at the United Nations that, as the President, he would not have vetoed mandatory sanctions. Given the importance of Black voters to the Democratic Party, these commitments had effectively tied

Dukakis's hands. As regards Bush, the Republican candidate, it is probable that sanctions-related legislation will be vetoed as a result of his election as President. It is, however, possible for the main provisions of the Dellums-Wolpe Bill to be "tagged on" to other, possibly unrelated, legislation at some future date. In this case it may become impossible to veto provisions, which are equivalent to those of the Dellums-Wolpe Bill (since that other legislation would also be affected by the veto). Moreover, it is probable that the Democrat-controlled Congress could eventually override any veto by Bush. To override a Presidential veto a two-thirds majority in both the House of Representatives and the Senate is required. The entire House of Representatives and one-third of the Senate was elected in November 1988, and the Democrats increased their majority in the Senate by two to twelve, while the Democrat majority was also slightly increased in the House of Representatives.

On the 11th of August 1988 the House of Representatives voted by 246 to 159 to take up the Dellums-Wolpe Bill, thereby enhancing the chances of the Bill being eventually passed by Congress. It is virtually certain, however, that the Bills will not be enacted by the United States Congress in 1988, since the Congress has to pass identical Bills for submission to the President, and the time-consuming House of Representatives-Senate conferences required,in order to achieve this objective, probably preclude the possibility of legislation in 1988. All legislation that has not been passed into law by the time that Congress dissolves at noon on the 3rd of January 1989, has to be abandoned, and any incomplete legislation may be re-introduced into the following Congress, which commences on the same day. The Presidential term in turn commences on the 20th of January 1989.

On the 19th of October, Senator Alan Cranston announced that the United States sanctions legislation was "dead", and that it would not be voted on during the course of 1988.

2.2 THE POSSIBLE IMPACT OF US DISINVESTMENT

A progressive decline in the foreign ownership of South African mining shares has occurred over the past six years. Table 2.1 shows the trend in foreign ownership over the period 1982 - 1987.

TABLE 2.1

YEAR	TOTAL FOREIGN OWNERSHIP OF SOUTH AFRICAN MINING SHARES (% OF SHARES ISSUED)
1982	33,7
1983	30,6
1984	27,4
1985	28,5
1986	26,6
1987	23,8

(Source: Brown & Cooper, 1988: 8)

A recent estimate (Warburg Securities, 1988: 12) of the present extent of United States holdings in South African mining shares in terms of total market capitalization is as follows:

TABLE 2.2

VALUE OF UNITED STATES' SHAREHOLDINGS: SECTORAL ANALYSIS

SECTOR	% OF TOTAL HELD	VALUE OF HOLDING R'billion	VALUE OF HOLDING US$ billion
GOLD MINES	16,0	10,0	2,50
MINING HOUSES	4,0	1,5	0,35
PLATINUM MINES	12,3	1,0	0,25
DE BEERS	16,0	3,5	1,00
ALL MINING SHARES	12,0	16,0	4,50

(Source: Warburg Securities, 1988: 12)

It is clear that under the more uncertain investment conditions, which have prevailed during the last few years, there has been a steady disinvestment from South African mining shares by foreign investors. Nevertheless, the prospect of compulsory disinvestment from the South African equity market, remains a critical threat to the well-being of foreign investors.

Although there is no certainty that the Bills will be passed in their present form, the proposed measure could in fact become law. In this event it is likely that mechanisms will be provided for the gradual withdrawal or phasing-out of United States holdings. The amount involved, namely $4,5 billion, is certainly sufficient to swamp the relatively illiquid financial Rand market, which is unlikely to be able to absorb even a fraction of this amount. The daily value of the actively traded financial Rand pool has been estimated at R500 million, although that value fluctuates over a very wide range (Warburg Securities, 1988: 13). The forced sale of United States holdings within a limited period, as is proposed in the present draft legislation, would therefore severely depress the financial Rand, thereby incurring substantial losses in US$ terms to foreign investors.

Market prices would necessarily fall sharply as a consequence of any enforced selling. Since the sale of securities would take place prior to any transfer via the financial Rand mechanism, share prices would initially take a tumble. Clearly the disruption would be temporary, as United States holdings are absorbed at potentially and literally bargain prices, and the financial Rand subsequently declines and ultimately absorbs the shock of disinvestment. The decline in the exchange rate of the financial Rand would lead to compensating increases in the Rand-denominated prices of South African mining shares, and therefore Dollar-denominated prices would take the brunt of any disinvestment.

Since the proposed legislation would affect shares currently in issue, and since new United States investment is already prohibited in terms of the Anti-Apartheid Act of 1986, there would in fact be no change to the status quo as regards the ability of South African industry to raise foreign capital. Similarly, the financial Rand mechanism facilitates disinvestment without South African reserves of foreign exchange being affected.

Clearly the South African economy would be adversely by the other provisions of the Bills relating to the prohibition of all imports and exports, except for strategic minerals. However, gold remains South Africa's primary export, and in 1987 South Africa produced 44% of the total non-communist world production (Warburg Securities, 1988: 11). It is unclear as to how South African gold could be prevented from reaching the United States market even in the event of the enactment of the Bills. Similarly the United States relies heavily on South Africa as a supplier of such minerals as chrome, platinum group metals, manganese, vanadium, asbestos and industrial diamonds, and its principal alternative supplier in many cases would be the USSR, a situation which may be assumed to be unacceptable.

The impact of the Dellums-Wolpe Bill is thus more limited than might at first be imagined. South African investors are ultimately protected by the safety-valve provided by the financial Rand, and in the light of present economic circumstances in South Africa, the proposed legislation does not, by itself, contribute to a marked deterioration of South Africa's position in world capital and trade markets, unless it is accompanied by mandatory international resolutions supporting the sanctions provisions of the Bills. Nevertheless, the Bills may influence investor sentiment in other countries throughout the world, in the sense that they may believe that ultimately the lead given by the United States will be followed by their own countries. Secondly, the passage of the Bills would probably lead to a tumble in the foreign prices of South African shares. A steady weakening in the overseas markets for South African mining shares should therefore have occurred since the introduction of the Bills, and may be expected to continue as a result of a pre-emptive and gradual withdrawal by foreign investors. It is thus anticipated that South African mining shares have shown increasing negative abnormal returns since the introduction of the Bills.

CHAPTER 3

THE EFFICIENT MARKET HYPOTHESIS: BACKGROUND THEORY

3.1 INTRODUCTION

The development of stock markets has resulted in the broadening of the ownership of companies, and concurrently in many cases, the separation of management from ownership. As a result of this separation, investors have increasingly turned to investment advisors and analysts, in order to determine those shares and securities, which potentially offer the highest returns.

Markets play an important role in the allocation of available resources. Farmers will, for instance, invest their resources in producing those agricultural commodities, which offer the highest potential profits, where these can be feasibly produced. In order to ensure the efficient allocation of available resources, and therefore the greatest possible economic welfare of a community or nation, it is both desirable and necessary that markets operate as efficiently and effectively as possible. At the same time those investors, who are able to identify the most profitable opportunities in any market, will yield the highest returns.

Two quite distinct approaches to investments analysis have developed over time, namely *fundamental analysis* and *technical analysis*. The fundamental analyst aims to study all the available information on a particular investment, in order to determine whether it is underpriced, in which case that investment would rate as a *"buy"*, overpriced, in which case that investment would rate as a *"sell"* or fairly priced, in which case the investment in question would be regarded as a *"hold"*. Fundamental analysts believe that markets are inefficient as far as the semi-strong and strong forms of the Efficient Market Hypothesis are concerned (these concepts will be explained in greater detail in the ensuing two sections of this chapter) (Kana, 1986: 12).

Fundamental analysis centres on the fundamentals of a company and includes inter alia the analysis of:

- historic growth;
- competitive position and market share;
- financial strength and the capability of expansion;
- the quality of earnings;

- the quality and track record of management;
- the risk attaching to the operations of the company, including business, operating and financial risk;
- the capacity for funding acquisitions; and
- prospects for future growth.

The fundamental analyst uses the company's financial statements, market research surveys, economic and industrial publications, management interviews and so forth in order to forecast a company's future earnings and dividends. By using discounted cash flow techniques, the analyst calculates the return which a share offers at the ruling price. In this way the analyst is able to formulate an opinion as to whether a share or other security offers value at the current price.

The technical analyst, in contrast, believes that it is sufficient to analyse historic price and volume trends, and in the case of chartists, the graphical formations discernable in these trends, in order to forecast the future price movements of traded securities. Technical analysis is based on the premise that at any point in time, a security's price reflects the sentiment of all investors and market participants, and the fundamentals are therefore already discounted in the price. By implication technical analysts reject the weak form of the Efficient Market Hypothesis, which, as a derivative of random walk theory, states that current securities prices fully reflect the information implicit in the historical sequence of past prices (Seneque, 1979: 18).

Markowitz (1952) came to the conclusion that the simplistic ranking of securities in terms of their expected returns would not necessarily provide the most optimal return to an investor. It is necessary to take into account the associated levels of risk. Being rational investors would seek the highest possible returns for the lowest risk exposure.

According to Markowitz it would be possible to identify suitable portfolios, which optimised *the expected return at a given level of risk, and consequently analysts should* attempt to determine the most efficient portfolio given the risk profile of a particular investor, rather than determine which specific shares offer the highest potential returns.

The economic processes underlying efficient markets play a number of important roles. Knight (1981) has commented on a number of these functions, including:

a) Stock markets facilitate the divorce of ownership from management. Prices reflect the market's rating of management performance.
b) Changes in shareholders do not affect the daily operations of the company. The *stock market provides a medium for* the exchange of shareholdings without disrupting operations.
c) Market prices assist management in determining the cost of capital.
d) Market ratings reflect the confidence of investors and therefore provides a measure of the risk of a company to shareholders, creditors, loan capital providers and other parties.
e) Share prices may reflect the relative inefficiency or ineffectiveness of a company in managing its resources. Competitors may therefore effect take-overs of poorer performers. In this way resources are re-allocated to more efficient companies.

3.2 THE ORIGINS OF THE EFFICIENT MARKET HYPOTHESIS

Developments in the concept of efficient markets in the last few decades owe a great deal to the work of Louis Bachelier.

Bachelier's study (1900) of commodity prices led him to the conclusion that the future trend of those prices was no more predictable than the path of a series of cumulated random numbers. In other words, prices follow a *"random walk"*, and the conditional and marginal probability distributions are the same. A knowledge of the sequence of past prices is therefore of no value in predicting the behaviour of future prices.

Modern work on the "random walk" theory gained impetus in 1958 as a result of Osborne's presentation of a paper titled "Brownian Motion in the Stock Market". In that *paper he stated:*

"It is the purpose of this paper to show that the logarithms of common-stock prices can be regarded as an ensemble of decisions in a statistical steady state, and that this ensemble of logarithms of prices, each varying with the time, has a close analogy with the ensemble of

co-ordinates of a large number of molecules".

Osborne found a significant similarity between share price movements and the the physical laws governing Brownian movement, which describes the random movement of tiny particles suspended in a solution.

Osborne concluded that *"the stock market [was] a fair meeting ground between buyers and sellers".* This supported Bachelier's contention that the [commodities] market was a *"fair game",* in that neither buyers nor sellers could be expected to show a profit from market inefficiency, and therefore the current price served as an unbiased estimate of the future price.

Roberts (1959) concluded that share price patterns common to technical analysis could be generated by using random numbers, and .us suggested that share price changes were in fact random. Empirical work conducted in the early 1960's (Moore, 1962; Granger & Morgenstern, 1963; Fama, 1965) provided substantial evidence in support of the random walk model. In particular Fama's analysis was of a higher quality than that of his predecessors, and demonstrated that the movement of share prices was random and that no future movements could be inferred from past trends or patterns. The assertion that successive share price changes are independent of each other has significant implications for both fundamental and technical analysis. In the case of fundamental analysis the implication is that at any point in time a security's price represents *"good estimates of intrinsic or fundamental values. Thus, additional fundamental analysis is of value only when the analyst has new information which was not fully considered in forming current prices, or has new insights concerning the effects of generally available information which are not already implicit in current prices"* (Fama, 1965).

In the case of technical analysis, any validity of the random walk model implies that, *unless analysts can consistently use their techniques to make meaningful and accurate* predictions of future prices, such analysis has no predictive validity (Fama, 1965).

The random walk model, should it in fact accurately reflect reality, raises questions as to the nature of the economic processes that yield such results. The answer lies in the

nature of the market itself. As a result of the empirical research conducted to test the random walk model, and the subsequent supportive evidence in favour thereof, the *Efficient Market Hypothesis was postulated, since in terms of the* Hypothesis it is impossible to "beat the market".

3.3 THE EFFICIENT MARKET HYPOTHESIS

An efficient market has been described as *"one in which the interaction of a large number of buyers and sellers results in prices that reflect publicly available information about the goods traded and that react virtually instantaneously to reflect new information as it becomes available"* (FASB, 1976: 39).

Another definition of an efficient market has been provided by Jensen (1978):

"A market is efficient with respect to a given information set if it is impossible to make profits by trading on the basis of that information set. By economic profits is meant the risk-adjusted returns net of all costs".

While the random walk model asserts that the change in the price of a security in any period is independent of preceding price movements, the Efficient Market Hypothesis postulates that the expected return, rather than the whole distribution of returns, is *independent of previous returns*, and is therefore equal to the equilibrium value anticipated by the market (Strebel, 1977). By implication it is impossible to employ trading rules, which will result in abnormal returns or returns greater than those expected by the market, in an efficient market.

The random walk model can be rejected, if statistically determined non-random behaviour can be demonstrated. In order to prove market inefficiency, it is, however, necessary to demonstrate further that such statistical non-randomness can be used to achieve returns which differ materially from the anticipated market equilibrium returns (Strebel, 1977). Nevertheless, the random walk model and the Efficient Market Hypothesis are interdependent. The greater the randomness, the more likely that the market is efficient, since increasing non-randomness provides increased opportunities for the employment of investment strategies, which may result in superior returns.

The hypothesis described above, namely that at any point in time, all prices "fully reflect" all publicly available information is too general to provide empirically testable assertions. In order to circumvent this problem three levels of market efficiency have been defined, since *"general statements(s) of the model are improvable in a direct way"* (Henfrey, Albrecht & Richards, 1977: 6).

3.4 THE DIFFERENT FORMS OF THE EFFICIENT MARKET HYPOTHESIS

Three forms of the Efficient Market Hypothesis have been defined, namely:

a) the weak form;
b) the semi-strong form; and
c) the strong form.

The weak form is directly derived from the random walk model and states that *"current share prices fully reflect the information implied by the historical sequence of past prices"* (Seneque, 1977: 18). Thus past price changes cannot be used to predict future price changes. Thus technical analysis is rendered useless under the weak form of the Efficient Market Hypothesis, since share price behaviour conforms to random walk (Henfrey, Albrecht & Richards, 1977).

The semi-strong form asserts that *"current share prices fully reflect all publicly available information"* (Seneque, 1977: 18). Thus investors cannot generate different returns to those anticipated by the market by using information, which is generally available, and it is impossible to achieve superior returns to a "buy and hold" strategy.

The strong form states that *"share prices reflect not only what is publicly known about the company but also what is knowable; that is, the activities of analysts and others make it impossible for investors, who pay transaction expenses, to achieve a consistently superior risk adjusted performance"* (Henfrey, Albrecht & Richards, 1977). Thus all information, whether it is publicly available or not, is fully reflected in the current share price. Ultimately the implication is that even insider trading cannot yield superior performance consistently.

3.5 ASSUMPTIONS UNDERLYING THE EFFICIENT MARKET HYPOTHESIS

Under the Efficient Market Hypothesis the ruling price is the best estimate of value. There are a number of assumptions underlying efficient markets, of which the most important are a homogeneous product, that there are no limits to the supply of securities (i.e. the securities are tradeable), that there are many buyers and sellers and that there are no market entry or exit barriers (Kana, 1986: 10). Nevertheless it is important to distinguish between *"perfect"* and *"efficient"* markets.

Copeland and Weston (1979: 197) have defined four pre-requisites for perfect [capital] markets, namely:

- markets are frictionless, since there are no transaction costs, taxes or regulatory constraints. All assets are perfectly divisible and marketable;
- there is perfect competition;
- information is costless and received simultaneously by all the market participants; and
- all individuals are rational and concerned with the maximization of utility.

The previous definitions of efficient markets are much less restrictive than those required for a perfect market. A market can be efficient without being frictionless. Similarly costless information is not a necessary condition for market efficiency, nor is it necessary to have perfect competition (Cornell & Roll, 1981), since prices may still fully reflect all publicly available information or all information, as the case may be, even under imperfect competition or monopoly conditions. It is also not a necessary condition for all individuals to receive the same information, or to receive it simultaneously, since prices are set at the margin.

The Johannesburg Stock Exchange (JSE) is a market in which many buyers and sellers participate, and in terms of the regulations of the JSE a minimum number of shareholders is required for listed companies. This assists in promoting tradeability, although Strebel (1977) and Saloner (1977) have shown that the JSE is only efficient with respect to shares having an annual trading volume in excess of 200 000 respectively. Because of the role that large institutions play on the JSE, approximately

fifty per cent of listed shares have annual trading volumes less than 200 000 (Kana, 1986: 11).

Saloner and Strebel (1977) also demonstrated, that at average annual trading of less than approximately 250 000, the beta risk co-efficient is volume dependent. Thus the lower the volume, the lower the beta, and similarly the share's market risk (the ex-post beta estimate) is determined by trading volume, rather than inherent riskiness. For the purposes of this study only those shares having an annual trading volume in excess of 250 000 will be considered.

Secondly, the JSE is not a frictionless market. However, transaction costs are fixed and determinable, and as has been indicated above, this is not a necessary condition for market efficiency. Nevertheless, the system of taxation in South Africa may affect efficiency, since the distinction between capital (non-taxable) and revenue (taxable) transactions is a grey area. However, it may be argued that this does not by itself affect the ability of the market to fully reflect available information, but rather the efficient allocation of resources in the economy.

As regards the homogeneity of products, the JSE complies with this condition. Each listed share or security confers the same rights on the holder as any other share or security of that class.

3.6 OTHER MODELS OF EFFICIENT MARKETS

3.6.1 The Fair Game Model

As has been indicated by Fama (1976) a test of the efficiency of the market presupposes a model of market equilibrium. Tests of market efficiency simultaneously imply a test of the market model, and, although evidence of the absence of superior returns may support market efficiency, the same results *"might imply an invalid market model, and thus, preclude any conclusion with respect to market efficiency"* (Strebel, 1977: 15).

The term "fully reflects" requires more specific definition, since it is so general, that it cannot be employed by itself for empirical testing. It is usually assumed that the expected return of a security is a function of its risk, and therefore that market equilibrium conditions may be expressed in terms of expected returns. *"The basic model of market equilibrium is then the "fair game" expected return model"* (Gilbertson & Roux, 1977: 21). In terms of this model differences between actual and expected market prices are compared, and the differences are expected to equal zero. In a fair game abnormal returns cannot be generated.

3.6.2 Martingales and Submartingales

In order to test the Efficient Market Hypothesis, it is necessary to define more specific models than the fair game model. One such model is referred to as a martingale, and asserts that the expected price of a security in the next time period is the same as the current price. If a price sequence follows a submartingale model, then the expected value of the next period's price is equal or greater than the current price. In the case of a martingale the expected price change is equal to zero.

