STOCK RETURNS AS PREDICTORS OF INTEREST RATES AND INFLATION: THE SOUTH AFRICAN EXPERIENCE.

by

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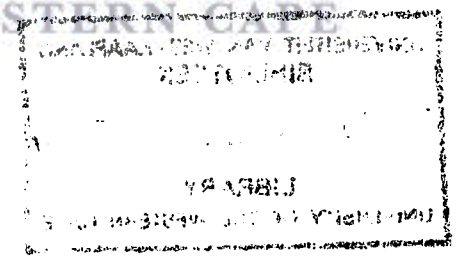

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ABSTRACT

This study analyses the extent to which stock returns provide forecasts of changes in interest rates and inflation for the South African market. The period under investigation, January 1966 - February 1989, is characterised by structural changes in the South African economy, especially in the financial markets. The earnings yield on shares is used as a measure of the return on stocks. Stock returns of 10 specific industries are used in addition to the overall market return. Monthly inflation series were constructed by employing both the Consumer Price Index (CPI) and the Producer Price Index (PPI). Before examining that relationship, tests were done to examine the relationship between nominal stock returns and expected inflation. The relation between the stock market and expected inflation is estimated by using three measures of expected inflation. The results appear to suggest that the stock market reacted positively to expected inflation during the 1966 - 1982 period. Two proxies of expected inflation are used to measure future inflation. Best results were obtained with the Fama-Gibbons measure. In addition, the results suggest that stock returns provide additional information of future inflation to that contained in the Fama-Gibbons and interest rate models. Returns for specific industries, used in this study, appear to provide marginally better forecasts of inflation than the overall market return. The results also suggest that stock returns provide forecasts of changes in interest rates and inflation. There is no evidence that the specific industries used, provide consistent better forecasts of interest rate changes than the overall market.

1. PROBLEM STATEMENT, LITERATURE REVIEW AND DATA

1.1 INTRODUCTION

The primary aim of this study is to examine the extent to which stock returns provide forecasts of changes in interest rates and inflation for the South African market. The underlying assumption of this study is that investors make use of all available (public) information to assess stock prices. The impetus for this work was provided by the study of Titman & Warga (1989).

Firstly, this study will examine the relation between nominal stock returns and the expected component of the inflation rate. Three measures of expected inflation are used to investigate this relation. Measuring the relation in different subperiods should enable us to determine whether or not a shift in the relation between stock returns and expected inflation occurred during the sample period. A breakpoint was arbitrarily chosen at the end of 1982. The Chow test was performed (see Appendix III) which lend support to this decision. This however does not negate the possibility that the shift occurred at another point or that more than one shift occurred.

Secondly, stock returns as a predictor of changes in inflation, is examined. However, before examining that relationship, tests were done to determine whether stock returns contain forecasts of inflation not already incorporated in the Fama-Gibbons and the interest rate models of expected inflation. Finally, stock returns as a predictor of interest rate changes, is examined.

1.2 REVIEW OF THE LITERATURE

The relationship between stock returns and actual, expected and unexpected inflation, has for more than a decade been subject to considerable empirical investigation. The proposition that the stock market provides a hedge against inflation implies that stock price movements mirror movements in the inflation rate.

Nelson(1976), Oudet(1973), Jaffe & Mandelker (1976) and others have found a significant negative relationship between stock returns and expected inflation as well as unexpected inflation. Fama & Schwert(1977) showed that stock returns were negatively related to anticipated inflation, unanticipated inflation and changes in anticipated inflation.

Titman & Warga(1989) reported a statistically significant positive relation between stock returns and future inflation rate changes as well as a significant positive relation between stock returns and future interest rate changes. This finding is in sharp contrast to earlier empirical research for the US market.

Firth(1979) investigated the relationship between stock returns and inflation between 1955-1976, on British data. Nominal stock returns were regressed on current and past rates of inflation. He found, contrary to the results for US data, a significant positive relation between stock returns and current inflation. However, the regression coefficients of the lagged inflation rate invariably assumed negative signs. Furthermore, the relationship between stock returns and expected inflation was not considered.

Peel & Pope(1988) also investigated the relation between stock returns and inflation in the UK. Their findings were similar to those reported for the US market.

Gultekin (1983a) examined the relation between nominal stock returns and inflation for some twenty-six countries. He concluded that no consistent positive relation between nominal stock returns and inflation for the period 1947-79 exists. Regression coefficients were predominantly negative. No systematic relationship seemed to appear over time and across countries.

Solnik (1983) investigated the relationship between stock returns and inflationary expectations for nine countries over the period 1971-80. A negative relation between stock returns and expected inflation was found. Although the impact of stock returns on the real interest rate was found to be small, it was significant for four countries. Solnik (1984: p73) investigated the relationship between stock prices and monetary variables for the nine major stock markets, over the period 1971-1982. He concluded that the specific influence of international monetary variables such as exchange rates was weak compared to that of domestic variables such as changes in inflation expectations and interest rates. He went further in stating that ".... in all countries stocks appear to be a (short-term) 'negative hedge' against inflation and interest rates. Furthermore, inasmuch as they do not correct real exchange rate movements, they are also bad overall 'monetary' hedges."