3.6.3 The Random Walk Model

The Random Walk Model asserts that *"the change in a share's during any period is in no way dependent on previous price changes"* (Strebel, 1977: 15). Moreover, a random walk model is more restrictive than the fair game or martingale models, since all the moments of a distribution must remain the same with or without the information set or sequence, and the mean of the underlying distribution must remain constant. In this event a "fair game" will result, and actual returns will conform to expected returns (Samuelson, 1965). The "fair game" model asserts that the conditions underlying market equilibrium can be expressed in terms of expected returns, but it does not provide information regarding the economic processes which yield that result, whereas the random walk model incorporates a specific stochastic process with specific properties (Gilbertson & Roux, 1977). [Van Rooyen (1976) has proposed five different types of random walk, and the reader is referred to this article for further information, as a more detailed discussion of

this topic is beyond the scope of this dissertation).

3.6.4 The Price Trend Model

This model was developed by Taylor (1980) as a more accurate description of share price behaviour than the random walk model. Formally the definition of the model is similar to that given for random walks, except that a stochastic process is also defined for the trend component in the model. ("*A stochastic process can be conveniently imagined to consist of the performance of a succession of random experiments, each experiment determining the value of one random value*" (Gilbertson & Roux, 1977: 21)).

CHAPTER 4

A SURVEY OF EMPIRICAL RESEARCH ON THE EFFICIENT MARKET HYPOTHESIS

4.1 INTRODUCTION

This chapter sets out a survey of the empirical work conducted on the Efficient Market Hypothesis. Both the research results and the methodologies used, where necessary, will be reviewed. The following review of the research has been categorised according to the form of the Efficient Market Hypothesis, on which the research was conducted. Empirical tests on the Efficient Market Hypothesis rely partially or wholly on the expected returns, as derived from the model, against which subsequent and actual returns may be compared. However, the validity of the expected return is a function of the Efficient Market Hypothesis, and therefore in order to test the Efficient Market Hypothesis, its validity must be assumed (Brown, 1987).

The following survey has not been strictly presented in chronological order, and emphasis has been placed on research conducted on the semi-strong form, which is the specific area of concern of this dissertation. It is also of interest to note, as Fama (1970: 383) has succinctly stated, that *"to keep the proper perspective....to a large extent the empirical work in this area preceded the development of the [efficient market] theory"*.

4.2 RESEARCH ON THE WEAK FORM

This research originated from work on the random walk model. Bachelier (1900) was the first analyst to define and test the random walk model, and his study of commodity prices led to his conclusion that they followed a "random walk". Bachelier's basic assumption was that prices should behave in such a manner that the abnormal profit of any investor was zero, and thus commodity speculation would amount to a "fair game", but the stochastic process implied by this assumption is in fact a martingale rather than a random walk (Kopinsky, 1984: 113).

In order to test the validity of the random walk model, most researchers undertook tests to determine whether or not individual prices within a price series were independent of each other. This was accomplished in the main by calculating serial correlation co-efficients for various lags or by applying the Wald-Wolfowitz runs test, or various modifications thereof.

Bachelier's analysis was neglected for many years, until Kendall (1953) performed a similar analysis and found evidence of random walk. These results were supported by Cowles (1960), but both Kendall and Cowles found that, for a few securities, the series had a greater autocorrelation co-efficient, which went against the notion of a pure random walk. Working (1960) demonstrated, however, that spurious autocorrelation results, where raw data has been averaged in some form.

Roberts (1959) demonstrated that random numbers could generate price changes that resembled actual price movements. Each outcome was statistically independent of preceding outcomes. Similarly, Osborne (1958) found a significant similarity between share price movements and the Brownian movement, which describes the random movement of tiny particles in a solution. Both these studies provided support for the random walk model.

Fama's seminal work in 1965 formed the beginning of the formal development of the Efficient Market Hypothesis. His objective was to prove that a *"series of price changes has no memory, that is, that the past cannot be used to predict the future in any meaningful way"* (1965: 34). Fama examined the daily prices of thirty shares between 1957 and 1962. In order to prove his point, it was necessary to show that prices followed a random walk, and thus that successive price changes are independent, and that price changes conform to an appropriate probability distribution. Fama found that the autocorrelation co-efficients behaved on the whole as if the elements in the underlying population were independent. Similarly, for the runs tests there were no more long runs (the duration of successive price changes) than would be expected under the hypothesis of independence. The results obtained were remarkably similar to those that would have been expected had the prices within the series been totally independent. Moreover, he found that daily price changes were distributed in a stable Paretian distribution, which is *"the only possible limiting distribution for sums of independent, identically distributed random variables"* (1965: 44). This departure from the normal distribution could have been the result of patterns of dependence in successive price changes, indicating a shift in the mean of the underlying price movements. The evidence did not provide support for this contention, however, since the outliers were too extreme to be accounted for in terms of a shift in the mean.

Fama (1965) observed that large daily price changes tended to be followed by changes of similar magnitude, which would suggest evidence of dependence. The signs of these successive changes were, however, totally random, indicating that while these results went against the random walk model, they did not refute the Efficient Market Hypothesis. Fama (1970) later attempted to explain this price behaviour and suggested that new information is not always evaluated precisely, and therfore prices may at times overadjust or underadjust. Since, however, the initial large price change is followed by successor price changes, of which the signs are random, the *"initial large change at least represents an unbiased adjustment to the ultimate price effects of the information and this is sufficient for the [validity of the] expected return efficient markets model"* (Fama, 1970: 31).

Fama (1965) also applied Alexander filter techniques, whereby if the market moves up by a certain percentage, the investor continues to hold his portfolio, until such time as the market moves down by the same percentage, at which point the investor sells his portfolio. The investor would subsequently go long once the market had recovered by the same percentage. Alexander (1961; 1963) had concluded that superior returns could not be achieved by using filter rules. Similarly Fama found that a simple buy and hold strategy would outperform a trading strategy based on filter rules. Although Alexander concluded that his research supported the random walk model, the results actually support the submartingale model. Fama (1970) also made the point that it is unnecessary to prove random walk , in order to show that a buy and hold strategy will outperform trading strategies based on historic prices. The submartingale model, whereby expected prices are equal to or greater than the current price, is sufficient proof.

Fama (1965) pointed out that the activities of fundamental and technical analysts may contribute to the independence of successive price movements, since their timeous responses to new information and any existing inefficiencies in the market (for example, arbitrage) would contribute to its efficiency.

A study conducted by Theil and Leenders (1965) found evidence of dependence in daily share price movements on the Amsterdam Stock Exchange. Information theory was used to determine the extent to which prices reacted to the information available

in the market. If price movements were not functionally dependent on the nature and extent of available information, then this would imply dependence on the preceding series. Fama (1965a) concluded, however, that the proportion of stocks that advanced, declined or remained unchanged in period t was of little use in predicting those proportions in period (t+). Theil and Leender's results may, nevertheless, have indicated inefficiency specific to the Amsterdam Stock Exchange.

Osborne and Niederhoffer (1966) found evidence of non-randomness in share price behaviour, in that reversals (pairs of consecutive price changes of opposite sign) were between two to three times as likely as continuations (pairs of consecutive changes of the same sign). It was also found that continuations tended to follow a preceding continuation more frequently than a preceding reversal. Osborne and Niederhoffer explained these results in terms of the manner in which transactions are undertaken on the New York Stock Exchange, and the dependence suggested would appear to only go against the strong form of the Efficient Market Hypothesis.

Tests of independence in South Africa have yielded mixed results. Affleck-Graves and Money (1975) applied serial correlation tests on the residuals of fifty shares listed on the JSE over the period 1968 to 1973. Ten different lags were used, yielding a total of five hundred observations, of which only thirty-five indicated dependence. Similarly runs tests performed on the same data suggested that the market was efficient in the weak form. In any event the limited autocorrelation which was derived was negligible and could not have given rise to abnormal returns.

Contradicting results were obtained by Hadassin in 1976 in a study involving autocorrelation and runs tests (supposedly using "superior statistical tests") on thirty shares quoted on the JSE over the period 1971 to 1973. The study provided evidence that the JSE is not an efficient market, although Hadassin stated that the results did *"not necessarily imply that chartists and fundamental analysts in fact make greater gains than the market"* (1976: 22), and further suggested that the results of "superior analysts" be evaluated. Hadassin's study did not take into account transaction costs and the resultant impact on any abnormal gains implied in his research.

Gilbertson and Roux (1977) were critical of both the above studies, on the following grounds:

- that the random walk model is more rigorous than the Efficient Market Hypothesis and therefore *"rejection of the former does not necessarily invalidate the latter"* (1977: 23);
- since tests of correlation assume a constant mean in a distribution, there will be a bias towards the rejection of the random walk hypothesis, if no correction for non-stationarity is made;
- the tests did not determine the nature of the statistical distribution of price changes, and since the commonly used statistical tools are based on the assumption of finite variance, they *"need to be interpreted with caution"* (1977: 23); and
- the simple linear relationships, which underly the serial correlation tests, may be inappropriate for the identification of patterns of dependence in share price movements.

Gilbertson and Roux concluded that *"whereas the small correlation coefficients are consistent with the EMH, they do not prove its validity. Conversely, the observed deviations from independence do not justify rejection of the hypothesis"* (1977: 23). They subsequently reviewed the results of trading rule and portfolio performance tests. In the case of the former, they concluded that a buy and hold strategy invariably has generated higher returns, and *"it can be shown that this would be a major consequence of market efficiency"* (1977: 23). Similarly, portfolio performance tests conducted in the JSE have yielded results, which are consistent with the Efficient Market Hypothesis.

Strebel (1977) argued that the *"EMH is at best half a truth"* (1977: 15). He reviewed the empirical tests previously performed on the JSE, and concluded that *"the indications of non-random behaviour discussed...imply that the JSE may be inefficient"* (1977: 17). To prove inefficiency would, however, require that superior returns can be consistently achieved from the application of mechanical trading rules rather than a simple buy and hold strategy. Strebel could find no evidence of the existence of such a rule and concluded that this provided support for the Efficient Market Hypothesis, provided the underlying market model is valid.

Saloner and Strebel (1977) examined the impact of trading volumes on the measurement of the beta of shares and portfolios, and concluded that shares, which have an average trading volume of less than approximately 250 000 per annum, had betas that are volume dependent. The correlation between risk and return of these shares was weak, but statistically significant for highly traded shares. Strebel (1977: 18) concluded that since *"some 50% of the shares listed on the JSE fall into the low volume category and since most mutual funds and investment trusts are reasonably well-diversified across the market, their beta risk coefficients will also be volume dependent, even if the relationship is somewhat diluted.....In brief, nothing can be said about the efficiency or otherwise of the JSE, on the basis of the portfolio performance tests carried out to date"*. Moreover, *"at best, the efficient market hypothesis only applies to half of the shares traded on The Johannesburg Stock Exchange: those with average annual trading volumes in excess of at least 250 000"* (1977: 20).

Gilbertson and Roux (1978) responded to Strebel's criticisms, by pointing out methodological objections raised were unfounded and that the limited data employed by Saloner and Strebel in their aforementioned study on low volume shares casted doubt on the validity of that study. Moreover, Gilbertson and Roux applied a trading rule test to fourteen of Strebel's low volume shares, and found no evidence that *"the filter rule is able to generate profits that are consistently superior to those associated with a buy and hold strategy. Indeed, the opposite appears to be the case"* (1978: 25). These results were supported by research initiated by Clarke (1979), whereby volume was found not to be a meaningful predictor of price movements on the JSE. Secondly, Gilbertson and Roux demonstrated that the conclusions derived by Strebel in respect of portfolio performance tests were not justifiable, and predicated on *"results calculated from questionable raw data and the use of methodology which is open to criticism"* (1978: 30). Strebel (1978) replied by contending that Gilbertson and Roux had overstated their results regarding low volume shares, and that they ignored the effects of these, which cast doubt on portfolio performance tests.

Botha (1980) tested the applicability of the random walk model on the daily gold price over the period 1968 to 1975. He found considerable support for the contention that the daily gold price followed a random walk.

4.3 RESEARCH ON THE SEMI-STRONG FORM

Tests of the semi-strong form usually examine the adjustment of prices to new publicly available information. If prices do not rapidly and accurately absorb and impound new information, the market would by implication be inefficient.

Brown and Ball (1968) found that prices had almost fully discounted the informational content (85 to 90%) of earnings reports by the time these were published. Where earnings increased, residuals had increased, and vice versa. Scholes (1969) also tested this hypothesis, and similarly found evidence for the semi-strong form, although his results also seemed to violate the strong form.

Brown, S. (1978), however, contested these findings. In a study of annual earnings announcements, that significantly exceeded market expectations, Brown found that abnormal returns, net of transaction costs, could be generated by purchasing those securities at the time the announcement was made, and the subsequent adjustment process averaged forty-five days.

Similarly, Pettit (1971) studied the impact of dividend announcements on price performance, and his results showed that the informational content of dividend announcements was not fully reflected at the announcement date. Therefore abnormal returns could be generated in the ensuing period.

Fama, Fisher, Jensen and Roll undertook a study of 940 stock splits between 1957 and 1959, in order to determine if there was *"any unusual behaviour in stock prices in the months surrounding the split"* (1969: 1), and whether such behaviour would be explainable in terms of the *"relationships between the splits and changes in other more fundamental variables"* (1969: 2). Since splits were associated with large increases in dividends, the sample was split into two groups, namely those that announced increased dividends in the year following the split and those that did not do so.

The results indicated consistent price increases in the twenty-nine months prior to the split announcement across both groups, but since the median time lapse between the announcement date and the effective date of the split was sixty-nine days, the sustained

increases could not have been the result of the split, but rather due to *"a sharp improvement .... in the earnings prospects of the company sometime during the years immediately preceding the split"* (1969: 9), which in turn suggested that splits occur when share prices rise to a greater extent than would be expected in terms of the market.

The greatest increases in residuals occurred approximately three to four months prior to the split date, and appears to be ascribable to the expectation of higher dividends. For those shares that had the expected dividend increase, subsequent residual fluctuation is negligible, while those shares that announced decreased dividends after the split showed a significant decline in residuals thereafter. Fama, et al (1969: 20) concluded that *"the evidence indicates that on average the market's judgements concerning the information implications of a split are fully reflected in the price of a share at least by the end of the split month but probably almost immediately after the announcement date"*.

Reilly and Drzycimski (1981) found that it was possible to obtain an abnormal gain of on average 4,25%, if an informed investor purchased the securities in question in the fifteen days prior to the announcement of the split. Firth (1977), who performed the tests of Fama, et al on share splits in the United Kingdom, found, however, that share price adjustments to this new information were completed rapidly and it was not, therefore, possible to generate abnormal returns from the information once it had been published.

Scholes (1972) investigated the price effects, where large lines or blocks of shares were sold. In terms of the price pressure hypothesis, the price should fall temporarily and subsequently revert to its original levels, which would be indicative of market inefficiency. Scholes' results contradicted the price pressure hypothesis, since prices fell on average by one to two per cent, and remained at the newly established level. Similarly, Dann, Mayers and Raab (1977) demonstrated that abnormal returns could only be attained in the first five minutes after the occurrence of the event (the sale of a large block of shares). Within fifteen minutes prices had reached a new equilibrium.

Take-overs can have a marked impact on share prices, and it has been shown that on average a shareholder in a take-over target makes a gain of twenty-eight per cent (Lorie, Dodd & Kimptor., 1985: 71). From a market efficiency point of view, the issue is whether an abnormal return can be generated from purchasing shares in a target on the announcement date. Dodd (1981) found that investors who purchased shares in targets on the day after an announcement and held those shares until the take-over was either effected or abandoned, generated no abnormal returns.

In contrast to research results particularly in the United States, which suggest that *"evidence has become so persuasive that it is fair to conclude that semi-strong form market efficiency is now an accepted working assumption in financial economics research"* (Lorie, Dodd & Kimpton, 1985: 73), research in South Africa has indicated severe market inefficiency. Wanckel (1979) studied the impact of earnings announcements on share price behaviour, and found that, in respect of interim earnings announcements, abnormal returns could be obtained subsequent thereto, while in the case of final announcements, the major part of the adjustment process occurs during the first, subsequent day of trading.

Knight and Affleck-Graves (1983) studied the impact on share price behaviour of the announcement of a switch to the last-in-first-out (LIFO) method of stock valuation from the first-in-first-out (FIFO) of stock valuation. The sample consisted of twenty-one listed industrial companies that had quantified the impact of the change. Their findings showed initially positive abnormal returns, followed by a steady and clearly defined negative trend, ultimately yielding abnormal negative returns, before levelling off. Their conclusion was that *"the market is inefficient in respect of this piece of information for two reasons:*

1. *The market appears to be deceived by the negative impact on earnings despite the improved cash position [resulting from the change to LIFO]; and*
2. *This negative impounding takes a long time [approximately eight weeks]"* (1983: 27).

On further analysis of the data by partitioning, it was shown:

1. That on average the impact of the change was less severe in the case of low risk/low beta firms, although the direction of the changes in the cumulative average residuals was almost identical, and it took the same period of time to impound the new information in both cases;
2. That firms, on which the (negative) impact on earnings of the change to LIFO was high, were far more adversely and negatively affected, suggesting that *"it appears irrefutable that the market reacts in the direction of the earnings figures and not in relation to the economic implication of the change"* (1983: 29). Once again the same amount of time was taken to negatively impound the information in the case of both groups;
3. That the negative changes were smaller and occurred more rapidly for later observations in the sample, implying that *"the information consumption process may be changing.....[and] it appears as if the market is becoming educated to LIFO and although it still seems to be deceived by the accounting numbers it is impounding the information more quickly and less severely"* (1983: 29); and
4. That the conclusions for the study were virtually identical whether short-term or long-term betas were used. The stationarity of betas was thus not a problem for the study.

Kana (1986) showed that the JSE reacts speedily and efficiently with specific reference to the impounding of information relating to takeovers and mergers.

4.4 RESEARCH ON THE STRONG FORM

As has been noted above Scholes (1969) found evidence contradicting the strong form of the Efficient Market Hypothesis. Similarly, Osborne and Niederhoffer (1966) showed that specialists [market makers on the New York Stock Exchange] could use their knowledge on incomplete orders to produce abnormal returns. It would also seem to be intuitively logical, that persons with privileged access to information, which has not been released or published, [i.e. insider trading, which is illegal] could generate abnormal profits.

In order to test the strong form, empirical tests have generally focused on the ability of professional portfolio managers to produce superior returns, and most of the

research in this area has focused on the performance of mutual funds relative to the market.

Friend, Brown, Herman and Vickers (1962) reported to the Securities and Exchange Commission, that, although half of the mutual funds in the study performed better than the Standard and Poor's Index, there was no indication of consistently superior performance.

Jensen (1969) studied the risk-adjusted returns of 115 mutual funds in the USA over the period 1955 to 1964, and compared the performance of each fund with a hypothetical random portfolio on the securities market line. He found that 89 of the mutual funds produced inferior returns for their level of risk, and the average deviation from the market line equalled -14,6%. Thus investors would have been better off to have avoided the additional transactions costs incurred by investing in the funds. Where these additional costs were ignored, a positive deviation of 0,09%, which is negligible, from the market line resulted. Jensen concluded that the fact that fund managers *"are unable to forecast returns accurately enough to recover their research and transactions costs is a striking piece of evidence in favour of the strong form...at least as far as the extensive subset of information available to these analysts is concerned"* (1969: 170).

Rogoff (cited in Hogin, 1979) showed that insider traders outperformed the market. Lorie and Niederhoffer (1968) confirmed the superior performance of insider trading, as might logically be expected.

In South Africa available research appears to be strongly in favour of the strong form of the Efficient Market Hypothesis. Taylor (1980) examined the performance of mutual funds in South Africa over the period 1967 to 1977, and arrived at the conclusion that mutual funds on average did not produce superior returns over that period. By implication, and with the assumed exception of insider trading, the market is efficient even in the strong form.

Gilbertson and Vermaak (1980) examined the performance of eleven mutual funds over the period 1974 to 1981, and found that on average the unit trusts had underperformed

the market (the surrogates, for which were the JSE Actuaries All Shares and Industrial indices, and the Rand Daily Mail-100 index), where risk was not considered. When the results were adjusted for risk, the majority of the mutual funds outperformed the market, and thus [illegible]ted that the mutual funds had superior information to the rest of the market.

4.5 SUMMARY

Most studies have show[illegible]he Efficient Market Hypothesis in its various forms is a valid description of rea[illegible] particularly in the United States, where most of the empirical research has been undertaken. Although some degree of inefficiency has been demonstrated, from time to time, the magnitude thereof is generally insufficient to generate abnormal returns, especially when transactions costs are taken into account. It is, however, logical to expect, and empirically supported, that insider traders acting on privileged information do on average generate abnormal returns.

In South Africa research on the weak form of the Efficient Market H[illegible]othesis has been mixed and conflicting. However, no trading rules, which allow investors to consistently outperform the market, have as yet been discovered. Thus the weak form has as yet not been disproved within the context of the JSE. It would also appear that research in favour of the random walk model is more reliable and conclusive, than is the case with research which supports dependence in share price behaviour.

Recent studies have shown serious market inefficiency as far as the semi-strong and strong forms of the Efficient Market Hypothesis are concerned. Kana's study (1986) provides strong support for the semi-strong form, although the fact that share prices in that study started showing significant abnormal returns seven months prior to the closing date of the takeover offer may indicate evidence in favour of the strong form. However, it may just as well show evidence of insider trading. It is possible that market efficiency on the JSE is increasing with the efflu[illegible]xion of time, which appears to have been suggested by the results of the study conducted by Knight and Affleck-Graves (1983).

CHAPTER 5

RESEARCH METHODOLOGY

5.1 INTRODUCTION

The survey of empirical research conducted on the Efficient Market Hypothesis, which was covered in the preceding chapter, showed that, while the semi-strong form is *"now an accepted working assumption in financial economics research [in the United States]"* (Lorie, Dodd & Kimpton, 1985: 73), the semi-strong form of the hypothesis appears to be a sometimes poor representation of share price behaviour on the JSE, although the research produced to date is not conclusive. It is therefore both desirable and necessary that further tests of efficiency be carried out using data derived from the JSE, in order to establish, which point of view the weight of evidence favours, and secondly, to determine whether the degree of efficiency is improving over time.

In this chapter the hypotheses to be tested in this dissertation are stated. A review of available, alternative methodologies is subsequently undertaken. Finally, a detailed description of two-stage time-series methodology, and the use of the personal computer in the study, are provided.

5.2 STATEMENT OF HYPOTHESES

MAIN HYPOTHESES

The purpose and specific objectives of this study have been set out under sections 1.1 and 1.2 of chapter 1.

The main hypotheses, which this study seeks to prove, are as follows:

1) That the market is efficient in the semi-strong form with respect to sanctions-oriented draft legislation;
2) That the informational content of the introduction of the Dellums-Wolpe Bill, and its subsequent passage in the House of Representatives on the 11th of August 1988 (information generating events for the purposes of this study), had a negative impact on mining share prices; and
3) That the informational content of the withdrawal of the sanctions legislation on the 19th of October, and the subsequent election of Bush as the President of the

United States on the 8th of November 1988 (information generating events for the purposes of this study), had a positive effect on mining share prices.

SUB-HYPOTHESES

Specifically it is hypothesized that:

1) The cumulative average residual returns of South African mining shares increased immediately and significantly as a result of the introduction of the Dellums-Wolpe Bill in May 1988 (the first information generating event);
2) The cumulative average residuals of South African mining shares increased significantly again at the time of the passage of the Bill by the House of Representatives on the 11th of August 1988 (the second information generating event);
3) Alternatively, in the cases of (1) and (2) above, that the cumulative average residuals were stable after the information generation events, but had increased significantly prior to those events, in which case the study seeks to determine the number of weeks prior to those events, when the market began to anticipate the related informational contents;
4) The share price adjustment process occurred rapidly in both cases, and therefore the market is efficient;
5) The informational content of the aforementioned information generating events was negative;
6) The negative trend was reversed as a result of the withdrawal of the sanctions legislation on the 19th of October and the subsequent election of Bush as the President of the United States on the 8th of November 1988 (the third and fourth information generating events respectively);
7) The cumulative average residuals in the case of high risk shares were initially significantly more negatively impacted and subsequently significantly more positively impacted, than those for low risk shares; and
8) There was no differential market reaction in respect of shares in which United States persons held a larger percentage of the issued shares, or where the Rand value holdings were significantly larger. It is hypothesized, therefore, that the market anticipated substitution effects.

United States on the 8th of November 1988 (information generating events for the purposes of this study), had a positive effect on mining share prices.

SUB-HYPOTHESES

Specifically it is hypothesized that:

1) The cumulative average residual returns of South African mining shares increased immediately and significantly as a result of the introduction of the Dellums-Weipe Bill in May 1988 (the first information generating event);
2) The cumulative average residuals of South African mining shares increased significantly again at the time of the passage of the Bill by the House of Representatives on the 11th of August 1988 (the second information generating event);
3) Alternatively, in the cases of (1) and (2) above, that the cumulative average residuals were stable after the information generation events, but had increased significantly prior to those events, in which case the study seeks to determine the number of weeks prior to those events, when the market began to anticipate the related informational contents;
4) The share price adjustment process occurred rapidly in both cases, and therefore the market is efficient;
5) The informational content of the aforementioned information generating events was negative;
6) The negative trend was reversed as a result of the withdrawal of the sanctions legislation on the 19th of October and the subsequent election of Bush as the President of the United States on the 8th of November 1988 (the third and fourth information generating events respectively);
7) The cumulative average residuals in the case of high risk shares were initially significantly more negatively impacted and subsequently significantly more positively impacted, than those for low risk shares; and
8) There was no differential market reaction in respect of shares in which United States persons hold a larger percentage of the issued shares, or where the Rand value holdings were significantly larger. It is hypothesized, therefore, that the market anticipated substitution effects.

5.3 GENERAL CONSIDERATIONS

5.3.1 Measuring Share Returns

One of the key issues in the measurement of share price performance is that of a control group in empirical testing. Unfortunately, tests of the Efficient Market Hypothesis cannot be conducted using control and experimental groups in the strict scientific sense, although it may be approximated as shown by Knight and Affleck-Graves (1983) in their study. Tests of the semi-strong form usually examine the adjustment of prices to some information generating event. The problem lies in extrapolating what the sequence of price movements would have been, should that event not have occurred.

The major methodologies, that may be used to forecast expected share returns against which actual returns may be compared, are as follows (Kana, 1986: 33):

1) Single equation causal regression models
2) Relative strength models
3) The Sharpe-Lintner or market model
4) The capital asset pricing model

(1) Single equation causal regression models

These attempt to identify the underlying fundamental variables, which determine share price movements, and incorporate these in a formula, which may be used to project future prices or some other variable. One such model is that of Weaver and Hall (cited in Kana, 1986: 33), which attempts to forecast dividend yields:

$$\log z = a + b \log y + c \log x + d \log w + e \log r + f \log u$$

where
- z = the mean dividend yield;
- y = the mean dividend payout ratio;
- x = the forecast short-term earnings growth rate;
- w = the forecast long-term dividend growth rate;

v = historical earnings variability;
u = the historical earnings growth rate; and
a to f = various weighting factors.

Similarly, Whitbeck and Kiser (cited in Kana, 1986: 34) developed the following model in order to forecast the price-earnings ratio:

Expected Price-Earnings Ratio = 8,2 + 1,5x + 6,7y - 0,2z

Where x = the earnings growth rate;
y = dividend payout percentage; and
z = the standard deviation in the earnings growth percentage.

Whitbeck and Kiser found that their model yielded profitable opportunities, when the actual price-earnings ratio was less than 85% or greater than 114% of the expected price-earnings ratio derived in terms of the model.

These deterministic models assume that certain key independent variables are identifiable, and that their relative predictive power is stationary over time. However, new variables may come to affect the dependent variable over time, or alternatively, the relative importance of each variable may not be stable over time. Moreover, the impact of differing accounting policies, and of different industries is not considered. For these reasons, single equation causal regression models are not considered suitable for the purposes of this study.

(2) Relative strength models

These models assume that there is an exact, proportionate and determinable relationship between movements in market indices and individual securities. If there should be a deviation of the expected return from the actual return on a security, this may be ascribed to the occurrence of events specific to that security. However, research (Kana, 1986: 35) has shown that share prices do not move in exact proportion to movements in market indices, and since these models do not make provision for factors, which may specifically affect individual securities or attempt to quantify

unsystematic risk, they are considered to have limited predictive value.

(3) The Sharpe-Lintner or market model

In terms of this model the greater the covariance between the returns of a specific security and the market returns (the market being the most commonly used portfolio in asset-pricing models), the greater the risk premium required for that security. This is logically to be expected in the context of portfolio selection, since the greater the positive correlation between the returns of a security and the related portfolio's returns, the greater is the incremental risk associated with that security. The mode. therefore provides seperate measures of syster rket related risk, indicated by the beta coefficient (β)) and unsystemat c, or non-market related risk, represented by the alpha coefficient (t may be expressed in the following form:

$$\theta_j = \frac{\overline{R_m} - i}{\sigma_m^2}(r_{jm}\sigma_j\sigma_m)$$

where $\overline{R_m}$ is the expected eturn for the market or a portfolio;
i is the risk-free rate;
σ^2_m is he variance of possible market or portfolio returns;
$(r_{jm}\sigma_j\sigma_m)$ is the covariance of returns for security j with the market or a portfolio's returns; and
θ_j is the risk premium for security j.

(4) The capital asset pricing model (CAPM)

A derivative of the market model, the CAPM expresses risk in terms of the beta coefficient. The beta is a measure of a security's returns relative to market returns, and an individual security's risk premium is expressed as the market risk premium (the premium required over and above the risk-free rate) weighted by the relative risk

(beta) of that security. Formally, the model states:

$$R_j = R_f + \beta_j(R_m - R_f)$$

where R_j is the expected return of security j;
R_f is the risk-free rate;
β_j is the beta of security j; and
R_m is the market return.

Through the process of diversification, it is possible to remove all risk except the covariance of the security with the market.

There are a number of assumptions underlying the CAPM, and Kopinsky (1984: 63 -64) has summarised these as follows:

a) All investors have homogeneous expectations regarding expected returns, risk and correlation statistics;
b) Each security's returns are normally distributed;
c) All investors are risk-averse and have quadratic utility functions, in terms of which the mean and variance of a price distribution contain all the information required by investors;
d) All securities are infinitely divisible and perfectly liquid;
e) There are no transaction costs or taxes, and the markets are in equilibrium;
f) All investors have the same time horizon;
g) Information is available at no cost; and
h) Inflation does not exist and interest rates are constant, or alternatively changes are perfectly anticipated.

Jensen (1969) has also pointed out that the CAPM assumes that all investors can borrow or lend at an exogenously determined risk-free interest rate, and that there are no restrictions on selling short.

Although the assumptions are highly restrictive, they may be relaxed without seriously impairing the predictive power of the model (Jensen, 1969). In terms of the model the

market portfolio must be efficient, since the market is the aggregate of individual portfolios and each portfolio is efficient.

At this stage it is important to distinguish the nature of the beta coefficient in the market model and the CAPM respectively. Kana (1986: 45) has succinctly summarised the difference as follows:

"The coefficient beta (β) in the market model is similar in nature to the beta (β) of the CAPM but is by de finition not the same variable. β in the CAPM measures the covariance of the return on an asset with the return on the market divided by the market returns' variance:

$$\beta_j = Cov(k_j k_m)/\sigma_m^2).$$

β in the market model measures responsiveness of the asset's return to changes in the market index".

The market model is not a theory as is the case with the capital asset pricing model, which seeks to explain share price behaviour in terms of its underlying assumptions. Rather, the market model is a method of separating systematic from unsystematic risk premiums using simple linear regression. In this study two-stage time series methodology, which was first applied by Fama, Fisher, Jensen and Roll (1969) and which is derived from the market model, is employed as a test of the semi-strong form. According to Knight and Affleck-Graves (1983: 21) this method has now become *"firmly established in the finance literature..."*.

5.3.2 Two-stage Time Series Methodology

A detailed description of this method is given in Knight and Affleck-Graves (1983) and the following description is based on their analysis.

The first stage of the methodology involves the identification of those movements in the prices of securities, which may be attributed to factors impacting on the market as a whole, in order to avoid confounding the impact of specific events with broad market movements. The market related return can be identified and removed by

estimating the alpha (α_j) and beta (β) coefficients in the market model, namely $R_{jt} = \alpha_j + \beta_j R_{mt} + e_{jt}$,

where: R_{jt} is the return on security j in period t;
R_{mt} is the market return in period t; and
e_{jt} is the residual or abnormal return on security j in period t.

The coefficients α_j and β_j are estimated using ordinary least squares. According to Knight and Affleck-Graves (1983: 23), it is *"customary to omit several periods around the date of the announcement [i.e. the specific information generating event]....so that any unusual price behaviour in this period will not obscure the long-term relationship between R_t and R_{mt}"*. The criteria for determining the length of the period to be excluded is, however, arbitrary (Fama, 1965).

Assuming the market model is valid, the differences between the actual and forecast returns can be determined for each of the periods omitted around the information generating event. The difference for each period is referred to as the residual or abnormal return for that period. Algebraically the relationship may be expressed as follows:

$$e_{jt} = R_{jt} - \overline{R}_{jt}$$

where e_{jt} is the residual return in period t;
R_{jt} is the actual return in period t; and

$\overline{R}_{jt}$ is the forecast return for period t (in terms of the market model).

In the second stage of the methodology, the residuals are averaged cross-sectionally across all the securities in the sample, in order to further reduce the price movements, which are not attributable to the information generating event. Finally, the cumulative average residuals (CAR's) are calculated, plotted graphically and analysed. Conclusions can, therefore, be derived as to the speed, at which the price adjustment process has taken place, and whether the direction of any price change is logically correct (i.e according to expectations).

The distribution of the residual returns is assumed to be serially independent, independent of the distribution of market returns and independent of time, (*t*). Individually and, therefore, in the aggregate, residuals have an expected value equal to zero, although it is *"important to note ....that some random variation around zero is to be expected and it is only persistent or very marked deviations from zero that should be further examined. If the event being studied....has any informational value, a movement away from zero would be expected at period 0 [the actual date of the information generating event]. Hence the plot of the CAR's can be used to test both the efficiency of the JSE* and *the informational content of the [information generating event]* " (Knight and Affleck-Graves, 1983: 23).

If CAR's are plotted graphically, the direction of the impact of the informational content of the information generating event and the efficiency of the market may be analysed. Various situations are possible and these are briefly described below.

a) Positive informational value and an efficient market

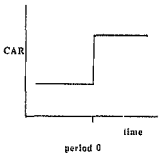


Figure 5.1

In this case the CAR's are constant prior to the occurrence of the information generating event at period 0 (the base period), and after the specific event has taken place, the CAR's remain constant after moving to a higher level. The market is efficient *"because it adjusts to the informational content of the [event] immediately and the informational content....is positive because the jump is upwards"* (Knight and Affleck-

Graves, 1983: 24).

(b) Negative informational value and an efficient market

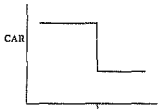


Figure 5.2

In this case the informational content is negative, since the CAR's adjust to a lower level after the occurrence of the information generating event. The market is, however, efficient for the same reasons given under (a) above.

(c) Positive informational value and an inefficient market

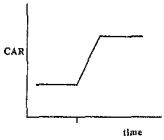


Figure 5.3

While the informational content is positive, the market is inefficient, since there is a

slow and gradual adjustment over several periods, in which investors could potentially generate abnormal returns, to the new equilibrium level.

(d) Negative informational value and an inefficient market

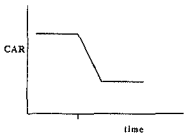


Figure 5.4

The interpretation of this case is identical to that under (c) above, except that the informational content is negative.

(c) Informational value is zero and the market may be either efficient or inefficient

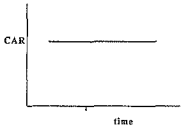


Figure 5.5

The information generating event has had no impact on price behaviour in this case.

No conclusions can be drawn about the efficiency of the market, except that, if a positive or negative adjustment was expected, the market may be regarded as being inefficient.

5.4 SUMMARY OF METHODOLOGY

In this study two-stage time series methodology, a derivative of the market model, will be employed in order to identify the market related return of a share (namely, the beta coefficient), the specific risk (namely, the alpha coefficient) and the abnormal or residual return associated with the occurrence of a specific information generating event.

The raw data in this study will consist of the weekly returns calculated in accordance with the following formulas.

(a) **Measuring actual share returns**

The following formula will be used for this purpose:

$$R_{jt} = \frac{P_{jt} - P_{jt-1}}{P_{jt-1}}$$

where R_{jt} is the return on share j in week t;
P_{jt} is the price of share j at the end of week t; and
P_{jt-1} is the price of share j at the beginning of week t (or alternatively the end of the previous week).

Dividends paid have been excluded from the above formula for two reasons:

1) Shares form the constituents of indices, and while shares are cum dividend, the price should reflect that state of affairs. Indices are therefore affected by the weighted average impact of the share price response to cum dividend situations.

2) When shares become ex dividend the share will reflect the informational content of that situation by declining more or less commensurately. The indices will to that extent be similarly affected. The inclusion of *dividends paid* in the measurement of share returns would therefore be misleading unless the calculation of index (or market) returns included a compensating adjustment. Since this would constitute a highly onerous process, dividends are omitted in both the cases of the measurement of share and market returns respectively.

(b) **Measuring market returns**

The following equation will be employed for this purpose:

$$R_{mt} = \frac{I_{mt} - I_{mt-1}}{I_{mt-1}}$$

where R_{mt} is the market return in week t;
I_{mt} is the surrogate (for the market) index at the end of week t; and
I_{mt-1} is the surrogate index at the end of the previous week.

(c) **Forecasting share returns**

The previously discussed market model will be used in this case. Algebraically the model is as follows:

$$\bar{R}_{jt} = \alpha_j + \beta_j R_{mt}$$

where R_{jt} is the expected return on share j in week t;
α_j is the non-market related return of share j;
$\beta_j R_{mt}$ is the market related return of share j;
β_j is the beta of share j; and
R_{mt} is the market return in week t.