Wahlroos & Berglund (1986) found a significant negative

relationship between real stock returns and the rate of inflation (expected and unexpected) on data for the Finnish economy. Their findings appear to hold irrespective of the expectations formation mechanism.

Efforts to explain the consistent negative relation between stock returns and inflation for the US market are to be found in Fama(1981) and Geske & Roll (1983). Fama suggests that the stock return - inflation correlation is spurious in nature, reflecting only the interaction between the real and monetary sectors of the economy. Fama's argument is formally tested by Wahlroos & Berglund (1986: p386). They conclude: "It therefore seems that the Fama (1981) proposition cannot explain all of the surprisingly strong negative relationship between real stock returns and inflation in our data."

Geske & Roll (1983: p1) argue that "..... stock returns are negatively related to changes in expected inflation because they signal a chain of events which results in a higher rate of monetary expansion." They argue that the negative correlation between stock returns and inflation is devoid of any causation and suggests that the spurious causality is induced by "reverse causality" models.

1.3 THE DATA

The sample data used in this study is measured on a monthly basis. Returns on both the stock market and the money market are measured on the last Friday of each month. Full details and sources for all variables are given in Appendix I.

a) Nominal interest rate

The nominal short-term interest rate used in this study is the allotment rate set at the weekly treasury bill tender. The weekly tender is conducted by the South African Reserve Bank (SARB) on behalf of the Treasury.[1]

At the time of writing this report the main participants in the Treasury bill market are the four discount houses. Other participants in the Treasury bill market include the banks, insurance companies, pension funds and building societies. Faure (1987: p27) remarked that "..... these institutions' motivation to tender for or hold treasury bills would include their expectations regarding interest rate movements and their needs in terms of the statutory investment requirements". Raine & Barr(1980) argue that the 91 day Treasury bill rate is insensitive to market conditions. However, in 1979 the SARB initiated plans to make the Treasury bill market more market orientated. This constitutes one of the structural breakpoints, which will later be investigated.

Gidlow (1981: p27) has ascribed the inefficiency of the Treasury Bill market to the intervention of the Reserve Bank through the

tendering for the bills itself or through the medium of the National Finance Corporation (presently the Corporation for Public Deposits) or by varying the amount of the bills offered at the tenders. He remarks: "An important imperfection in this market concerns its thinness. Banking institutions other than discount houses participate in it on an irregular basis, some banks holding virtually no Treasury bills during periods of rising interest rates, while non-banking firms and individuals show virtually no interest in Treasury bills. In other words, the market lacks breadth since there is an absence of a large variety of different investors who hold such bills."

A major operational change in the Treasury bill market occurred in the 1979/80 period and again in the 1984/85 period. At several instances during 1979 and 1980 the authorities supplemented the weekly tender by the issue of Treasury bills on a tap basis with maturities ranging between six and nine months in an effort to reduce the amount of liquidity in the banking system. This resulted in a much lower Treasury bill rate during this period. Furthermore, in August 1979 the Governor of the Reserve Bank announced that the Bank would in future put more emphasis on cash reserve requirements (and open market transactions) rather than liquid asset ratios in managing bank credit. By the end of 1980 the Treasury bill rate was allowed to become more market related.

In August 1984 the Reserve Bank raised its discount rate for Treasury bills from 18,75% to 21,75% as part of the government's restrictive package to "cool off" the economy. This measure had a profound effect on all money market rates. These restrictions

were gradually relaxed by the middle of 1985.

b) Return on stocks

The price of a share reflects the expected value of future cash flows. A change in the share price will thus represent changing expectations of future expected cash flow values.

The quantitative value of a share is essentially based on its dividend yield and/or its earnings yield. It is generally accepted that rising (declining) confidence in the Stock Exchange is associated with earnings (dividend) yield share valuations.

In analysing the information content of dividends on the Johannesburg Stock Exchange (J.S.E.) Ooms, Archer & Van der M Smit (1987: p187) remarked that ".... the market is probably not reacting to dividend information but to the underlying earnings information which is simultaneously released." We will thus employ the earnings yield (E.Y.) as a measure of the return on stocks.[2] In an efficient market a change in earnings yield from one period to another should reflect the market's response to new information that will influence future prices.

c) The rate of inflation

Differing views exist as to which index to use to measure inflation. However, of even greater importance is the problem of defining inflation.[3] Parkin & Swoboda (1977: p4) has suggested " .... that a useful starting point (for the analysis of

inflation) is to recognise that inflation is the first difference of the logarithm of some price index. However, the breadth of the index and the length of time over which the change is considered are both matters upon which choice may be exercised. Hence, there is no unique measure of the rate of inflation and the precise definition chosen may reflect the particular problem at hand ....."[4]. A further problem one encounters is with regard to the timing of index measurements, their public announcements and the speed at which the information reaches the market.

This study will employ two price indices to construct the inflation series. The first is the Consumer Price Index (CPI), the price index most frequently used in empirical research and secondly the Producer Price Index(PPI). Both indices are seasonally adjusted.

(i) Consumer price index (CPI)

The CPI underwent several changes since the 1958 revision.[5] Although the first South African index covered only 40 items, the Department of Statistics currently evaluates approximately 250 000 price quotations per year for some 600 goods or services. Prices for items selected are collected by means of a postal survey from a representative sample of bottle stores, supermarkets, shops, garages, cinemas, municipalities, Post Offices, universities etc. at monthly or quarterly intervals.

The CPI is not a month end index but various components are measured on any of the first seven days of the month. Public announcement is not made until the third week of the following

month. This announcement may convey little additional information to the market, beyond that already available to the market i.e. in times of persistent high inflation rates, the market would perhaps more easily anticipate price changes.

(ii) Producer price index (PPI)

In an attempt to alleviate some of the problems in using the CPI, an alternative inflation series based upon the producer price index (PPI) was also constructed. GST effects, levies on farm products as well as housing costs are excluded from the PPI. A major drawback of the PPI is the fact that the index is made known almost two months after it was sampled.

Information relating to more than 1000 commodities are collected by means of a postal survey from manufacturing and wholesale establishments, government departments, agricultural control boards, etc. Prices of non-agricultural products are generally sampled at quarterly intervals. (Data on agricultural produce are usually collected at monthly intervals). These prices relate to the first seven days of the month except for certain processed foodstuffs where information is obtained whenever price changes occur.

1.4 RATIONAL EXPECTATIONS

(a) Theory

This study assumes rational expectations. The rational expectations doctrine was formally introduced into economics by Muth (1961). Muth (1961: p4) suggested ".... that expectations, since they are informed predictions of future events, are essentially the same as the predictions of the relevant economic theory. At the risk of confusing this purely descriptive hypothesis with a pronouncement as to what firms ought to do, we call such expectations 'rational'. It is sometimes argued that the assumption of rationality in economics leads to theories inconsistent with, or inadequate to explain, observed phenomena especially changes over time (e.g. Simon). Our hypothesis is based on exactly the opposite view: that dynamic economic models do not assume rationality."

Investors, it is assumed, are rational when playing the stock market. They use current/available and relevant information in an optimal and efficient manner, to assess stock prices. In other words, investors will ".... obtain information about the objective probability distribution of outcomes associated with a particular policy action and analysed with reference to the relevant economic theory, and he will use this information to generate expectations concerning the variable which interests him."[6]

It is argued that investors (and their advisors) will attempt to anticipate market movements by forming forecasts of prices and

have expectations of price changes, in close proximity to how the market determines actual prices. This does not imply that they have perfect foresight. Expectations will not be perfect since available information will be incomplete and it also does not imply that they possess the same expectations. This point is well articulated in (the Federal Reserve's) Readings on Inflation (1979: p205): "Some critics argue that rational expectations demand too much wisdom and perceptiveness of people to be believable. But the validity of rational expectations does not require that every consumer or market or business manager be the complete seer of future prices and other economic events."

Thus from a practical viewpoint rational expectations imply that investors make economic decisions in a way that tends to take into account all available information bearing significantly on the future consequences of their decisions. It is assumed, that they will use the information in such a way so as not to repeat their past mistakes. If information is consistently ignored or misinterpreted, their expectations would not be regarded as being rational.

b) Hypothesis

According to Mishkin (1981) to prove the efficient use of information in markets is to prove the existence of rational expectations. The efficient market hypothesis (EMH) posits that the stock market is so efficient that current stock prices correctly reflect its future dividend and earnings potential. In other words, share prices at any point in time provide an unbiased estimate of the true intrinsic value of the share given

all the available information. This implies that any new and relevant information is quickly and accurately assessed by the market so that current prices "fully reflect" all available information.

Fama, however, has cautioned that one should clearly define what is meant by "fully reflect". Nelson (1976: p482) went further in stating: "It follows that market efficiency is not in itself a testable hypothesis, but can only be tested jointly with a particular hypothesis about the behaviour of expected returns." In this regard Tinic & West (1979: p94) state that: "Virtually all analyses of the subject of pricing efficiency have been based on the assumption that the conditions of market equilibrium can be stated in terms of expected returns. More specifically, they have assumed that the expected price of a security one period into the future, given today's relevant set of information, is equal to today's price plus the expected return for the next period."

Notationally we can write it as follows:

$$E\,[\tilde{P}_{j,t+1}/\phi_t] = P_{j,t} + E(\tilde{r}_{j,t+1}/\phi_t) \qquad (1)$$

Where:

E = expected value operator

$P_{j,t}$ = price of share j at time t

$P_{j,t+1}$ = price of share j at time t + 1

$r_{j,t+1}$ = return on share j at time t + 1

$\tilde{}$ denotes a random variable.

ϕ_t = the information set at time t.