The beta and alpha coefficients will be calculated by regressing the weekly returns of the mining shares used in this study (details are provided in the following chapter) against the weekly returns of the ma ..et over the period 31 October 1986 to 1 January 1988. The cut-off date of 31 October 1986 is considered justifiable on the grounds that the Anti- Apartheid Act of 1986 was passed in early October 1986, and this event most likely affected the stationarity of the beta coefficients of affected shares. Knight and Affleck-Graves (1983) also demonstrated that the use of short-term data did not result in significantly dissimilar configurations in the plots of the CAR's derived in their study.

The beta coefficient is calculated by using the following formula,

$$\beta_j = \frac{n(\xi^n_{j=1} R_m R_j) - (\xi^n_{j=1} R_m)(\xi^n_{j=1} R_j)}{n(\xi^n_{j=1} R^2_m) - (\xi^n_{j=1} R_m)^2}$$

while the alpha coefficient is calculated as follows:

$$\alpha_j = \frac{\xi^n_{j=1} R_j - \beta_j \xi^n_{j=1} R_m}{n}$$

where is the number of weeks used in the regression;

R_m	is the market return in each week;
R_j	is the return on each share in each week;
β_j	is the beta coefficient for share j; and
α_j	is the alpha coefficient.

(d) Calculating residuals

The following formula, which has been previously discussed, has been used for this purpose:

$$e_{jt} = R_{jt} - \overline{R}_{jt}$$

where $\overline{R}_{jt}$ is the forecast return for the jth share in week t;
R_{jt} is the actual jth share return in week t; and
e_{jt} is the residual in week t for share j;

(c) **Calculating Cumulative Average Residuals (CAR's)**

The average residual is calculated using the simple average method for each week's (the time interval used in this study, each week being deemed to end on a Friday) population of residuals, each week being defined as that same week before or after the information generating event for each of the securities in the sample. The average residuals so calculated are cumulated in order to derive a plot of the CAR's.

5.5 USE OF THE COMPUTER

The calculations referred to above were carried out on a LOTUS 123 spreadsheet model developed on a personal computer. The exercise was repeated twice (independently of each other), in order to ensure the accuracy of the calculations.

CHAPTER 6

DATA SELECTION AND COLLECTION

6.1 SOURCE OF THE DATA

Share prices and indices, which were used for the purposes of calculating weekly and residual returns in this study, were derived from the database maintained by the JSE. The data was downloaded onto diskettes and subsequently imported into the LOTUS 123 model used in this study.

The study group consisted of mining shares listed on the JSE and was extracted from Brown and Cooper (1988), which provides a comprehensive summary of gold mining, mining houses, platinum and diamond shares in terms of both the Rand value of foreign and United States holdings, and the percentage of issued shares held by those non-residents (of South Africa) as at 31 December 1987. The aforementioned authors are analysts at one of the leading firms of stockbrokers in South Africa, namely Davis Borkum Hare.

6.2 SELECTION OF THE DATA

The study group used was limited to those mining shares that were listed on the JSE at 31 October 1986, and which remained listed continuously over the period 31 October 1986 to 15 December 1988. Moreover, those individual shares, which underwent major or substantial changes during part or parts of the aforementioned period, were excluded from the study group. Major or substantial changes are deemed for the purposes of this study to include:

(1) take-overs;
(2) mergers;
(3) rights offers;
(4) reconstructions of share capital;
(5) material new share issues;
(6) major changes in the nature of operations; and
(7) changes to the sector classification.

Major or substantial changes were identified by scrutinising the Monthly Bulletins, which provide summaries of any material changes to shares quoted on the JSE, and

which are published by the Johannesburg Stock Exchange.

Shares, which had an average annual trading volume of less than 250 000 in (the calendar years) 1986 and 1987, were excluded from the study group (see Appendix F, which shows the shares traded for the study group after exclusions were made).

The study was limited to United States holdings in South African mining shares, since this study is concerned with determining the efficiency of the JSE with specific reference to the effects of the Dellums-Wolpe Bill on mining share price behaviour. The shares used in this study are shown in the following appendices:

1) *Appendix A:* Foreign Holdings in South African Gold Mining Shares - Percentage of Shares in Issue as at 31 December 1987.
2) *Appendix B:* Foreign Holdings in South African Mining Houses, Platinum and Diamond Shares - Percentage of Shares in Issue as at 31 December 1987.
3) *Appendix C:* Rand Value of Foreign Holdings in South African Gold Mining Shares as at 31 December 1987.
4) *Appendix D:* Rand Value of Foreign Holdings in South African Mining Houses, Platinum and Diamond Shares as at 31 December 1987.
5) Appendix E: Mining Shares Excluded for the Purposes of this Study from Appendices A - D above.

6.3 THE CHOICE OF THE BASE PERIOD

The selection of a base date or period is necessarily arbitrary to some extent, but it is highly important, since the base date (equivalent to period 0 on the graphs of CAR's, or zero week in this study) reflects that point in time, when the informational content of information generating events can reasonably be considered to have become publicly available, or from which the market's anticipation of the information generating event can be measured. Both the Dellums-Wolpe and Cranston Bills were introduced in May 1988 (the first information generating event in this study). The first subsequent published research on the extent of foreign and United States holdings in South African mining shares was produced by Brown and Cooper (1988) on the 26th of May 1988. This report was referred to in articles published in the Business Day on Friday,

the 3rd of June, while the actual event was given extensive press coverage. It is clear that all market participants will not have received this information simultaneously. For the purposes of this study it is considered reasonable to suggest that this information may be deemed to have been publicly available by the following Friday, the 10th of June 1988 (zero week for the purposes of this study). Similarly the passing of the Dellums-Wolpe Bill by the House of Representatives on the 11th of August 1988 a Thursday, (the second information generating event) may be considered to have been publicly available information by Friday, the 19th of August (the 10th week after zero week). The effective withdrawal of the sanctions (draft) legislation (as a result of the announcement by Senator Alan Cranston on Wednesday, the 19th of October) (the third information generating event) for the remainder of 1988 (since the draft legislation is likely to be re-introduced during the course of 1989) was fairly widely publicised on October the 20th and 21st, and may be deemed to have become publicly available information by Friday, the 28th of October 1988 (the 20th week after zero week). Since the United States Presidential election was a most widely publicised event, the election of Bush as the President of the United States (the fourth information generating event) may be regarded as having become publicly available information on the Friday following the election (held on Tuesday, the 8th of November), namely 11 November 1988 (the 22nd week after zero week).

6.4 OMISSION OF PERIODS AROUND THE BASE DATE

It is customary to omit several periods around the base date, or the date of occurrence of the information generating event, in order to avoid that any unusual price behaviour obscures the determination of the long-term relationship between the return on a security and the return on a portfolio (normally the market), as well as to isolate the impact of the information generating event, or the anticipation thereof, on price behaviour. In this study weekly periods and data have been used, since the information generating events occurred over a relatively short period of time (during 1988). The number of periods to be omitted around the base date is also arbitrary; however, they should be sufficient to prevent the obscurement of the long-term relationship between R_t and R_m. In this study a total of 22 weeks were omitted before zero week, while the omitted period consisted of 27 weeks after zero week.

Weekly residual returns have thus been calculated over the period 8 January to 15 December 1988 (the latter being a Thursday, since the 16th was a public holiday), in order to identify any unusual share price behaviour, which arose from the introduction of the Dellums-Wolpe and Cranston Bills in May 1988, the passage of the Bill in the House of Representatives on the 11th of August, the subsequent effective withdrawal of the draft legislation on the 19th of October, and the election of Bush (who has distanced himself publicly from sanctions) as President of the United States on the 8th of November 1988. For the purpose of computing weekly returns each week has been deemed to end on a Friday. A total of 30 residuals was derived for each of the thirty-nine mining shares, which formed part of the study group.

6.5 THE SELECTION OF A SURROGATE FOR THE MARKET RETURN

In order to estimate the beta and alpha co-efficients in the market model, it is necessary to calculate the market return (Knight and Affleck-Graves, 1985: 21). The market return is normally calculated by using an appropriate surrogate for the market portfolio. The JSE Actuaries All Share Index may be considered to be the most representative surrogate for the market as a whole, since it is broadly based and includes selections from each sector of the market.

Since this study is concerned with the share price behaviour of listed mining shares, it may argued that it is more appropriate to use a more specific surrogate for the market return than the broadly ...al JSE All Share index. In particular, the Mining Producers index or the All Gold ... may be regarded as being more representative of the market return, as the sample used in this study includes only mining shares. Notwithstanding this, the JSE All Share index has been used in this study for the following reasons:

1) The JSE All Share index is representative of the market as a whole;
2) Foreign holdings in South African industrial shares are relatively small, and unpublished research by Mathison and Hollidge Inc., a large stockbroking firm on the JSE, has identified only four industrial shares in which United States persons have significant holdings. Since the greater majority of mining shares are affected by foreign, and specifically United States, shareholdings, the JSE All Share index

is more neutral in that it represents shares with large, small and negligible foreign holdings.

3) A recent calculation indicates, that the correlation co-efficient of the Dow Jones with the (South African) Industrial Share Index over the period January 1981 to January 1988, is 0,75, whereas, similarly, it is 0,70 for the (South African) All Gold Index (Gerson, 1988: 6). This indicates that the Industrial Share and All Gold indices are relatively strongly correlated, as would be expected in a mining driven economy, such as that in South Africa, and further that a major extraneous influence such as the Dow Jones has similar effects on both the aforementioned indices

4) Economically in South Africa, the prices of minerals should have, in general, similar impacts on industrials and mining shares, as the following summary of the transmission mechanism should indicate.

"Firstly, a rise in the gold price improves our [South African] terms of trade, boosts our national income and enables [South Africa] to achieve higher levels of Gross Domestic Expenditure. Accordingly, industrial earnings rise and this is anticipated by prior movements in the Industrials Index. Secondly, we know that the rate of change of the Industrials Index at its turning points is strongly and negatively correlated with the peaks and troughs of the B. A. Rate. Yet, as it happens, the B.A. Rate itself is strongly influenced by the Dollar price of gold..... [since a] rise, for instance, in the metal's overseas price injects liquidity into the economy and the money market" (Gerson, 1988: 2).

5) The ..ining sector contributes 60,2% to the JSE All Share Index, while financials and industrials contribute the balance of 39,8%.

CHAPTER 7

RESULTS OF THE STUDY

7.1 INTRODUCTION

The results of the empirical work conducted in this study are presented in this chapter in tabular and graphical form. The results for the study group as a whole are set out and interpreted in section 7.2. Further analysis by partitioning is set out in section 7.3; the study group was partitioned into pairs according to the following criteria respectively:

(a) Low beta (low risk) versus high beta (high risk) (section 7.3.1);
(b) Low versus high United States' percentage equity holdings (percentage of shares in issue) (section 7.3.2); and
(c) Low versus high Rand value (i.e. synthesis of price and quantity variables) of United States' shareholdings (section 7.3.3).

Although the cumulative average residuals (CAR's) are presented in respect of all the periods omitted around zero week, the *detailed interpretation* of the CAR's is concentrated on the weeks around each information generating event used in this study. In this way the residual-disturbing impact of unknown, confounding events should be reduced, and the impact of the information generating events, which are analysed in this study, should be more clearly represented. The reduced period of examination is, however, arbitrary, although the approach is based on that adopted by Knight & Affleck-Graves (1983: 25).

A summary of the information generating events used in this study is shown below.

TABLE 7.1

INFORMATION GENERATING EVENTS: SUMMARY

EVENT NUMBER	DESCRIPTION OF EVENT	DATE AT WHICH INFORMATIONAL CONTENT DEEMED TO BE PUBLICLY AVAILABLE	NUMBER OF WEEKS AFTER WEEK 0
1.	Introduction of Dellums-Wolpe Bill.	10.06.88	0
2.	Passage by House of Representatives.	19.08.88	10
3.	Effective withdrawal of Bill.	28.10.88	20

The fourth information generating event, namely the election of Bush as the President of the United States on the 8th of November 1988, has not been independently analysed, because of its close proximity to information generating event 3 (having occurred in the twenty-second week after zero week). It has, therefore, been analysed as part of the third information generating event, in the sense that it should have provided additional momentum to the positive informational content of the third information generating event.

7.2 RESULTS FOR THE WHOLE STUDY GROUP

The average residuals and the CAR's for the study group as a whole are shown in

Tables 7.2.1 and 7.2.2 respectively. Where the week number reference is prefixed by the use of a minus (-), this indicates the number of weeks prior to zero week. Where a prefix has not been used, the number of weeks after zero week is indicated.

The cross sectional average residuals and the CAR's were derived using the market model; as can be seen the fluctuations in the average residuals are erratic. In order to smooth the data, a three week moving average is also presented for both the average residuals and the CAR's. The analysis will, however, focus on the actual (not smoothed) data.

The average residuals and the CAR's (and the associated three week moving averages) are graphically shown in figures 7.2.1 and 7.2.2 respectively. Although line graphs have been used, the lines joining the weekly data points should not be interpreted as necessarily indicating a linear relationship between such; they are shown for convenience in order to display the nature of the movements in the data over successive periods.

Since the informational content of the introduction of the Dellums-Wolpe was logically expected to be negative, this impact should be manifested in negative average residuals for the study group. In fact as early as week -22, the average residuals show a strong negative tendency, a pattern which is fairly consistent until week -5; a noticeable exception is the relatively large positive residual in week -10. During the period, weeks -5 to -4, the average residuals are progressively less negative, and ultimately positive, albeit small in value, in weeks -3 to 0. The latter may reasonably be ascribed to expected random fluctuation (Knight & Affleck-Graves, 1983: 23). In the two weeks subsequent to zero week the average residuals are sharply negative, which is the expected outcome. This is, however, followed surprisingly by positive average residuals in weeks 3 and 4. This may be interpreted as a counterbalancing adjustment to an over-reaction in weeks 1 and 2 (Fama, 1970). The average residuals subsequently fluctuate randomly around the (expected) zero level for seven weeks until week 11. Weeks 12 to 15 show sharp negative average residuals, which is to be expected as a result of the negative impact of the second information generating event, namely the passage of the Dellums-Wolpe Bill by the House of Representatives. The response is, however, somewhat belated, since the negative impact should have occurred at week 10 (unless

the information should be deemed to have become publicly available in week 13). Weeks 16 and 17 show relatively strong reversals into positive average residuals: although difficult to interpret, this may again be ascribed to an adjustment to the previously exaggerated negative over-reaction, if this is in fact the case. Week 19 again shows a relatively large negative average residual. Thereafter the residuals are generally fairly random and negative; it appears, therefore, that the study group did not react positively to the (positive) information generating events in weeks 20 and 22. This may be interpreted as indicating, that the market expected the impact of these events to be short-lived and thus little positive informational content was perceived therein. In fact the Dellums Bill was re-introduced within minutes of the 101st Congress being sworn in on the 4th of January 1989 (Business Day, 1989: 2). Moreover, the Democratic Party had increased its majorities in both the House of Representatives and the Senate in the November, 1988 elections; the negative informational content of these events would most likely have counteracted the positive informational content of the withdrawal of the Bill and the election of Bush as President.

The graph of the CAR's shows more strikingly the impact of the information generating events of this study. Commencing in week -22, the CAR's show a generally persistent and consistently increasing deviation from the expected zero value until week -4. Between weeks -4 and 0, the CAR's are relatively stable and fluctuate in a relatively narrow range. In the two weeks subsequent to zero week, the CAR's resume their negative trend, before stabilising around the -31,6 to -33,2 range between weeks 3 and 11. During weeks 12 to 15 the CAR's are successively and increasingly negative, before showing relative stability in weeks 16 to 18. Thereafter, the negative trend is continued through to week 27, which indicates that the market did not respond positively to the third and fourth information generating events. Because the interpretation of these last events may be confounded by the counteracting impact of the outcome of the elections for the Senate and the House of Representatives, and because information generating events 3 and 4 would most likely only retard the progress of sanctions-orientated draft legislation, they are not analysed further in this study, as *a priori* expected outcomes are not clearly determinable.

If prices do not accurately and rapidly absorb and impound new publicly available information, the market would by implication be inefficient. In the case of the first

information generating event, the study group appears to have anticipated that outcome by at least twenty-two weeks prior to that event. The CAR's have also responded in the right direction, namely negatively as would be expected. After zero week the CAR's reacted negatively for two successive weeks before stabilising for seven to eight weeks. This would indicate that the negative impounding, other than during the "anticipation" period, took place over a relatively short period of time (namely ten business days). Nevertheless, it would have been possible to generate a small abnormal return (1,8%, assuming maximum transaction costs) after transactions costs during weeks 0 to 2 by acting on the informational content of the first information generating event at week 0. It is submitted, however, that such an abnormal return is immaterial, and that it could equally be generated on the basis of the random fluctuations in the CAR's alone.

The study group thus appears to have responded efficiently to the first information generating event. Firstly, the CAR's reacted in the right direction to the informational content of event 1. Secondly, the market had anticipated that informational content such that, by the time the information was publicly available, the study group had almost entirely completed the negative impounding process (This may provide evidence for the strong form of the EMH). Thirdly, by the time the information was publicly available, there was virtually no scope for the generation of abnormal returns. For these reasons, the market may be regarded as being efficient with regard the occurrence of the first information generating event.