Equation (1) suggests that the expected future return should accurately reflect all available information, including all current and past values of any relevant variables such as earnings, interest rates, inflation etc.

Although actual returns may differ from expected returns, market efficiency implies that the expected difference between the realised return and the expected return will be zero. That is

$$E\left[\tilde{r}_{j,t+1} - E\left(\tilde{r}_{j,t+1}/\phi_t\right)\right] = 0 \qquad (2)$$

or alternatively

$$E\left[\tilde{P}_{j,t+1} - E\left(\tilde{P}_{j,t+1}/\phi_t\right)\right] = 0 \qquad (3)$$

2. EMPIRICAL RESULTS

2.1 STOCK RETURNS AND EXPECTED INFLATION

a) Measuring unobserved inflation

Expectations are to a large degree unobservable. This has forced researchers in using unverified models of expectations formation in which expected inflation is based on past rates of inflation and/or historical trends in other related variables.

The research literature contains five major approaches to the measurement of inflationary expectations: (a) Carlson & Parkin (1975); Figlewski & Wachtel (1981) and Batchelor & Orr (1984) used survey data [7] to estimate inflation; (b) Fama & Schwert (1977), Fama (1981), Solnik(1983) and Gultekin (1983a) followed Fama (1975) in using short term interest rates as predictors of inflation; (c) Gultekin (1983a) and Wahlroos & Berglund (1986) used contemporary inflation as a proxy for future inflation; (d) Nelson (1976), Gultekin (1983a) and Wahlroos & Berglund (1986) used extrapolative time series (ARIMA) models to predict inflation; (e) Burmeister, Wall & Hamilton (1986) followed Hamilton (1985) in using the Kalman filter technique [8] in estimating expected rates of inflation. In order to investigate the relationship between nominal stock returns and expected inflation, three measures of expected inflation are employed in this study. Firstly, the contemporaneous inflation rate is used as a proxy for expected inflation. Secondly, the 91 day Treasury bill rate is used as a predictor of inflation. Lastly, the Fama - Gibbons measure of expected inflation is employed.

(i) Contemporaneous rate of inflation as a proxy for expected inflation.

If it is reasonable to assume that much of the information about future inflation is contained in past rates of inflation, then we can estimate the relation between stock returns and expected inflation by using the realised rate of inflation as a proxy for the expected rate of inflation.

(ii) Short term interest rates as predictors of inflation

The interest rate model used to predict inflation is based on the Fisher relation:

$$R_t = \tilde{r}_t + \tilde{\pi}_t \qquad (4)$$

where R_t: nominal interest rate observed at the beginning of period t.

r_t: expected real return for period t.

π_t: expected rate of inflation for period t.

~ denotes a random variable.

Rewriting equation (4) in the form:

$$\tilde{\pi}_t = -\tilde{r}_t + R_t \qquad (5)$$

which can be estimated by ordinary regression techniques as;

$$\tilde{\pi}_t = \alpha_0 + \alpha_1 R_t + \epsilon_t \qquad (6)$$

Fama(1975) presented evidence suggesting that US Treasury bills are efficient predictors of short term inflation. However, several studies e.g. Carlson (1977) and Joines (1977) questioned his finding. Notwithstanding the above, Fama (1977: p496) concludes that ".... the interest rate remains the best single predictor of the inflation rate .....". Fama's research covered the period 1953-71, a period in which the US experienced relatively low levels of inflation. In contrast, South Africa is experiencing relatively high levels of inflation and some degree of government (political) intervention in the financial markets. These factors may substantially weaken the forecasting ability of the 91 day Treasury Bill.

(iii) Fama - Gibbons measure of expected inflation

Fama & Gibbons (1984: p327) state that: "Interest rate models provide slightly better monthly forecasts and substantially better eight- and fourteen- month forecasts of inflation than a univariate time series model." They present a simple measure of expected inflation:

$$EXIFG_t = TBR_{t-1} - \frac{1}{12} \sum_{s=t-1}^{t-12} (TBR_{s-1} - MIR_s)$$

i.e. the difference between the Treasury bill rate and a proxy for the expected real rate. The expected real rate is an equally weighted moving average of the past twelve months' ex post real rates where ex post real rates are defined as the differential between the Treasury bill rate and the inflation rate.[9]

b) Empirical tests

Irving Fisher posited that the nominal interest rate could be expressed as the sum of the expected real interest rate and the expected rate of inflation. This exposition was later extended to other financial instruments. To this end Fama & Schwert (1977: p115) writes: "The proposition that expected nominal returns contain market assessments of expected inflation rates can be applied to all assets. Thus, if the market is an efficient or rational processor of the information available at time t-1, it will set the price of any asset j so that the expected nominal return on the asset from t-1 to t is the sum of the appropriate equilibrium expected real return and the best possible assessment of the expected inflation rate from t-1 to t." Furthermore they suggest that a regression of the form:

$$RM_t = \beta_0 + \beta_1 E(\pi_t/\phi_{t-1}) + \epsilon_t \qquad (7)$$

will constitute a valid test of the Fisher hypothesis on the stock market, where RM_t is the nominal stock return, E is the expectations operator, π_t is the rate of inflation in period t, ϵ_t is a zero mean, constant variance error term and ϕ_{t-1} is the information set available to investors at the end of period t-1.