As regards the second information generating event (the informational content, of which was deemed to have become publicly available in the 10th week after zero week), the market's anticipation of this event appears to be virtually non-existent. The CAR's in the preceding weeks are quite stable, although they do display a slight negative trend. The CAR's are also stable in the first subsequent week, namely week 11. During weeks 13 to 15 the negative adjustment process seems to take place, although it accelerates progressively during the course of that period. It would, therefore, have been possible to generate an abnormal return of 4,7% by acting on publicly available information at week 10. Although the CAR's responded negatively as expected, the negative impounding appears to take a relatively long time, namely five weeks. In order to explain this phenomenon, the author reviewed press coverage

Table 7.2.1

Average Residuals for the Whole Study Group

DATE	WEEK	SUM TOTAL OF ALL RESIDUALS	AVERAGE OF ALL RESIDUALS	3 WEEK MOVING AVERAGE
80188	-22	-136.15	-3.49	
150188		-66.90	-1.72	
220188	-20	-89.19	-2.29	-2.50
290188		-85.16	-2.21	-2.07
50288	-18	-19.83	-0.51	-1.67
120288		-31.49	-0.81	-1.18
190288	-16	4.79	0.12	-0.40
260288		-159.13	-4.08	-1.59
40388	-14	-88.96	-2.28	-2.08
110388		3.87	0.22	-2.05
180388	-12	-135.06	-3.46	-1.84
250388		-5.59	-0.14	-1.13
310388	-10	164.94	4.23	0.21
80488		-181.16	-4.65	-0.19
150488	-8	-43.79	-1.12	-0.51
220488		-158.60	-4.07	-3.28
290488	-6	-27.73	-0.71	-1.97
50588		-108.76	-2.79	-2.52
130588	-4	-25.62	-0.66	-1.39
200588		43.77	1.12	-0.77
270588	-2	51.46	1.32	0.59
30588		5.68	0.15	0.86
100688	0	4.45	0.11	0.53
170688		-101.43	-2.60	-0.78
240688	2	-119.93	-3.08	-1.85
10788		6.82	0.17	-1.84
80788	4	62.32	1.60	0.44
150788		-8.44	-0.22	0.52
220788	6	4.85	0.12	0.50
290788		-13.27	-0.34	-0.14
50888	8	-7.59	-0.19	-0.14
120888		2.16	0.06	-0.16
190888	10	-35.31	-0.91	-0.35
260888		22.16	0.57	-0.09
20988	12	-30.45	-0.78	-0.37
90988		-66.89	-1.71	-0.64
160988	14	-102.02	-2.62	-1.70
230988		-157.40	-4.04	-2.79
300988	16	31.30	0.80	-1.95
71088		80.23	2.06	-0.39
141088	18	0.54	0.01	0.96
211088		-130.99	-3.36	-0.43
281088	20	-38.15	-0.98	-1.44
41188		-10.71	-0.27	-1.54
111188	22	28.24	0.72	-0.18
181188		-68.62	-1.76	-0.44
251188	24	-22.16	-0.57	-0.53
21288		1.78	0.05	-0.76
91288	26	-43.09	-1.10	-0.54
151288		-43.09	-1.10	-0.72

Table 7.2.2

CAR's for the Whole Study Group

DATE	WEEK	CUMULATIVE AVERAGE RESIDUALS	3 WEEK MOVING AVERAGE
80188	-22	-3.49	
150188		-5.21	
220188	-20	-7.49	-5.40
290188		-9.70	-7.47
50288	-18	-10.21	-8.14
120288		-11.02	-10.31
190288	-16	-10.90	-10.71
260288		-14.98	-12.30
40388	-14	-17.26	-14.38
110388		-17.03	-16.42
180388	-12	-20.50	-18.26
250388		-20.64	-19.39
310388	-10	-16.41	-19.15
80488		-21.06	-19.37
150488	-8	-22.15	-19.88
220488		-26.24	-23.16
290488	-6	-26.96	-25.13
50588		-29.74	-27.65
130588	-4	-30.40	-29.03
200588		-29.28	-29.81
270588	-2	-27.96	-29.21
30688		-27.81	-28.35
100688	0	-27.70	-27.82
170688		-30.30	-28.60
240688	2	-33.35	-30.46
10788		-33.21	-32.29
80788	4	-31.61	-32.73
150788		-31.82	-32.21
220788	6	-31.70	-31.71
290788		-32.04	-31.85
50888	8	-32.23	-31.99
120888		-32.18	-32.15
190888	10	-33.06	-32.50
260888		-32.52	-32.59
20988	12	-33.30	-32.97
90988		-35.01	-33.61
160988	14	-37.62	-35.31
230988		-41.66	-38.10
300988	16	-40.86	-40.05
71088		-38.80	-40.44
141088	18	-38.79	-39.48
211088		-42.14	-39.91
281088	20	-43.12	-41.35
41188		-43.40	-42.89
111188	22	-42.67	-43.06
181188		-44.43	-43.50
251188	24	-45.00	-44.04
21288		-44.96	-44.80
91288	26	-46.06	-45.34
151288		-47.16	-46.06

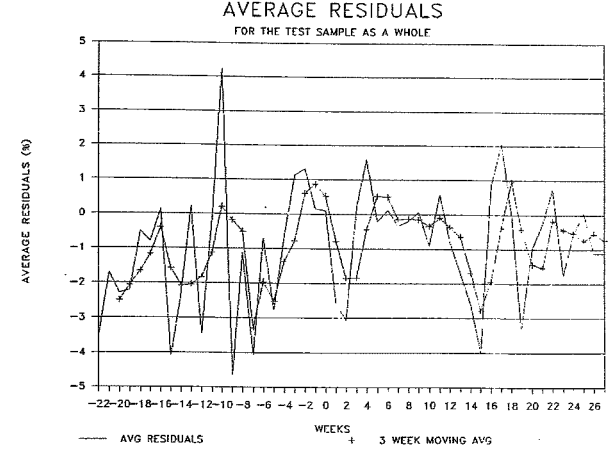

AVERAGE RESIDUALS
FOR THE TEST SAMPLE AS A WHOLE
AVERAGE RESIDUALS (%)
5
4
3
2
1
0
-1
-2
-3
-4
-5
-22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
WEEKS
AVG RESIDUALS
3 WEEK MOVING AVG

Figure 7.2.1

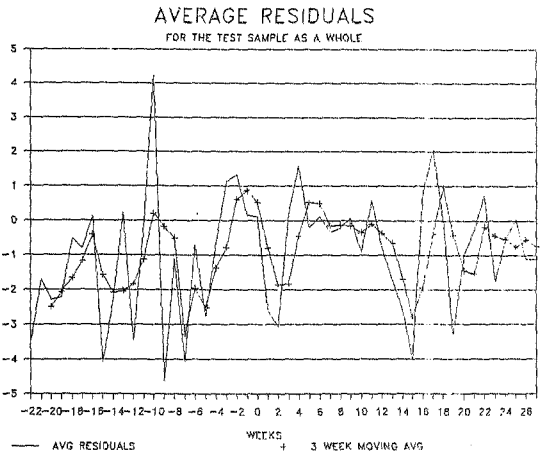


Figure 7.2.1

1651

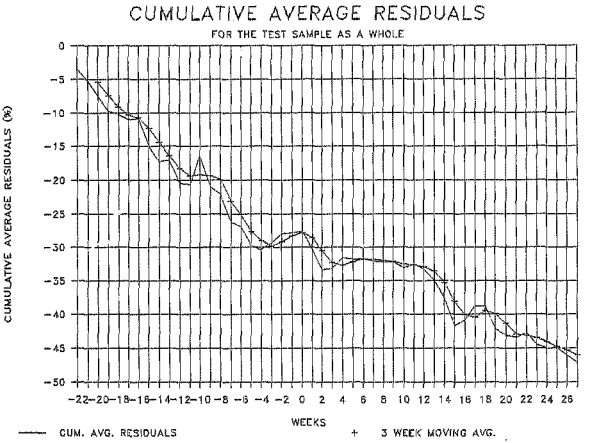

CUMULATIVE AVERAGE RESIDUALS
FOR THE TEST SAMPLE AS A WHOLE
CUMULATIVE AVERAGE RESIDUALS (%)
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
WEEKS
CUM. AVG. RESIDUALS
+ 3 WEEK MOVING AVG.

Figure 7.2.2

relating to the passage of the Deliut ...olpe Bill by the House of Representatives. It was found that the coverage was ... not as extensive as that accorded to the introduction of the Bill in May, 1988. Secondly, unlike the first information generating event, the coverage was not "headline" news. It is, therefore, submitted, that the informational content of event 2 may only have become publicly available by week 12, in which case the movement in the CAR's over that, and the subsequent periods, would make much more sense. If in fact this was the case, then the negative impounding process in weeks 13 to 15 would have occurred over a shorter period of time (namely 15 business days). Secondly, it would have been possible to generate a smaller abnormal return of 2,8% after maximum transactions costs by acting on the informational content of event 2 at week 13. Although this is an improvement, it would appear, that the market was relatively inefficient in its being relatively slow in impounding the informational content of event 2. The results of both events 1 and 2 read together seem to indicate that the market may be regarded as being relatively efficient; that is, the scope for abnormal returns is generally fairly small, and the market is information efficient (i.e. it responds in the right direction). Nevertheless, although the potential efficiency seems to outweigh the potential inefficiency, and although these results would appear to support Knight and Affleck-Graves' conclusion that the market is possibly becoming more efficient with the affluxion of time (1983: 31), it must be concluded that the level of efficiency implied in these results is not sufficient for the classification of the JSE as a truly efficient market with reference to the semi-strong form of the Efficient Market Hypothesis.

7.3 FURTHER ANALYSIS BY PARTITIONING

The study group consisting of thirty-nine mining shares was partitioned into pairs in terms of the criteria set out under section 7.1 above. The resultant groups are set out in table 7.3.1.1 for low beta versus high beta shares, table 7.3.2.1 for low versus high United States percentage shareholdings, and table 7.3.3.1 for low versus high Rand values of United States shareholdings. The original procedure used, albeit arbitrary, was to split the study group into two sub-groups of near-equal number, with the proviso that each sub-group taken as a whole differed significantly from the other, so as to ensure that each sub-group contained a sufficient number of shares. The average score for each sub-group does in fact differ significantly from the related other sub-

group, and the upper limit for the "low" sub-group also differs materially from the lower limit of the "high" sub-group.

The average residuals and the CAR's for both groups are graphically depicted in the ensuing sections for each of the three aforementioned criteria respectively. Corresponding three week moving averages are not shown in these cases in order to avoid cluttering the graphs.

7.3.1 Relative Risk

The average residuals and the related three week moving averages for both the "low beta" and the "high beta" groups are shown in table 7.3.1.2. Similarly the CAR's and the related three week moving averages for both groups are set out in table 7.3.1.3. The average residuals and CAR's are graphically represented in figures 7.3.1.1 and 7.3.1.2 respectively.

It is expected that there should be a differential market reaction by low beta and high beta shares to the information generating events of this study. Prior to zero week both groups display a well-defined negative and generally non-random trend in the movement of the CAR's. Surprisingly the negative impact is at first generally less for the high beta shares, although both sets of data move very much in tandem until week -2. Between weeks -4 and 0 the CAR's for the low beta group recover positively to a greater extent. The negative impact after week zero is generally greater for the high beta group, and the divergence between the low and high beta CAR's respectively is greatest in week 25.

As regards the first generating event, the subsequent negative impact is less for low beta than for high beta shares. In the case of the former an abnormal return of 1,6% could be generated during the adjustment period (which may be considered to be relatively immaterial), while the corresponding abnormal return for high beta shares is 4,4%. The adjustment for low beta shares occurs more rapidly, namely two weeks as against three weeks for the high beta shares. Between weeks 2 and 10 both sets of data display relatively stable movements, although these are more erratic for low beta shares, which also follow a persistent and gradual negative trend after week 4. It is

Table 7.3.1.1

Low Beta vs. High Beta Shares

	LOW BETA GROUP	BETA CO-EFFICIENT	ALPHA CO-EFFICIENT	US HOLDING PERCENTAGE
1	AFRIKANDER LEASE	0.621	-0.00008	26.8
2	BRACKEN	0.657	-0.00433	44.8
3	STILFONTEIN	0.740	-0.00593	13.8
4	BUFFELSFONTEIN	0.746	-0.00396	26.7
5	BLYVOORUITZICHT	0.853	-0.00159	46.4
6	LESLIE	0.857	0.000524	22.6
7	ZANDPAN	0.874	0.006986	13.4
8	KINROSS	0.878	-0.0012	18.9
9	WELKOM	0.898	-0.0022	10.1
10	HARMONY	0.909	-0.00217	25.4
11	WINKELS	0.933	0.001381	26.0
12	OESIL	0.955	-0.00357	16.6
13	CONS MODDER	1.018	-0.00731	55.8
14	FREEGOLD	1.027	-0.00182	13.9
15	GROOTVLEI	1.027	-0.00846	43.3
16	UNISEL	1.042	-0.00244	12.6
17	SOUTHVAAL	1.056	-0.00054	15.4
18	E.R.P.M.	1.098	0.003866	7.3
19	ST HELENA	1.109	-0.00566	21.3
	AVERAGE BETA CO-EFFICIENT	0.872		
	HIGH BETA GROUP			
20	ERGO	1.147	0.002749	10.6
21	AMGOLD	1.149	0.000362	8.7
22	WESTERN DEEP LEVELS	1.158	-0.00153	18.6
23	BEATRIX	1.164	0.004536	3.1
24	DURBAN DEEP	1.179	-0.00761	39.2
25	IMPALA PLATINUM	1.207	-0.00897	15.2
26	JOEL	1.208	0.006632	15.4
27	DEELKRAAL	1.210	0.004044	6.2
28	KLOOF	1.239	0.00859	19.4
29	VAAL REEFS	1.253	0.001897	22.4
30	EAST DAGGA	1.264	0.003486	21.5
31	ELSBURG	1.302	0.004834	18.1
32	EGOLI	1.314	0.00592	6.0
33	DE BEERS	1.322	-0.00033	16.4
34	GFSA	1.354	0.003933	5.6
35	SA LANDS	1.395	0.003523	7.7
36	WESTERN AREAS	1.402	0.004141	19.6
37	HARTEBEESTFONTEIN	1.424	0.007828	24.0
38	ELANDSRAND	1.456	0.001085	4.8
39	LORAINE	1.459	-0.00181	43.1
	AVERAGE BETA CO-EFFICIENT	1.220		

Table 7.3.1.2

Average Residuals: Low/High Beta Shares

DATE	WEEK	LOW BETA AVERAGE RESIDUALS	LOW BETA 3 WEEK MOVING AVERAGE	HIGH BETA AVERAGE RESIDUALS	HIGH BETA 3 WEEK MOVING AVERAGE
80188	-22	-3.09		-3.85	
150188		-1.92		-1.52	
220188	-20	-2.74	-2.58	-1.86	-2.42
290188		-2.72	-2.46	-1.73	-1.70
50288	-18	-1.81	-2.42	0.73	-0.95
120288		-0.24	-1.59	-1.35	-0.78
190288	-16	0.06	-0.66	0.18	-0.15
260288		-3.52	-1.26	-4.52	-1.90
40388	-14	-1.12	-1.56	-3.39	-2.58
110388		-0.45	-1.73	0.87	-2.35
180388	-12	-4.65	-2.08	-2.33	-1.62
250388		0.74	-1.46	-0.96	-0.82
310388	-10	3.16	-0.25	5.25	0.84
80488		-4.02	-0.04	-5.24	-0.32
150488	-8	0.00	-0.29	-2.19	-0.73
220488		-3.06	-2.36	-5.02	-4.15
290488	-6	-1.19	-1.42	-0.26	-2.49
50588		-3.22	-2.49	-2.38	-2.55
130588	-4	-1.17	-1.86	-0.17	-0.94
200588		1.49	-0.97	0.78	-0.59
270588	-2	1.84	0.72	0.82	0.48
30688		0.88	1.40	-0.56	0.35
100688	0	0.90	1.21	-0.63	-0.12
170688		-3.08	-0.43	-2.14	-1.11
240688	2	-2.38	-1.52	-5.74	-2.17
10788		2.92	-0.85	-2.44	-2.77
80788	4	0.98	0.51	2.19	-1.33
150788		0.60	1.50	-0.99	-0.42
220788	6	-0.35	0.41	0.58	0.59
290788		-0.82	-0.19	0.11	-0.10
50888	8	-0.43	-0.53	0.03	0.24
120888		0.51	-0.25	-0.36	-0.08
190888	10	-1.61	-0.51	-0.23	-0.19
260888		0.29	-0.27	0.84	0.08
20888	12	-1.21	-0.85	-0.37	0.09
90888		-1.35	-0.76	-2.05	-0.53
160888	14	-1.07	-1.21	-4.08	-2.17
230888		-3.70	-2.04	-4.35	-3.50
300888	16	1.22	-1.15	0.40	-2.68
71088		1.43	-0.35	2.65	-0.43
141088	18	1.79	1.48	-1.68	0.46
211088		-2.00	0.41	-4.65	-1.23
281088	20	-0.26	-0.15	-1.68	-2.66
41188		-0.02	-0.76	-0.52	-2.28
111188	22	1.66	0.46	-0.17	-0.78
181188		-2.24	-0.20	-1.31	-0.66
251188	24	-0.33	-0.30	-0.79	-0.76
21288		1.13	-0.48	-0.98	-1.03
91288	26	-1.50	-0.23	-0.73	-0.94
161288		-1.91	-0.76	-0.34	-0.69

Table 7.3.1.3

CAR's Low/High Beta Shares

DATE	WEEK	LOW BETA CUMULATIVE AVERAGE RESIDUALS	LOW BETA 3 WEEK MOVING AVERAGE	HIGH BETA CUMULATIVE AVERAGE RESIDUALS	HIGH BETA 3 WEEK MOVING AVERAGE
80188	-22	-3.09		-3.88	
150188		-5.01		-5.40	
220188	-20	-7.75	-5.28	-7.25	-5.51
290188		-10.46	-7.74	-8.98	-7.21
50288	-18	-12.27	-10.16	-8.26	-8.16
120288		-12.50	-11.74	-9.61	-8.95
190288	-16	-12.44	-12.40	-9.43	-9.10
260288		-16.06	-13.67	-13.95	-10.99
40388	-14	-17.18	-15.22	-17.33	-13.57
110388		-17.63	-18.96	-16.47	-15.92
180388	-12	-22.28	-19.03	-18.80	-17.53
250388		-21.55	-20.49	-19.78	-18.35
310388	-10	-18.39	-20.74	-14.53	-17.70
80488		-22.41	-20.75	-19.77	-18.03
150488	-8	-22.41	-21.07	-21.96	-18.75
220488		-25.47	-23.43	-26.98	-22.90
290488	-6	-26.66	-24.85	-27.24	-25.39
60588		-28.88	-27.34	-29.62	-27.95
130588	-4	-31.05	-29.20	-29.79	-28.88
200588		-29.56	-30.16	-29.01	-29.47
270588	-2	-27.72	-29.44	-28.19	-29.00
30688		-26.84	-28.04	-28.74	-28.65
100688	0	-25.93	-26.83	-28.38	-28.77
170688		-29.02	-27.26	-31.52	-29.88
240688	2	-31.39	-28.78	-35.26	-32.05
10788		-28.47	-29.63	-37.70	-34.83
80788	4	-27.49	-29.12	-35.51	-36.16
150788		-26.89	-27.62	-36.51	-36.57
220788	6	-27.24	-27.21	-35.93	-36.98
290788		-28.06	-27.40	-35.82	-36.09
50888	8	-28.49	-27.93	-35.79	-35.85
120888		-27.98	-28.18	-36.17	-35.93
190888	10	-29.80	-28.59	-36.40	-36.12
260888		-29.31	-28.98	-35.56	-36.04
20888	12	-30.52	-29.81	-35.93	-35.96
90888		-31.87	-30.57	-37.98	-36.48
160988	14	-32.94	-31.78	-42.07	-38.66
230988		-36.14	-33.82	-46.43	-42.16
300988	16	-35.11	-35.00	-46.03	-44.84
71088		-33.18	-35.35	-43.37	-45.28
141088	18	-32.19	-33.86	-46.05	-44.82
211088		-34.19	-33.45	-49.70	-46.04
281088	20	-34.44	-33.61	-51.36	-48.71
41188		-34.46	-34.36	-51.85	-50.98
111188	22	-32.80	-33.90	-52.05	-51.77
181188		-35.03	-34.10	-53.36	-52.43
251188	24	-35.37	-34.40	-54.15	-53.19
21288		-34.24	-34.88	-55.14	-54.21
91288	26	-35.74	-35.11	-55.87	-55.05
151288		-37.84	-35.87	-56.21	-55.74

AVERAGE RESIDUALS
LOW BETA VS. HIGH BETA SHARES
AVERAGE RESIDUALS (%)
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
WEEKS
LOW BETA
HIGH BETA

Figure 7.3.1.1

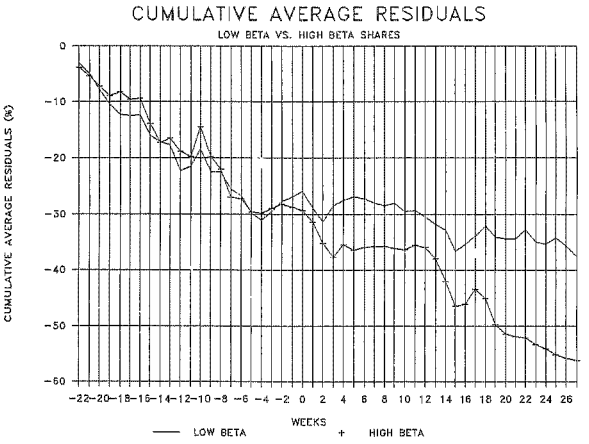

CUMULATIVE AVERAGE RESIDUALS
LOW BETA VS. HIGH BETA SHARES
CUMULATIVE AVERAGE RESIDUALS (%)
0
-10
-20
-30
-40
-50
-60
-22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
WEEKS
LOW BETA
HIGH BETA

Figure 7.3.1.2

possible that holders of low beta shares (such as the institutions) in general had a better anticipation of the negative informational content of event 2.