In reference to the Fama & Schwert study Geske & Roll (1983: p1) made the following observation: "It seems natural to consider first whether the Fama/Schwert results indicate a causative influence of inflation on stock returns. The authors used inflation as the 'explanatory' regression variable, but there are several reasons to suspect either a reversed causality or no causality at all"

(emphasis added).[10]

In order to investigate the relation between the return on the stock market and expected inflation, the following regressions were performed on monthly data from 1966 to 1989:

$$RM_t = \beta_0 + \beta_1 MIR_{e,t} + \epsilon_t \qquad (8)$$

Where $MIR_{e,t}$: expected inflation in period t

RM_t : nominal stock return in period t.

ϵ : error term ~ $N(0,\sigma_\epsilon^2)$

Provided that $MIR_{e,t}$ is an unbiased estimate (good proxy) for the expected rate of inflation, the Fisher hypothesis suggests that the slope coefficient in equation (8) should equal one. It is assumed, that the three measures of expected inflation are reasonable proxies of the market's expectation of the rate of inflation.

Regression (8) was run for the three measures of expected inflation over the following three periods: a) 66/1 - 89/2; b) 66/1 - 82/12 and c) 83/1 - 89/2. The regression estimates invariably indicated strong autocorrelation in the residuals. The estimates were adjusted for autocorrelation, the results of which are displayed in Table 1 (see Appendix II). We will in turn briefly discuss the results under the various periods.

a) January 1966 - February 1989

No significant correlation between stock returns and the three proxies for expected inflation seems to exist over this period.

b) January 1966 - December 1982

A significant positive correlation between stock returns and expected inflation appears to exist, except for proxies employing the PPI.

c) January 1983 - February 1989

A significant negative correlation between stock returns and the Fama-Gibbons measure of expected inflation (employing the PPI) was found for this period.

A striking feature of the results is the low coefficient of determination for most of the regressions. The slope coefficients (over the first subperiod) are consistently less than one, which suggests that the stock market has only been a partial hedge against inflation. Over the latter period, however, stock returns appear to be negatively correlated with expected inflation.

2.2 STOCK RETURNS AS PREDICTORS OF INFLATION

Significant positive correlations were found between nominal stock returns and expected inflation. Given rational expectations, this implies that if stock returns adjust to changes in expected inflation, the adjusted stock price should contain forecasts of changes of actual inflation. This possibility is explored in three parts. Firstly, whether stock returns contain forecasts of inflation not already incorporated in the Fama-Gibbons and the interest rate models of expected inflation. Secondly, the relation between changes in the inflation rate and lagged stock returns is estimated and finally changes in the inflation rate are regressed on lagged stock return changes.

Stock returns of industries which (on an a priori basis) are highly sensitive to changes in inflation are used in addition to the overall market return. Regression estimates of the overall market return plus the specific industry return that provides the "best fit" are presented in Tables 2 - 13.

Before discussing the results we need to point out that monthly stock returns are highly correlated with one another. To overcome the problem of multicollinearity, lagged stock returns were selected by means of the stepwise variable selection method. It should be noted that in some cases (where the regression estimates, after adjustment for aotucorrelation, suggested another lagged specification) the choice of the lagged operator has been arbitrary.

Tables 2 - 4 deal with the question of whether stock returns can improve inflation forecasts provided by models of expected inflation. The results in Table 2 suggest that stock returns provide improvements over the Fama-Gibbons and interest rate proxies of expected inflation. The Durbin-Watson statistic indicates that the regression coefficients suffer from severe autocorrelation in the residuals. The regression estimates are reproduced in Table 3 after adjustment for autocorrelation. Although the R^{-2} statistic shows that stock returns marginally improve inflation forecasts especially for the inflation rate as measured by the CPI, most of the stock return parameters are no longer statistically significant. One possible explanation for the latter result is probably the fact that the explanatory variables are strongly correlated with one another, over this period.

Tables 2 - 3 investigate the period January 1966 to December 1982. The results presented in Table 1 suggest that the stock market reacted positively to expected inflation during the 1966 - 1982 period. Given rationality, this implies that the said period probably provides the "best period" to measure stock returns forecasting ability above that provided by expected inflation models.

The results presented in Table 4 (after adjustment for autocorrelation) provide further evidence of the additional forecasting power of stock returns above that provided by the Fama-Gibbons model. South Africa experienced relatively low levels of inflation during this period. At the start of 1974 South Africa started to experience rising price levels following

the oil crisis in the early seventies. Thus, Table 4 examines stock returns forecasting ability (of inflation) above that provided by expected inflation models (used in this study) during a period when South Africa experienced relatively low inflation levels. It is interesting to note that the stock return parameters assume negative signs.