The initial adjustment period after event 2 in week 10 is the same for both groups, namely five weeks, which is relatively long. Moreover, it would have been possible to generate abnormal returns of 3,1% and 6,1% for the low beta and high beta groups respectively. After week 15 the CAR's for the low beta group react fairly randomly, although the overall trend is slightly negative. The high beta group initially reverses the previous negative trend, before showing sharp downward movements in weeks 18 and 19. Thereafter the negative trend decelerates, although the successive movements are not random.

It would appear, therefore, that the market is relatively more inefficient for high risk shares, although the degree of inefficiency in the low risk group is such that the market in low risk shares may also be regarded as being inefficient in the semi-strong form. Nevertheless, the market seems to have been efficient in its treatment of the informational content implied in events 1 and 2, and the ultimately greater negative impact on high risk shares is in accordance with expectations. Fluctuations in the average residuals of high beta shares are generally larger and more pronounced, although the movements are equally erratic for both groups.

7.3.2 The Impact of United States' Percentage Shareholdings

The average residuals and the related three week moving averages for both the "low U.S. holdings" and the "high U.S. holdings" groups are shown in table 7.3.2.2. Similarly the CAR's and the related three week moving averages for both groups are set out in table 7.3.2.3. The average residuals and CAR's are graphically represented in figures 7.3.2.1 and 7.3.2.2 respectively.

As may be expected, fluctuations in the average residuals of the high U.S. holdings group are more pronounced and larger than those of the low U.S. holdings group. Nonetheless, fluctuations in both sets of data follow a similarly erratic path.

Table 7.3.2.1

Low vs. High United States' Percentage Shareholdings

	LOW PERCENTAGE HOLDINGS GROUP	US HOLDING PERCENTAGE
1	BEATRIX	3.1
2	ELANDSRAND	4.8
3	GFSA	5.8
4	EGOLI	6.0
5	DRIEFONTEIN	6.2
6	E.R.P.M.	7.3
7	SA LANDS	7.7
8	AMGOLD	8.7
9	WELKOM	10.1
10	ERGO	10.6
11	UNISEL	12.6
12	ZANDPAN	13.4
13	STILFONTEIN	13.5
14	FREEGOLD	13.9
15	IMPALA PLATINUM	15.2
16	JOEL	15.4
17	SOUTHVAAL	15.4
18	DE BEERS	16.4
19	OFSIL	16.6
	AVERAGE PERCENTAGE US HOLDING	10.4
	HIGH PERCENTAGE HOLDINGS GROUP	
20	ELSBURG	18.1
21	WESTERN DEEP LEVELS	18.6
22	KINROSS	18.9
23	KLOOF	19.4
24	WESTERN AREAS	19.6
25	ST HELENA	21.3
26	EAST DAGGA	21.5
27	VAAL REEFS	22.4
28	LESLIE	22.6
29	HARTEBEESTFONTEIN	24.0
30	HARMONY	25.4
31	WINKELS	26.0
32	BUFFELSFONTEIN	26.7
33	AFRIKANDER LEASE	28.5
34	DURBAN DEEP	39.2
35	LORAINE	43.1
36	GROOTVLEI	43.3
37	BRACKEN	44.5
38	BLYVOORUITZICHT	45.3
39	CONS MODDER	55.8
	AVERAGE PERCENTAGE US HOLDING	26.7

(Source: Brown & Cooper, 1988: 23 - 24)

Table 7.3.2.2

Average Residuals: Low/High US Percentage Shareholdings

DATE	WEEK	PERCENTAGE HOLDINGS LOW US AVERAGE RESIDUALS	LOW US 3 WEEK MOVING AVERAGE	PERCENTAGE HOLDINGS HIGH US AVERAGE RESIDUALS	HIGH US 3 WEEK MOVING AVERAGE
80188	-22	-3.31		-3.67	
150188		-1.35		-2.06	
220188	-20	-1.71	-2.12	-2.64	-2.86
290188		-1.55	-1.54	-2.83	-2.58
50288	-18	0.60	-0.89	-1.57	-2.41
120288		-0.75	-0.57	-0.88	-1.75
190288	-16	0.61	0.15	-0.34	-0.92
260288		-3.76	-1.30	-4.38	-1.86
40388	-14	-2.59	-1.91	-1.98	-2.24
110388		-0.71	-2.35	1.11	-1.76
180388	-12	-2.11	-1.80	-4.75	-1.88
250388		-0.83	-1.22	0.50	-1.04
310388	-10	4.04	0.37	4.40	0.05
80488		-4.35	-0.38	-4.93	-0.01
150488	-8	-1.46	-0.59	-0.80	-0.44
220488		-4.30	-3.37	-3.84	-3.19
290488	-6	-0.40	-2.05	-1.01	-1.88
50588		-2.58	-2.43	-2.99	-2.61
130588	-4	-1.85	-1.61	0.48	-1.17
200588		0.19	-1.41	2.01	-0.17
270588	-2	1.89	0.01	0.97	1.15
30688		-0.11	0.59	0.39	1.12
100688	0	0.03	0.54	0.19	0.52
170688		-1.55	-0.54	-3.60	-1.01
240688	2	-2.36	-1.29	-3.76	-2.39
10788		-0.22	-1.38	0.54	-2.27
80788	4	1.56	-0.33	1.61	-0.54
150788		-0.48	0.30	0.04	0.73
220788	6	-1.45	-0.11	1.82	1.09
290788		0.44	-0.50	-1.08	0.18
50888	8	-0.32	-0.44	-0.07	0.15
120888		-0.51	-0.13	0.59	-0.18
190888	10	-0.78	-0.54	-1.03	-0.17
260888		-0.07	-0.45	1.18	0.25
20988	12	-0.70	-0.52	-0.85	-0.23
90988		-1.14	-0.64	-2.25	-0.64
160988	14	-2.68	-1.55	-2.35	-1.82
230988		-2.81	-2.28	-5.20	-3.27
300988	16	0.46	-1.74	1.12	-2.15
71088		3.25	0.30	0.92	-1.05
141088	18	-0.08	1.21	0.11	0.72
211088		-2.57	0.20	-4.11	-1.03
281088	20	-1.52	-1.39	-0.46	-1.49
41188		0.08	-1.33	-0.62	-1.73
111188	22	0.47	-0.32	0.97	-0.04
181188		-2.97	-0.81	-0.61	-0.09
251188	24	-0.28	-0.93	-0.84	-0.16
21288		0.14	-1.04	-0.04	-0.50
91288	26	-0.58	-0.24	-1.80	-0.83
161288		-0.37	-0.27	-1.80	-1.15

Table 7.3.2.3

CAR's: Low/High US Percentage Shareholdings

DATE	WEEK	PERCENTAGE HOLDINGS LOW US CUMULATIVE AVERAGE RESIDUALS	LOW US 3 WEEK MOVING AVERAGE	PERCENTAGE HOLDINGS HIGH US CUMULATIVE AVERAGE RESIDUALS	HIGH US 3 WEEK MOVING AVERAGE
80188	-22	-3.31		-3.87	
150188		-4.85		-5.73	
220188	-20	-6.38	-4.77	-8.57	-5.99
290188		-7.92	-6.31	-11.40	-8.57
50288	-18	-7.31	-7.20	-12.96	-10.98
120288		-8.07	-7.77	-13.82	-12.73
190288	-16	-7.46	-7.61	-14.16	-13.65
260288		-11.21	-8.91	-18.55	-15.51
40388	-14	-13.80	-10.82	-20.54	-17.75
110388		-14.51	-13.15	-19.43	-19.51
180388	-12	-16.62	-14.98	-24.18	-21.38
250388		-17.45	-16.19	-23.88	-22.43
310388	-10	-13.40	-15.83	-19.27	-22.37
80488		-17.75	-16.20	-24.20	-22.38
150488	-8	-19.21	-16.79	-25.00	-22.82
220488		-23.52	-20.16	-28.84	-26.01
290488	-6	-23.91	-22.21	-29.85	-27.89
50588		-26.49	-24.64	-32.84	-30.51
130588	-4	-28.34	-28.25	-32.39	-31.85
200588		-28.15	-27.66	-30.36	-31.85
270588	-2	-28.46	-27.65	-29.35	-30.70
30688		-26.57	-27.06	-29.00	-29.58
100688	0	-26.54	-26.52	-28.80	-29.06
170688		-28.09	-27.07	-32.40	-30.07
240688	2	-30.45	-28.36	-36.16	-32.46
10788		-30.67	-29.73	-35.82	-34.73
80788	4	-29.08	-30.06	-34.01	-35.26
150788		-29.56	-29.77	-33.98	-34.54
220788	6	-31.01	-29.88	-32.36	-33.45
290788		-30.58	-30.36	-33.44	-33.26
50888	8	-30.89	-30.82	-33.52	-33.11
120888		-31.39	-30.95	-32.83	-33.30
190888	10	-32.17	-31.48	-33.95	-33.46
260888		-32.25	-31.94	-32.77	-33.22
20988	12	-32.95	-32.46	-33.63	-33.45
90988		-34.09	-33.10	-35.88	-34.09
160988	14	-36.96	-34.67	-38.24	-35.92
230988		-38.73	-36.95	-43.44	-39.19
300988	16	-38.32	-38.69	-42.32	-41.33
71088		-38.06	-38.38	-41.40	-42.39
141088	18	-38.15	-37.18	-41.29	-41.67
211088		-38.72	-38.98	-45.40	-42.70
281088	20	-40.24	-38.37	-45.86	-44.18
41188		-40.15	-38.70	-46.48	-45.92
111188	22	-39.68	-40.02	-45.51	-45.95
181188		-42.66	-40.83	-46.12	-46.04
251188	24	-42.94	-41.76	-46.96	-46.20
21288		-42.80	-42.80	-47.00	-46.69
91288	26	-43.38	-43.04	-48.80	-47.52
161288		-43.75	-43.31	-50.41	-48.87

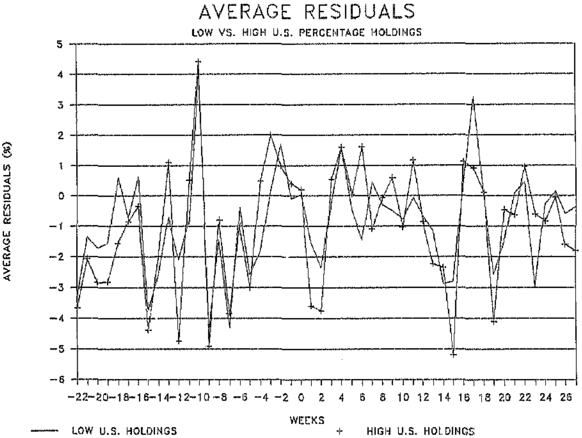

AVERAGE RESIDUALS
LOW VS. HIGH U.S. PERCENTAGE HOLDINGS
AVERAGE RESIDUALS (%)
5
4
3
2
1
0
−1
−2
−3
−4
−5
−6
−22 −20 −18 −16 −14 −12 −10 −8 −6 −4 −2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
WEEKS
LOW U.S. HOLDINGS
+ HIGH U.S. HOLDINGS

Figure 7.3.2.1

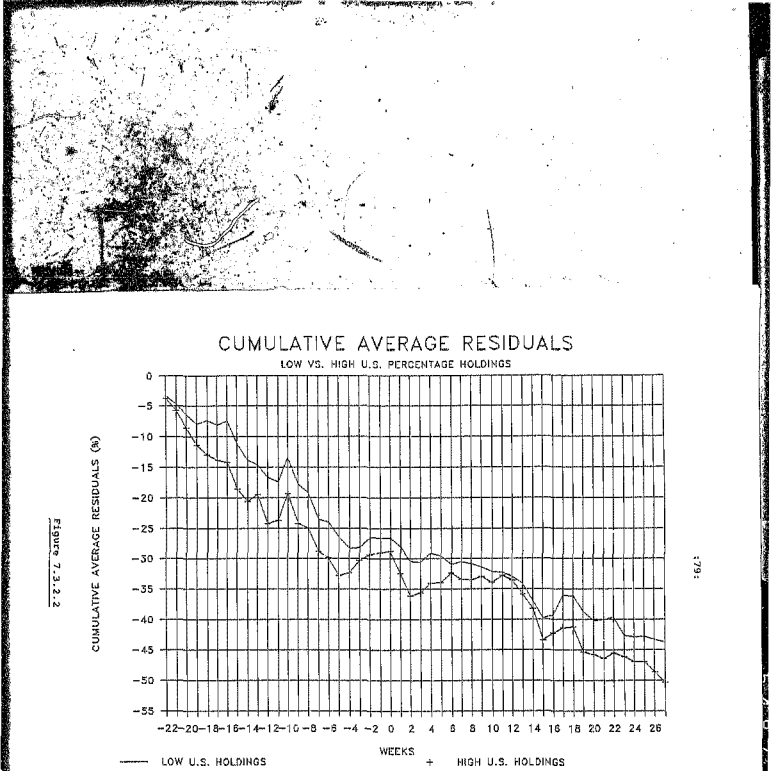

CUMULATIVE AVERAGE RESIDUALS
LOW VS. HIGH U.S. PERCENTAGE HOLDINGS
CUMULATIVE AVERAGE RESIDUALS (%)
0
-5
-10
-15
-20
-25
-30
-35
-40
-45
-50
-55
-22 -20 -18 -16 -14 -12 -10 -8 -6 -4 -2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
WEEKS
LOW U.S. HOLDINGS
HIGH U.S. HOLDINGS

Figure 2.2.3.7

It may be expected that the negative impact on the high U.S. holdings would be larger than that for the low U.S. holdings group. The movements in the CAR's reveal that this is indeed the case. Almost immediately there is a significant divergence between the two sets of data, with the high U.S. holdings group the more adversely affected. The gap between the two data sets is fairly consistently the same over the whole deletion period, although it narrows such as to be virtually eliminated during weeks 11 to 14. The adjustment periods are almost identical for both sets of data after each information generating event, although it may be argued that a better anticipation of the informational content of event 2 occurred in respect of the low U.S. holdings group. Nevertheless, the adjustment periods in respect of event 2 are long at nine weeks for both sets of data. Moreover, abnormal returns could have been generated after event 1 for the high U.S. holdings group, and for both groups after event 2. Clearly this is indicative of market inefficiency in the semi-strong form. The informational content of the information generating events is, however, correctly and negatively responded to. Nevertheless, it was hypothesized in this study that there should have been virtually no divergence between the movements in the CAR's for both groups, because of anticipated substitution effects. This is clearly not the case, and therefore the market appears to have responded inefficiently in its treatment of the high *vis-a-vis* the low U.S. holdings group.

7.3.3 The Impact of the Rand Value of United States' Holdings

The average residuals and the related three week moving averages for both the "low Rand value" and the "high Rand value" groups are shown in table 7.3.3.2. Similarly the CAR's and the related three week moving averages for both groups are set out in table 7.3.3.3. The average residuals and CAR's are graphically represented in figures 7.3.3.1 and 7.3.3.2 respectively.

The average residuals for both groups are equally erratic, but surprisingly the fluctuations for the low Rand value group are generally much larger than those for the high Rand value group. It may be argued that the high Rand value group should show the larger fluctuations and the greater negative impact, because of supply and demand considerations, since the largest investments in Rand terms would be the most difficult to absorb in the event of forced disinvestment. This apparent anomaly may be

Table 7.3.3.1

Low vs. High Rand Values of United States' Shareholdings

LOW RAND VALUE GROUP		RAND VALUE US HOLDING R'MILLIONS
1	SA LANDS	4.83
2	EGOLI	5.34
3	AFRIKANDER LEASE	5.41
4	LESLIE	19.36
5	E.R.P.M.	23.59
6	DURBAN DEEP	24.60
7	STILFONTEIN	32.39
8	BRACKEN	32.61
9	GROOTVLEI	39.62
10	BEATRIX	46.38
11	EAST DAGGA	48.63
12	ELSBURG	61.56
13	ST HELENA	73.86
14	DEELKRAAL	79.50
15	UNISEL	79.95
16	ZANDPAN	86.30
17	ERGO	86.95
18	CONS MODDER	94.43
19	WELKOM	99.97
AVERAGE RAND VALUE		57.73
HIGH RAND VALUE GROUP		
20	KLANDSRAND	124.40
21	LORAINE	129.84
22	WESTERN AREAS	134.51
23	JOEL	148.99
24	KINROSS	170.23
25	BUFFELSFONTEIN	177.85
26	BLYVOORUITZICHT	211.39
27	WINKELS	229.83
28	HARMONY	242.29
29	IMPALA PLATINUM	250.02
30	GFSA	268.71
31	OBSIL	373.58
32	AMGOLD	583.67
33	SOUTHVAAL	627.91
34	FREEGOLD	671.59
35	WESTERN DEEP LEVELS	701.85
36	HARTEBEESTFONTEIN	780.44
37	KLOOF	1033.88
38	VAAL REEFS	1529.95
39	DE BEERS	1752.95
AVERAGE RAND VALUE		501.46

(Source: Brown & Cooper, 1988: 25 - 26)