Tables 5 - 6 present evidence of the relation between changes in the rate of inflation and prior stock returns; equations 1a, 1b, 2a & 2b and changes in the rate of inflation and changes in the lagged stock returns; equations 1c, 1d, 2c & 2d. The F tests provide evidence that both lagged stock returns and changes in lagged stock returns provide forecasts of changes in rates of inflation. The two subperiods have been selected to coincide with the Government's restrictive economic package that was announced on 2 August 1984.

Further evidence of stock returns forecasting ability of changes in inflation is presented in Table 7. Table 7 measures the relation between changes in monthly inflation and monthly nominal stock returns given a shift in the relation between expected inflation and nominal stock returns (as indicated by the Chow test). It should be noted that the stock return parameters assume negative signs over the period in which a significant positive correlation was found between stock returns and expected inflation and vice versa.

2.3 STOCK RETURNS AS PREDICTORS OF INTEREST RATES

The traditional view has it that share prices are negatively correlated with movements in interest rates i.e. rises in interest rates are (usually) accompanied by declining stock prices and vice versa. This implies that the earnings yield on stocks will be positively correlated with movements in interest rates.[11]

According to the efficient markets hypothesis interest rates should only respond to unexpected information. Thus, if the actual rate of inflation is higher (lower) than expected, investors may revise their inflationary expectations upwards (downwards) which will imply an increase (decrease) in the current nominal interest rate. If current interest rate changes provide estimates of changes in expected inflation, then future interest rate changes may also provide proxies of expected inflation. Thus, if stock prices provide forecasts of changes in the rate of inflation they should also provide forecasts of interest rate changes. This proposition is investigated by regressing 1) nominal interest rate changes on lagged nominal stock returns and 2) nominal interest rate changes on lagged nominal stock return changes.

The evidence presented in Table 8 suggests that stock returns provide forecasts of changes in interest rates. It is interesting to note that the estimates suggest that stock returns and changes in stock returns explain roughly the same amount of variation in interest rate changes. In addition, the results indicate strong autocorrelation in the residuals. We adjust for

the latter with no meaningful change to our previous observations (see Table 9).

Tables 10 - 11 give estimates of the relation between interest rate changes and lagged stock returns and interest rate changes and stock return changes lagged one and two months, over the subperiods: 66/1 - 82/12 and 83/1 - 89/2. The two subperiods have been selected in accordance with the evidence presented in Appendix III. As far as short term interest rate changes are concerned our earlier finding holds for both periods. The F-test in Table 11 does not support our finding for long-term interest rates. The results have not been adjusted for autocorrelation in the residuals.

The results presented in Tables 12 - 13 suggest that evidence of stock returns as predictors of long-term interest rate changes occurred largely in the October 1979 to December 1982 period. The time period chosen for Tables 12 - 13 broadly coincide with the SARB initiative to "liberate" the financial markets and the "structural breakpoint".

3. SUMMARY AND CONCLUSION

This study attempted to address the issue of whether stock returns provide forecasts of changes in interest rates and inflation for the South African market.

A significant positive relation between nominal stock returns and expected inflation was found. Most of the apparent positive correlation between stock returns and expected inflation appears to exist over the 1966 - 1982 period. In addition, the results suggest that for the latter part of the sample data stock returns reacted negatively to expected inflation.

The results presented suggest that stock returns improve inflation forecasts provided by the Fama-Gibbons and interest rate models. The results also indicate that returns for specific industries used in this study, provide marginally better forecasts of inflation than the overall market return. In addition, the results indicate that stock returns provide forecasts of changes in inflation for the South African market.

Furthermore the evidence suggests that stock returns provide forecasts of changes in interest rates. There is no evidence that specific industries provide consistent better forecasts (of interest rate changes) than the overall market. The relation between stock returns and (long-term) interest rates especially over the 1979/10 - 1982/12 period is interesting since it implies that yields on long-term government stock are to some extent predictable.

The implementation of market orientated policies in the 1979/80 period stimulated great interest in the financial markets which led to a much higher stock exchange activity. The fundamental change brought about by the broadening of the financial markets probably induced a greater awareness of movements in interest rates.

FOOTNOTES

1) See Gidlow (1981: p26) and Faure (1987: p23)

2) In this study the terms stocks and shares are used interchangably.

3) See debate between Botha and Lewin that was carried in the South African Journal of Economics (1977: p289-298)

4) Quoted by Kantor (Lecture notes: p1)

5) See Lynch (1979: p59-73)

6) Shaw (1984: p56)

7) Survey data: One way to find out what peoples' expectations are about the stock market, inflation, interest rates etc. is to ask them. In the absence of survey data for these variables, on a monthly basis, for the South African market, we will omit it from our analysis.

8) Kalman filtering: Hamilton(1985) developed a technique for "estimating financial market expectations of inflation based on the observed time series properties of inflation and interest rates", with quarterly data. Burmeister, Wall & Hamilton (1986: p147) also used Kalman filtering in estimating expected rates of inflation by using (a) monthly data and (b) an alternative method for estimating the parameters of the model. They conclude that the expected

inflation series is "... unbiased, rational and efficient."