Table 7.3.3.2

Average Residuals: Low/High Rand Value of US Shareholdings

DATE	WEEK	VALUE OF U.S. INVEST LOW VALUE AVERAGE RESIDUALS	LOW VALUE 3 WEEK MOVING AVERAGE	VALUE OF U.S. INVEST HIGH VALUE AVERAGE RESIDUALS	HIGH VALUE 3 WEEK MOVING AVERAGE
80188	-22	-2.95		-4.01	
150188		-1.89		-1.74	
220188	-20	-1.91	-2.18	-2.64	-2.80
290188		-0.68	-1.43	-3.86	-2.68
50288	-18	-3.13	-1.91	1.98	-1.44
120288		-1.83	-1.88	0.17	-0.50
190288	-16	0.64	-1.44	-0.37	0.59
260288		-4.87	-2.02	-3.33	-1.18
40388	-14	-2.78	-2.34	-1.81	-1.83
110388		-0.09	-2.58	0.52	-1.54
180388	-12	-3.55	-2.14	-3.38	-1.56
250388		1.21	-0.81	-1.42	-1.43
310388	-10	3.91	0.52	4.53	-0.09
80488		-6.27	-0.38	-3.11	0.00
150488	-8	-0.87	-1.07	-1.36	0.02
220488		-4.87	-3.93	-3.50	-2.65
290488	-6	-1.53	-2.36	0.07	-1.80
50588		-3.08	-3.09	-2.51	-1.98
130588	-4	-0.14	-1.58	-1.15	-1.20
200588		1.66	-0.52	0.61	-1.02
270588	-2	1.90	1.14	0.77	0.08
30688		-0.48	1.03	0.74	0.71
100688	0	0.09	0.50	0.14	0.55
170688		-2.52	-0.97	-2.68	-0.60
240688	2	-5.51	-2.65	-0.76	-1.10
10788		0.40	-2.54	-0.05	-1.16
80788	4	0.62	-1.50	2.52	0.57
150788		0.34	0.45	-0.74	0.58
220788	6	0.09	0.35	0.15	0.65
290788		-1.18	-0.25	0.46	-0.04
50888	8	-0.02	-0.37	-0.36	0.08
120888		-0.49	-0.56	0.58	0.22
190888	10	-0.75	-0.42	-1.06	-0.28
260888		0.76	-0.16	0.38	-0.05
20988	12	-2.34	-0.78	0.70	0.01
90988		-2.31	-1.29	-1.14	-0.02
160988	14	-3.37	-2.67	-1.89	-0.78
230988		-4.46	-3.38	-3.53	-2.22
300988	16	0.27	-2.52	1.31	-1.41
71088		2.58	-0.54	1.56	-0.26
141088	18	0.40	1.08	-0.35	0.84
211088		-4.10	-0.37	-2.66	-0.49
281088	20	-1.02	-1.57	-0.94	-1.32
41188		-1.36	-2.17	0.76	-0.94
111188	22	0.71	-0.56	0.70	0.19
181188		-2.51	-1.06	-1.05	0.18
251188	24	-0.18	-0.66	-0.94	-0.42
21288		0.72	-0.66	-0.59	-0.86
91288	26	-0.87	-0.11	1.33	-0.95
151288		-1.75	-0.64	-0.49	-0.80

Table 7.3.3.3

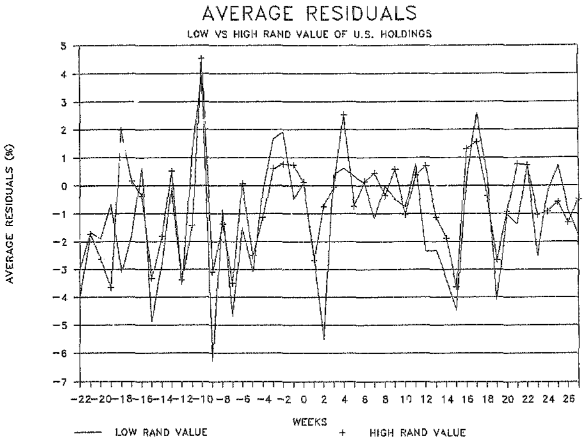
CAR's: Low/High Rand Value of US Shareholdings

DATE	WEEK	U.S. INVEST LOW VALUE CUMULATIVE AVERAGE RESIDUALS	LOW VALUE 3 WEEK MOVING AVERAGE	U.S. INVEST HIGH VALUE CUMULATIVE AVERAGE RESIDUALS	HIGH VALUE 3 WEEK MOVING AVERAGE
80188	-22	-2.95		-4.01	
150188		-4.64		-5.75	
220188	-20	-8.55	-4.71	-8.39	-8.05
290188		-7.23	-6.14	-12.05	-8.73
50288	-18	-10.36	-8.05	-10.07	-10.17
120288		-12.19	-9.93	-9.91	-10.68
190288	-16	-11.55	-11.37	-10.27	-10.05
260288		-10.42	-13.39	-13.60	-11.26
40388	-14	-19.20	-15.72	-15.41	-13.09
110388		-19.29	-18.31	-14.89	-14.63
180388	-12	-22.84	-20.45	-14.27	-16.19
250388		-21.64	-21.26	-19.69	-17.61
310388	-10	-17.73	-20.74	-15.16	-17.71
80488		-23.99	-21.12	-18.27	-17.71
150488	-8	-24.86	-22.19	-19.63	-17.68
220488		-25.53	-26.13	-23.13	-20.34
290488	-6	-31.06	-28.48	-23.06	-21.94
50588		-34.14	-31.58	-25.57	-23.92
130588	-4	-34.28	-33.16	-26.72	-25.11
200588		-32.62	-33.68	-26.11	-26.13
270588	-2	-30.72	-32.54	-25.34	-26.05
30688		-31.20	-31.51	-24.60	-25.35
100688	0	-31.10	-31.01	-24.45	-24.80
170688		-33.62	-31.97	-27.14	-25.40
240688	2	-39.13	-34.62	-27.90	-26.50
10788		-38.73	-37.16	-27.96	-27.67
80788	4	-38.11	-38.66	-25.43	-27.10
150788		-37.77	-38.20	-26.17	-26.52
220788	6	-37.68	-37.85	-26.02	-25.87
290788		-38.56	-38.10	-25.56	-25.92
50888	8	-38.88	-38.47	-25.92	-25.83
120888		-39.37	-39.04	-25.35	-25.61
190888	10	-40.12	-39.46	-26.40	-25.88
260888		-39.36	-39.62	-26.02	-25.92
20988	12	-41.70	-40.39	-25.32	-25.91
90988		-44.03	-41.69	-26.46	-25.93
160988	14	-47.38	-44.36	-26.35	-26.71
230988		-51.84	-47.74	-31.99	-28.93
300988	16	-51.57	-50.26	-30.68	-30.34
71088		-48.99	-50.80	-29.12	-30.59
141088	18	-48.58	-49.71	-29.45	-29.76
211088		-52.68	-50.08	-32.13	-30.24
281088	20	-53.70	-51.65	-33.07	-31.56
41188		-55.08	-53.82	-32.29	-32.50
111188	22	-54.37	-54.38	-31.56	-32.31
181188		-56.88	-55.44	-32.60	-32.15
251188	24	-57.06	-56.10	-33.55	-32.57
21288		-56.34	-56.76	-34.14	-33.43
91288	26	-57.21	-56.87	-35.46	-34.38
151288		-58.96	-57.51	-35.98	-35.18

Table 7.3.3.3

CAR's: Low/High Rand Value of US Shareholdings

DATE	WEEK	U.S. INVEST LOW VALUE CUMULATIVE AVERAGE RESIDUALS	LOW VALUE 3 WEEK MOVING AVERAGE	U.S. INVEST HIGH VALUE CUMULATIVE AVERAGE RESIDUALS	HIGH VALUE 3 WEEK MOVING AVERAGE
80188	-22	-2.95		-4.01	
150188		-4.64		-5.75	
220188	-20	-6.65	-4.71	-8.39	-6.05
290188		-7.23	-6.14	-12.05	-8.73
50288	-18	-10.36	-8.05	-10.07	-10.17
120288		-12.19	-9.93	-9.91	-10.68
190288	-16	-11.55	-11.37	-10.27	-10.08
260288		-16.42	-13.39	-13.60	-11.26
40388	-14	-18.20	-15.72	-15.41	-13.09
110388		-19.29	-18.31	-14.89	-14.83
180388	-12	-22.84	-20.45	-18.27	-16.19
250388		-21.84	-21.26	-19.69	-17.81
310388	-10	-17.73	-20.74	-15.16	-17.71
60488		-23.99	-21.12	-18.27	-17.71
150488	-8	-24.86	-22.19	-18.83	-17.68
220488		-23.53	-28.13	-23.13	-20.34
290488	-6	-31.06	-26.48	-23.06	-21.94
50588		-34.14	-31.58	-25.57	-23.92
130588	-4	-34.28	-33.16	-26.72	-25.11
200588		-32.62	-33.68	-26.11	-26.13
270588	-2	-30.72	-32.54	-25.34	-26.05
30688		-31.20	-31.51	-24.60	-25.35
100688	0	-31.10	-31.01	-24.46	-24.80
170688		-33.62	-31.97	-27.14	-25.40
240688	2	-39.13	-34.62	-27.90	-26.50
10788		-35.73	-37.16	-27.96	-27.67
80788	4	-36.11	-38.68	-25.43	-27.10
150788		-37.77	-38.20	-26.17	-26.52
220788	6	-37.68	-37.85	-26.02	-25.87
290788		-38.86	-38.10	-25.56	-25.92
50888	8	-38.88	-38.47	-25.92	-25.83
120888		-39.37	-39.04	-25.35	-25.61
190888	10	-40.12	-39.46	-26.40	-25.89
260888		-39.36	-39.62	-26.02	-25.92
20988	12	-41.70	-40.39	-25.32	-25.91
90988		-44.00	-41.69	-26.46	-25.93
160988	14	-47.36	-44.36	-28.35	-26.71
230988		-51.84	-47.74	-31.99	-28.93
300988	16	-51.57	-50.26	-30.68	-30.34
71088		-48.99	-50.80	-29.12	-30.59
141088	18	-48.58	-49.71	-29.48	-29.76
211088		-52.68	-50.08	-32.13	-30.24
281088	20	-53.70	-51.65	-33.07	-31.56
41188		-55.08	-53.82	-32.29	-32.50
111188	22	-54.37	-54.38	-31.56	-32.31
181188		-56.88	-55.44	-32.60	-32.15
251188	24	-57.08	-56.10	-33.55	-32.57
21288		-56.34	-56.78	-34.14	-33.43
91288	26	-57.21	-56.87	-35.46	-34.38
151288		-58.96	-57.51	-35.96	-35.18



AVERAGE RESIDUALS
LOW VS HIGH RAND VALUE OF U.S. HOLDINGS
AVERAGE RESIDUALS (%)
5
4
3
2
1
0
−1
−2
−3
−4
−5
−6
−7
−22 −20 −18 −16 −14 −12 −10 −8 −6 −4 −2 0 2 4 6 8 10 12 14 16 18 20 22 24 26
WEEKS
LOW RAND VALUE
+ HIGH RAND VALUE

Figure 7.3.3.1

CUMULATIVE AVERAGE RESIDUALS

LOW VS HIGH RAND VALUE OF U.S. HOLDINGS

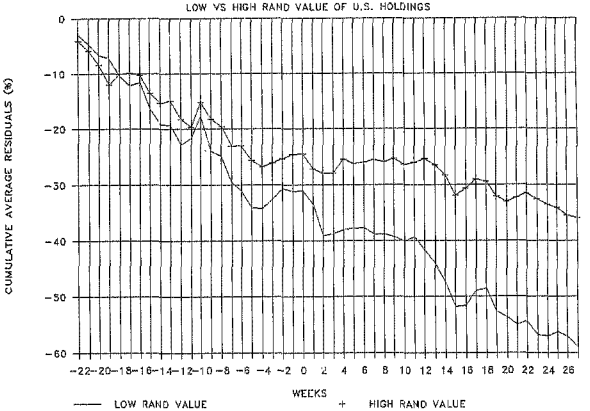
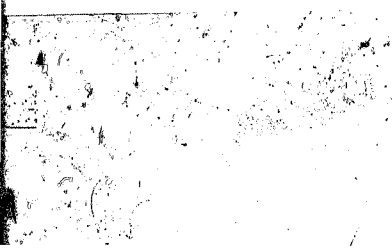


Figure 7.3.3.2



explained by examining the contents of each sub-group. The low Rand value shares may generally be described as speculative shares *in terms of generally accepted* investments research practice; certainly fourteen of the nineteen may be accurately described as such. In contrast only five of the twenty shares in the high Rand *value* group could be realistically described as speculative. These groups do, however, differ significantly from those derived in terms of the partition in respect of low versus high beta shares. *The larger fluctuations* in the low Rand value group may, therefore, be considered reasonable in the light of these circumstances.

Because of expected substition effects in the event of disinvestment, it was hypothesized in this study, that Rand values should not *lead to significant differences* in the CAR's of low versus high Rand value shares. This is clearly not the case; the gap between the two sets of data widens progressively during the course of the defetion *period*. Although the adjustment period after zero week is relatively short at two weeks, it is quite slow at four to five weeks after the second information generating event. *The data sets have, however,* responded in the right direction. While immaterial abnormal returns could have been generated in respect of the high Rand value (less speculative) group after the information *generating events, the same* cannot be said of the low Rand value (more speculative) group. After the first and second information generating events, abnormal returns of approximately four and nearly *eight per cent* respectively could have been derived. The relatively slow impounding of information and the fact that abnormal returns could be generated are indicative of an *inefficient market*, although in this case the high Rand value (less speculative) shares are relatively more efficient. The impounding of information, while it occurred in the *expected negative direction, is contrary to* the pattern expected under the hypothesized substition effects, and it is submitted that the market was information inefficient in its differential treatment of the low versus the *high Rand value group*.

CHAPTER 8

CONCLUSIONS

8.1 INTRODUCTION

The main hypotheses of this study are re-stated in section 8.2 below for convenience. The hypotheses are subsequently compared to the results of the study in section 8.3. The limitations of the study are discussed in section 8.4, and possible areas of future research are proposed in section 8.5.

8.2 RE-STATEMENT OF HYPOTHESES

The hypotheses, which this study sought to prove, are as follows:

1) That the market is efficient in the semi-strong form with specific reference to the impact of sanctions-oriented draft legislation;
2) That the informational content of the introduction of the Dellums-Wolpe Bill, and its subsequent passage in the House of Representatives on the 11th of August 1988 (information generating events for the purposes of this study), had a negative impact on mining share prices; and
3) That the informational content of the withdrawal of the sanctions legislation on the 19th of October, and the subsequent election of Bush as the President of the United States on the 8th of November 1988 (information generating events for the purposes of this study), had a positive effect on mining share prices.

8.3 CONCLUSIONS

In order for a market to be efficient, prices should accurately and rapidly impound new information. Although the results of this study showed, that the share prices of the study group (and the sub-groups) reacted in the expected, negative direction (except in the case of event 3, where an expected outcome was not clearly determinable, and thus no conclusions are made), the duration of the adjustment process after the informational content of the information generating events (namely, 1 and 2) was generally quite slow, and as a result abnormal returns could have been generated by acting on the basis of publicly available information. Thus while the residuals moved in the right direction, and the negative impounding was largely completed by the time the first information generating event occurred, the reaction

was certainly not fully completed, nor subsequently rapid enough to prevent the generation of abnormal returns. By implication the prices of the study group did not adjust efficiently to the informational content of the information generating events, although the adjustment was accurate. Therefore it is concluded that the JSE is not an efficient market in the semi-strong form.

The study group as a whole reacted as expected to the negative informational content of events 1 and 2 (namely, the introduction of the Dellums-Wolpe Bill and its subsequent passage by the House of Representatives). It may be argued, however, that the study group should not have reacted as negatively as it appears to have done, to the informational content of events 1 and 2; firstly, because of the limited economic impact of the Dellums-Wolpe Bill, and secondly, because of the safety-valve mechanism provided by the financial Rand. As has already been noted, the analysis of the residuals subsequent to events 3 and 4 (namely, the effective withdrawal of the Bill and the election of Bush as President respectively) was abandoned, because of the existence of counteracting and confounding factors. Conclusions relating to the duration of the adjustment process subsequent to event 2 must also be regarded as tentative, because of its close proximity to events 3 and 4; nevertheless the *initial* adjustment process was by itself quite slow, and, moreover, the positive informational content of events 3 and 4 had no discernable impact on the continued negative trend of the cumulative average residuals.

The study group appears to have anticipated the occurrence of event 1 well in advance. Certainly the adjustment process was largely completed by the time the informational content was deemed to be publicly available. The trend of the CAR's is clearly non-random. The relatively long adjustment period prior to week zero may be ascribed to uncertainty regarding the eventual occurrence of event 1. Insider information may be assumed to have played a relatively minor role, if any, during the adjustment period. The negative and non-random trend may, therefore, be considered to have reflect the weight of public opinion, rather than the impact of definitive information at the time.

The high beta shares behaved as expected in relation to the low beta shares. In contrast, the results for the high versus low U.S. percentage holdings sub-groups and

the high versus low Rand value sub-groups contradicted the hypothesized results, which postulated that the market would anticipate substitution effects and, therefore, not penalise shares which reflected large U. S. percentage holdings or large Rand investments by U.S. shareholders.

To this extent the market may be regarded as information inefficient.

Although the overall conclusion of this study is that the JSE (subject to the limitations of the study, which are discussed below) is not efficient in the semi-strong form, the efficient market hypothesis in this form may, nevertheless, in fact be a valid model for the JSE. The results for the study group may also be regarded as indicative of an improvement in relation to the results obtained by Knight and Affleck-Graves (1983). This may provide support for their contention that the level of efficiency on the JSE has improved with the passage of time (*1983: 31*).

8.4 LIMITATIONS

The major limitations of this study are, that the study group was limited to those mining shares with an average annual trading volume of at least 250 000 in 1986 and 1987, that the conclusions do not apply to unlisted (mining) shares and that no quasi-equivalent control group could be determined, because of the non-existence of matching shares, since the information generating events had a pervasive impact on mining shares in general. In addition, the study focused on events which affected the individual shares in the study group at approximately the same time, and the effects of spurious confounding variables could not be isolated or quantified. Moreover, the events related to the Dellums-Wolpe Bill are not specific events such as a takeover bid, or a dividend or earnings announcement. It was never certain that the Bill would be passed into law; thus the impact of the Bill on share price behaviour must be regarded as reflecting the weight of investor opinion, rather than as a definitive reaction to a specific event.

8.5 SUGGESTIONS FOR FUTURE RESEARCH

The conclusions of this study demonstrate that further research on the efficiency of

the Johannesburg Stock Exchange is both necessary and desirable, since the evidence for or against the Efficient Market Hypothesis in its semi-strong remains inconclusive. Nevertheless, there are indications that the degree of efficiency is improving over time, and therefo[illegible]ular and ongoing studies of market efficiency are needed to assess the degree o[illegible]fficiency with the effluxion of time. The Efficient Market Hypothesis is of cardinal importance to investment analysts and portfolio managers. Although a market may be regarded as inefficient, it is still relevant and important to establish the extent of inefficiency; whether a market is relatively efficient or relatively inefficient n[illegible]onsidered to be an important question in its own right.

It is suggested, in conclusion, that further clarifying research be undertaken in the following specific areas:

(a) volume dependence of betas;
(b) the impact of those information generating events having different accounting and economic effects;
(c) the impact on market efficiency once comprehensive futures markets are established in South Africa;
(d) the impact of the criteria applied to distinguish capital (non-taxable) from revenue (taxable) transactions on market efficiency; and
(e) the efficiency of the gilts and semi-gilts market.

APPENDICES

APPENDIX A

FOREIGN HOLDINGS IN INDIVIDUAL SOUTH AFRICAN GOLD MINING SHARES
(PERCENTAGE OF SHARES IN ISSUE)
AS AT 31ST DECEMBER 1947

Company	Issued Shares	US Holding	%	BOGES/ SIDDYAM	%	Landen /Register	%	Total Foreign Holding	%
Anglo American									
Afrikander Lease	6 727 500	1 804 778	26,8	Nil	Nil	Nil	Nil	1 804 775	26,8
Ergo	42 678 712	4 455 125	10,9	55 000	0,1	386 728	0,9	4 900 853	11,5
Klerksdorp	96 619 825	4 684 354	4,8	200 970	0,2	726 807	0,8	5 630 131	5,8
Freegold	115 179 121	16 182 823	13,9	5 007 081	4,3	2 400 160	2,1	23 590 064	20,3
Orkla	22 514 064	3 735 826	16,6	1 244 570	5,5	611 100	2,7	5 590 998	24,8
SA Lands	9 182 700	715 5s 1	7,7	Nil	Nil	917 590	10,0	1 626 134	17,7
Southvaal	26 000 000	4 025 000	15,4	154 768	0,5	328 386	1,3	4 506 192	17,3
Vaal Reefs	19 000 000	4 249 566	22,4	760 602	3,7	842 086	4,4	5 784 953	30,5
Welkom	35 750 037	3 570 511	10,1	257 547	0,7	756 262	2,1	4 584 120	12,9
Western Deep	27 164 115	5 049 315	18,6	1 291 091	4,7	514 443	1,9	6 844 849	25,2
	403 847 054	48 487 200	12,1	8 912 019	2,2	7 477 271	1,9	64 476 796	16,3
Anglovaal									
Harmsworth	112 000 000	26 911 570	24,0	2 206 433	2,0	2 726 099	2,4	31 858 102	28,4
Loraine	16 366 966	7 064 537	43,1	77 796	0,5	974 715	6,0	8 117 148	49,6
Zandpan	130 202 850	17 434 513	13,4	174 544	0,1	4 769 326	3,7	22 407 183	17,2
	258 569 816	51 410 720	19,9	2 458 273	0,9	8 469 140	3,3	62 382 413	24,1
Rand Mines									
Blyvooruitzicht	24 000 000	11 125 597	46,3	750 997	3,2	717 530	3,0	12 593 514	52,5
Durban Deep	3 325 000	910 979	39,2	Nil	Nil	198 362	8,6	1 110 371	47,8
ERPM	11 088 000	813 491	7,3	6 834 714	61,6	475 923	4,2	8 124 130	73,2
Harmony	25 964 000	6 825 018	26,4	6 524 652	25,1	1 699 961	7,1	14 949 952	58,6
	64 377 000	19 675 086	30,6	13 810 773	21,5	3 792 816	5,1	36 776 977	57,2
General									
Bantjes	85 000 000	2 650 273	3,1	77	Nil	603 836	0,8	3 363 986	5,9
Brakpan	14 000 000	6 272 110	44,8	Nil	Nil	2 148 310	15,3	8 418 420	60,1
Buffelsfontein	11 000 000	3 939 532	35,7	2 088 706	19,0	169 940	1,5	6 198 178	56,3
Grootvlei	11 438 817	4 957 072	43,3	23 407	0,2	554 790	5,7	5 532 269	48,3
Kinross	18 000 000	3 424 755	18,9	600	Nil	320 150	1,8	3 725 505	20,7
Leslie	16 000 000	3 629 647	22,6	Nil	Nil	2 752 508	17,2	6 382 155	39,8
Sillfontein	13 662 880	1 799 337	13,2	1 017 882	7,5	141 500	1,1	2 959 025	22,7
St Helena	9 625 000	2 051 549	21,3	1 312 664	13,6	316 020	3,3	3 679 233	38,2
Unitell	26 000 000	3 553 318	13,6	Nil	Nil	9 361 600	35,5	12 920 918	49,1
Winkels	13 180 000	3 170 041	26,6	Nil	Nil	500 275	3,2	3 560 316	29,8
	218 907 697	34 413 294	15,8	4 421 336	2,0	16 560 346	7,7	65 885 953	25,5
GFSA									
Doornkraal	58 540 000	5 130 790	8,7	199 221	0,2	10 647 719	10,7	17 057 930	17,1
Doornfontein	43 000 000	12 344 231	30,9	Nil	Nil	1 660 528	3,8	13 804 659	34,5
Driefontein	264 000 000	28 500 531	14,0	7 034 793	9,4	31 819 212	10,6	67 363 636	33,0
Kloof	121 100 000	23 497 161	19,4	Nil	Nil	23 793 814	19,6	47 290 775	39,0
Libanon	49 000 000	10 102 636	23,3	Nil	Nil	2 638 165	7,1	12 541 215	30,4
Venters	20 200 000	6 034 249	29,9	Nil	Nil	1 020 000	8,1	7 662 300	38,0
	524 840 000	85 609 312	16,8	7 234 1 4	1,4	72 167 796	13,7	166 030 304	31,6
JCI									
Ellaton	39 250 000	5 471 640	18,1	1 205	Nil	1 196 664	4,0	6 669 509	22,1
Joel	70 928 367	10 555 018	15,4	Nil	Nil	687 786	1,0	11 242 785	16,4
Joel 'B' class	13 585 672	136 433	1,0	Nil	Nil	30 031	0,6	217 054	1,6
Randfontein	8 113 200	1 167 686	15,1	441 322	7,0	504 976	6,0	1 913 515	31,1
Western Areas	40 506 850	7 912 631	19,5	200	Nil	913 721	2,2	8 836 552	21,8
	161 137 549	25 642 888	15,9	422 728	0,3	3 183 710	2,0	26 229 846	16,2
Gold									
Cons Modder	21 440 000	11 954 223	55,8	154 561	0,7	2 010 931	9,4	14 119 715	65,9
East Daggs	13 500 700	2 900 458	21,3	320	Nil	763 023	5,6	3 667 126	27,1
Egoli	26 000 000	1 569 610	6,0	Nil	Nil	790 362	3,0	2 359 972	9,0
	60 940 700	16 427 291	27,0	154 881	0,3	3 564 316	5,8	20 146 815	33,1
TOTAL	1 588 949 689	282 765 418		37 474 429		114 985 542		435 185 388	
Percentage of Total		18,74%		2,22%		6,81%		25,77%	

APPENDIX 6

FOREIGN HOLDINGS IN INDIVIDUAL SOUTH AFRICAN MINING HOUSES, PLATINUM AND DIAMOND SHARES

(PERCENTAGE OF SHARES IN ISSUE)
AS AT DECEMBER 1987

Company	Issued Shares	Total US Holding	%	SOGES/ SICOVAM	%	London Register	%	Total Foreign Holding	%
Mining Houses									
Anglo American	328 646 065	7 905 713	2,5	4 078 566	1,8	17 580 060	7,7	29 564 362	13,0
Amgold	21 052 012	1 927 521	8,7	242 617	1,0	4 381 367	20,0	6 549 5	29,8
Anglovaal	1 783 190	17 500	0,9	Nil	Nil	18 990	1,1	36 490	2,0
Anglovaal 'A'	1 783 190	36 531	2,1	Nil	Nil	44 167	2,5	80 698	4,6
Gencor	82 454 954	1 072 994	1,3	2 034	Nil	3 662 712	4,7	4 937 740	6,0
GFSA	61 904 919	4 693 266	5,6	Nil	Nil	23 721 450	29,0	28 814 716	34,6
JCI	7 573 300	89 109	1,2	26 451	0,4	205 434	4,1	423 093	5,7
Rand Mines	11 210 756	624 464	5,6	Nil	Nil	225 917	2,0	850 381	7,5
Total	434 907 976	16 354 167		4 349 671		50 150 027		70 853 885	
Percentage		3,7%		1,0%		11,5%		16,2	
Platinum Mines	Issued	Total US	%	SOGES/	%	London	%	Total Foreign	%
Company	Shares	Holding		SICOVAM		Register		Holding	
Impala	57 550 500	9 772 518	15,2	Nil	Nil	830 943	1,5	9 603 567	16,7
Lebowa	96 157 707	7 339 212	5,4	Nil	Nil	307 535	0,3	7 555 888	8,7
Leha	60 000 000	994 040	1,7	Nil	Nil	575 300	1,0	1 569 340	2,6
Northam	14 400 000	62 772	0,4	Nil	Nil	Nil	Nil	62 772	0,4
Rustenburg	125 220 421	25 592 330	20,4	86 001	Nil	243 4 116	2,0	28 113 437	22,4
Total	343 328 628	42 160 662		86 001		4 147 941		46 604 004	
Percentage		12,4%		Nil		1,2%		13,5%	
Diamonds	Issued	Total US	%	SOGES/	%	London	%	Total Foreign	%
Company	Shares	Holding		SICOVAM		Register		Holding	
De Beers	359 789 042	59 121 322	16,4	14 009 176	4,2	48 970 924	13,1	121 001 425	33,7
Total	1 939 173 743	466 670 998		56 665 379		216 254 454		579 994 782	
Percentage of Total		14,17%		2,01%		7,54%		23,62%	

APPENDIX C

RAND VALUE OF FOREIGN HOLDINGS IN INDIVIDUAL SOUTH AFRICAN GOLD MINING SHARES AS AT DECEMBER 1987

Company	Number Of Shares	Price 31 Dec (SA Cents)	Total US Holdings (R'M)	SOGES/ SICOVAM (R'M)	London Register (R'M)	Total Foreign Holdings (R'M)
Anglo American						
Alldamer Lease	6 727 500	330	5,41	Nil	Nil	5,41
Ergo	42 076 712	1950	86,95	1,07	7,54	95,56
Elandsrand	96 619 825	2650	134,40	5,50	19,23	149,19
Free gold	156 178 121	4150	671,59	202,79	99,60	878,98
Oryx	20 914 594	10 000	372,58	124,40	91,11	559,09
SA Lands	3 183 796	575	4,53	Nil	6,16	10,69
Southvaal	20 000 000	16 500	627,81	24,14	51,22	703,27
Vaal Reefs	10 000 000	36 000	1 529,95	252,97	303,15	2 086,07
Welkom	35 330 927	2 800	99,97	7,20	21,18	128,35
Western Deep Levels	27 184 115	12 900	701,85	178,07	71,51	951,43
	466 847 664		4 226,44	801,29	640,70	5 668,38
Anglovaal						
Harbeestfontein	112 000 000	2 900	760,44	64,04	79,34	925,82
Lorraine	65 300 560	1 655	126,64	1,42	17,09	145,14
Zandpan	130 202 850	495	86,30	0,66	23,75	110,71
	258 569 936		996,38	66,32	120,97	1 183,67
Rand Mines						
Blyvooruitzicht	24 000 000	1600	211,39	14,41	13,63	239,44
Durban Deep	7 375 000	3750	24,80	Nil	5,36	29,96
ERPM	11 088 000	2600	25,59	138,20	13,80	226,59
Harmony	26 854 850	3550	242,20	220,97	67,44	530,70
	64 297 850		501,97	533,58	100,23	1 035,71
Gencor						
Beatrix	83 000 000	1 750	45,38	Nil	11,43	57,81
Bracken	14 000 000	530	32,81	Nil	11,16	43,77
Bultelfontein	11 000 000	5 050	177,85	15,04	6,39	209,28
Groothyl	11 438 817	800	49,62	0,16	5,25	45,05
Kinross	18 000 000	5 000	170,23	6,03	16,01	192,27
Lisiia	16 000 000	535	19,36	Nil	14,73	54,09
Stilfontein	13 968 900	1 900	52,39	18,32	3,58	82,29
St Helena	9 825 000	3 900	73,86	47,25	11,34	132,45
Unisel	26 000 000	2 250	70,05	Nil	210,77	280,72
Winkelhaak	13 180 000	7 250	229,83	Nil	28,29	258,12
	216 394 737		902,68	186,82	317,92	1 416,82
GFSA						
Deelkraal	99 540 000	1 280	79,50	5,55	136,29	218,34
Doornkoppies	40 000 000	650	88,16	Nil	10,07	98,23
Driefontein	204 000 000	4075	1 181,76	266,07	1 296,83	2 744,66
Kloof	121 100 000	4 400	1 033,88	Nil	1 042,98	2 076,83
Libanon	40 000 000	1 250	126,29	Nil	35,47	161,76
Venters	20 200 000	1400	84,34	Nil	22,93	107,27
	524 840 000		2 970,95	269,62	2 544,34	5 464,91
JCI						
Eloburg	30 200 000	1 125	81,36	Nil	13,46	75,02
Joel	70 928 587	1 350	148,99	Nil	9,25	158,14
Jos 'S' ops	13 565 672	575	1,19	Nil	0,70	1,89
Randfontein	6 113 553	26 550	330,87	122,28	86,44	539,59
Western Areas	40 306 950	1 700	134,51	Nil	15,54	150,05
	161 137 542		977,12	122,28	123,49	942,89
Gold						
Cons Modder	21 440 000	790	84,43	1,22	15,86	111,51
East Dagga	13 508 720	1 675	46,83	Nil	12,79	61,42
Spet	26 000 000	540	5,34	Nil	2,68	8,02
	60 949 720		148,40	1,22	31,33	180,95
Total			1 003,24	1 904,55	3 881,00	15 886,89
Percentage of Total			52,40%	12,00%	24,55%	100,00%

APPENDIX D

RAND VALUE OF FOREIGN HOLDINGS IN INDIVIDUAL SOUTH AFRICAN MINING HOUSES, PLATINUM AND DIAMOND SHARES - AS AT 31ST DECEMBER, 1987

Company	Issued Shares	Price 31 Dec'87 (SA Cents)	Total US Holdings (RM)	SOGESI/ SICOVAM (RM)	London Register (RM)	Total Foreign Holdings (RM)
Mining Houses						
Anglo American	238 548 048	6 590	443,48	226,35	376,04	1 046,06
Anglovil	21 562 012	30 000	593,57	74,11	1 349,46	2 017,24
Anglovaal	1 783 190	26 000	4,90	Nil	9,31	14,21
Anglovaal 'A'	1 783 190	28 000	10,79	Nil	12,36	23,15
Camcor	82 454 964	4 950	53,11	0,10	191,20	244,41
GFSA	61 804 316	8 850	268,71	Nil	1 387,70	1 656,41
JCI	7 222 800	40 500	35,19	11,50	132,70	179,39
Rand Mines	11 210 786	6 900	43,08	Nil	12,59	55,67
Total			1 453,97	312,03	4 061,56	5 927,52
Percentage of Total			24,53%	5,26%	68,79%	100,00%
Platinum Mines	**Issued**	**Price**	**Total US**	**SOGESI**	**London Total Foreign**	
Company	Shares	31 Dec	Holding	SICOVAM	Register	Holding
Impala	57 650 000	2 850	250,02	Nil	23,68	273,70
Lebowa	66 157 797	330	33,65	Nil	1,01	34,66
Lonrho	60 000 000	910	9,56	Nil	5,22	14,78
Northam	14 400 000	2 200	1,38	Nil	Nil	1,38
Rustenburg	125 530 431	2 550	754,97	2,53	71,51	829,01
Total			1 939,27	2,53	101,23	1 143,53
Percentage of Total			90,88%	0,22%	8,90%	100,00%
Diamonds	**Issued**	**Price**	**Total US**	**SOGESI/**	**London Total Foreign**	
Company	Shares	31 Dec	Holding	SICOVAM	Register	Holding
De Beers	359 789 042	2 965	1 752,86	444,73	1 392,68	3 590,56
Percentage of Total			48,82%	12,39%	38,79%	100,00%

APPENDIX E

	SHARE/OPTION	REASON FOR EXCLUSION FROM LIST PER APPENDICES A, B, C & D.
1	ANGLO-AMERICAN (AAC)	RIGHTS ISSUE: 5 BARBROOK ORDS. @ 100c FOR EVERY 100 AAC. C.D.O.: 27.11.87
2	*ANGLOVAAL*	INSUFFICIENT SHARES TRADED (1987: 28000; 1986: 27000)
3	ANGLOVAAL "A"	INSUFFICIENT SHARES TRADED (1987: 37000; 1986: 85000)
4	*DOORNFONTEIN*	*SHARE SPLIT: EFFECTIVE 9.11.87. FROM R1 TO 25c.*
5	DRIEFONTEIN	SHARE SPLIT: EFFECTIVE 30.11.87. FROM R1 TO 50c.
6	GENCOR (GMF)	*RIGHTS ISSUE: 6 GRYX ORDS. @ 800c FOR* EVERY 100 GMF. C.D.O.: 5.5.88
7	JCI	RIGHTS ISSUE: 1 CONS METALLURGICAL ORD. AT 400c FOR EVERY JCI. C.D.O.: 7.11.86
8	JOEL "B" OPTIONS	NOT A MINING SHARE
9	LEBOWA PLATINUM	LISTED: 12.11.87
10	*LEFKOCRYSOS*	*LISTED: 1.9.87*
11	LIBANON	SHARE SPLIT: EFFECTIVE 16.11.87. FROM R1 TO 20c.
12	NORTHAM	LISTED: 5.3.87
		RIGHTS ISSUE: 80 NORTHAM ORDS. AT 4000c FOR EVERY 100 HELD. C.D.O.: 16.4.87
13	RAND MINES (RDM)	RIGHTS ISSUE: 111 BARBROOK ORDS. AT 100c FOR EVERY 100 RDM. C.D.O.: 27.11.87
		RIGHTS ISSUE: 2 BARPLAY LINKED UNITS AT R310 FOR EVERY 100 RDM. C.D.O.: 20.11.87
14	RANDFONTEIN (RFN)	RIGHTS ISSUE: 2 LINDUM & 3 BARNATO FOR EACH RFN AT 250 & 410c. C.D.O. 18.9.88
15	*RUSTENBURG PLATINUM* (RPT)	RIGHTS ISSUE: 55 LEBOWA PLAT. AT 275c FOR EVERY 100 RPT. C.D.O. 13.11.87
16	VENTERS	SHARE SPLIT: EFFECTIVE 23.11.87. FROM R1 TO 25c.

: *CLOSING DATE OF OFFER*)

(Sources: J.S.E., 1987: 40 - 106; J.S.E., 1988: 40 - 51)

APPENDIX F

		SHARES TRADED ('000's) 1986	SHARES TRADED ('000's) 1987	SHARES TRADED ('000's) AVERAGE
1	AFRIKANDER LEASE	427	369	398
2	AMGOLD	590	1310	950
3	BEATRIX	8501	4148	6324
4	BLYVOORUITZICHT	556	398	477
5	BRACKEN	3038	2443	2741
6	BUFFELSFONTEIN	1881	975	1328
7	CONS MODDER		4177	4248
8	DE BEERS		22822	20577
9	DEELKRAAL		6057	6353
10	DURBAN DEEP		753	982
11	EAST DAGGA	46[illegible]	2518	3577
12	EGOLI	15843	8770	12207
13	ELANDSRAND	2967	3073	3020
14	ELSBURG	11921	8844	10383
15	ERGO	3374	2369	2872
16	ERPM	1020	864	844
17	FREGOLD	5014	3557	4286
18	GFSA	2555	2128	2342
19	GROOTVLEI	4393	2810	3602
20	HARMONY	1556	1724	1640
21	HARTEBEESTFONTEIN	9777	8158	8968
22	IMPALA PLATINUM	4130	2615	3373
23	JOEL	10128	13944	12035
24	KINROSS	1380	981	1181
25	KLOOF	5867	6804	6336
26	LESLIE	6295	8904	7600
27	LORAINE	6899	4302	5600
28	OFSIL	2245	1729	1939
29	SA LANDS	3063	2101	2582
30	SOUTHVAAL	1511	1403	1457
31	ST HELENA	835	465	650
32	STILFONTEIN	720	592	656
33	UNISEL	746	850	798
34	VAAL REEFS	1625	1815	1720
35	WELKOM	2372	1223	1798
36	WESTERN AREAS	4659	5320	4940
37	WESTERN DEEP LEVELS	2004	1701	1853
38	WINKELS	375	453	414
39	ZANDPAN	15488	19532	17510

(Source: J.S.E., 1987: 2 - 39)

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