9) See Titman & Warga (1989: p48)

10) Black (1982: p29) argues that. The trouble with econometric models is that they present correlations disguised as causal relations."

11) De Kock advance three reasons why changes in interest rates affect the stock market (McGregor - 1989: p342).

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APPENDIX I: Key to symbols

i) Nominal interest rates

TBR: Allotment rate on new Treasury bills set at the Treasury bill tender, on the last Friday of each month

(Source: South African Reserve Bank Quarterly Bulletins).

[Period: 1964/1 - 1989/2]

GVTST: Longterm yield on Government stock

(Source: South African Reserve Bank)

[Period: 1965/1 - 1989/2]

ii) Stock returns

RM	:	Earnings yield for the overall market
RB	:	Earnings yield for banking shares
RBC	:	Earnings yield for building & construction shares
RBEVH	:	Earnings yield for the beverage & hotel industry
RFIN	:	Earnings yield for the financial sector
RGOLD	:	Earnings yield for the gold sector
RIND	:	Earnings yield for the industrial sector
RINSU	:	Earnings yield for the insurance industry
RINVTR	:	Earnings yield for the investment trusts
RMOTOR	:	Earnings yield for the motor industry
RPROPE	:	Earnings yield for the property industry

These indices are measured on the last Friday of each month.

(Source: SANLAM)

[Period: 1965/1 - 1989/2]

iii) Inflation rate

CPI: consumer price index, seasonally adjusted

PPI: producer price index, seasonally adjusted.

(Source: South African Reserve Bank Quarterly Bulletins)

[Period: 1965/12 - 1989/2]

a) $MIR1_t = [(CPI_t/CPI_{t-12}) - 1] \times 100$

b) $MIR2_t = [(PPI_t/PPI_{t-12}) - 1] \times 100$

iv) Expected inflation

1) TBR_{t-1} : Lagged 91 day Treasury bill rate

[Period: 1964/2 - 1989/2]

2a) $MIR1_{t-1}$: Lagged inflation rate employing CPI

b) $MIR2_{t-1}$: Lagged inflation rate employing PPI

[Period: 1966/1 - 1989/2]

3a) $EXIFG1_t$: Fama-Gibbons model employing CPI

b) $EXIFG2_t$: Fama-Gibbons model employing PPI

[Period: 1966/1 - 1989/2]

APPENDIX II: Tables

TABLE I
NOMINAL STOCK RETURNS AND EXPECTED INFLATION

	$RM_t = \beta_0 + \beta_1 MIR_{e,t}$								
No.	Proxy	Index	β_0	β_1	$t(\beta_0)$	$t(\beta_1)$	R^{-2}	DW	Period
1.	MIR_{t-1}	CPI	10,21225	0,09704	5,50	1,61	0,006	1,718	66/1 - 89/2
			10,28087	0,15399	7,88	2,11 *	0,017	1,632	66/1 - 82/12
			11,09657	-0,05093	7,94	0,56	-0,009	1,679	83/1 - 89/2
		PPI	10,70888	0,05108	5,73	0,88	-0,001	1,723	66/1 - 89/2
			10,84987	0,10204	4,64	1,34	0,004	1,714	66/1 - 82/12
			11,23678	-0,07078	9,73	1,01	0,000	1,799	83/1 - 89/2
2.	TBR_{t-1}		10,20837	0,12073	5,30	1,31	0,003	1,744	66/1 - 89/2
			7,68831	0,55705	3,02	3,09 **	0,040	1,751	66/1 - 82/12
			9,45228	0,06621	8,88	0,94	-0,002	1,702	83/1 - 89/2
3.	FAMA/ GIBBONS	CPI	9,83914	0,12931	5,92	1,43	0,004	1,718	66/1 - 89/2
			5,99126	0,59183	3,51	4,32 **	0,080	1,702	66/1 - 82/12
			11,77579	-0,10654	7,85	1,21	0,006	1,750	83/1 - 89/2
		PPI	10,93683	0,03255	6,65	0,39	-0,003	1,698	66/1 - 89/2
			9,02374	0,26014	4,12	1,97	0,014	1,684	66/1 - 82/12
			12,73172	-0,17499	10,29	2,17 *	0,048	1,711	83/1 - 89/2

NOTE: 1) R^{-2} denotes adjusted coefficient of determination
2) DW denotes Durbin-Watson statistic
3) ** indicates 1% level of significance
4) * indicates 5% level of significance
5) Regression estimates have been adjusted for autocorrelation.

TABLE 2

THE RELATION BETWEEN MONTHLY INFLATION AND EXPECTED INFLATION AND LAGGED STOCK RETURNS

January 1966 - December 1982

No.	ESTIMATED REGRESSION	R^{-2}	DW	F
1a	MIR1 = 3,93199 + 0,81715 TBR_{t-1} (6,09) (8,72)	0,270	0,055	
b	MIR1 = 0,92234 - 0,3246 TBR_{t-1} + 0,72271 RM_{t-1} (1,53) (0,29) (10,17)	0,515	0,123	103,34 **
c	MIR1 = 1,27146 + 0,12113 TBR_{t-1} + 0,97160 $RINSU_{t-2}$ (2,78) (1,60) (16,16)	0,681	0,200	264,01 **
2a	MIR1 = 1,61254 + 0,82122 $EXIFG1_t$ (6,09) (32,10)	0,835	0,265	
b	MIR1 = 1,79251 + 0,84840 $EXIFG1_t$ - 0,03697 RM_{t-1} (5,12) (19,73) (0,79)	0,835	0,267	0,66
c	MIR1 = 1,12902 + 0,66200 $EXIFG1_t$ + 0,26653 $RINSU_{t-2}$ (4,08) (15,14) (4,40)	0,849	0,286	18,31 **
3a	MIR2 = 6,49746 + 0,58171 TBR_{t-1} (6,64) (4,10)	0,072	0,022	
b	MIR2 = 2,25032 - 0,61723 TBR_{t-1} + 1,01987 RM_{t-1} (2,38) (3,49) (9,17)	0,343	0,063	84,17 **
c	MIR2 = 2,38159 - 0,42802 TBR_{t-1} + 1,43924 $RINSU_{t-1}$ (3,36) (3,71) (15,65)	0,580	0,141	245,00 **
4a	MIR2 = 1,62533 + 0,83957 $EXIFG2_t$ (4,68) (29,12)	0,807	0,115	
b	MIR2 = 2,73390 + 0,92302 $EXIFG2_t$ - 0,16967 RM_{t-1} (5,51) (23,53) (3,07)	0,814	0,127	9,40 **
c	MIR2 = 4,07774 + 0,87913 $EXIFG2_t$ - 0,22783 $RGOLD_{t-1}$ (6,69) (30,73) (4,78)	0,826	0,147	22,84 **

NOTE: 1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F denotes the F test whose null is that the stock return coefficient is zero.
5) ** indicates 1% level of significance
6) * indicates 5% level of significance

TABLE 3

THE RELATION BETWEEN MONTHLY INFLATION AND EXPECTED INFLATION AND LAGGED STOCK RETURNS: ADJUSTED FOR AUTOCORRELATION

January 1966 - December 1982

No.	ESTIMATED REGRESSION	R^{-2}	DW
1a	MIR1 = 8,99814 + 0,23183 TBR_{t-1} (3,64) (1,32)	0,004	2,349
b	MIR1 = 7,39583 + 0,31364 TBR_{t-1} + 0,02520 RM_{t-1} (4,55) (1,89) (0,36)	0,011	2,232
c	MIR1 = 5,57799 + 0,36349 TBR_{t-1} + 0,20285 $RINSU_{t-2}$ (4,72) (2,53) (2,63)	0,072	2,040
2a	MIR1 = 3,69111 + 0,61009 $EXIFG1_{t-1}$ (3,91) (7,07)	0,194	2,193
b	MIR1 = 3,48091 + 0,58410 $EXIFG1_{t-1}$ + 0,03877 RM_{t-1} (3,42) (5,96) (0,56)	0,192	2,191
c	MIR1 = 3,02547 + 0,54872 $EXIFG1_{t-1}$ + 0,16530 $RINSU_{t-2}$ (3,36) (6,08) (2,15)	0,241	2,182
3a	MIR2 = 16,85342 - 0,05278 TBR_{t-1} (2,71) (0,30)	-0,005	1,833
b	MIR2 = 11,85427 - 0,02291 TBR_{t-1} + 0,03720 RM_{t-1} (4,83) (0,13) (0,56)	-0,008	1,777
c	MIR2 = 9,77560 + 0,12161 TBR_{t-1} + 0,04449 $RINSU_{t-1}$ (6,60) (0,76) (0,57)	-0,005	1,492
4a	MIR2 = 6,73782 + 0,40217 $EXIFG2_{t-1}$ (4,38) (3,75)	0,060	1,733
b	MIR2 = 6,43471 + 0,39052 $EXIFG2_{t-1}$ + 0,03590 RM_{t-1} (3,93) (3,56) (0,54)	0,057	1,740
c	MIR2 = 5,76691 + 0,46429 $EXIFG2_{t-1}$ + 0,01572 $RGOLD_{t-1}$ (3,89) (4,62) (0,35)	0,065	1,711

NOTE: 1) t statistics in parentheses under regression coefficient
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) Regression estimates have been adjusted for autocorrelation

TABLE 4

THE RELATION BETWEEN MONTHLY INFLATION AND EXPECTED INFLATION AND LAGGED STOCK RETURNS: ADJUSTED FOR AUTOCORRELATION

January 1966 - April 1974

No.	ESTIMATED REGRESSION	R^{-2}	DW
1a	MIR1 = 2,79805 + 0,52135 $EXIFG1_t$ (2,91) (3,12)	0,081	2,175
b	MIR1 = 4,64540 + 0,60250 $EXIFG1_t$ - 0,30526 RM_{t-1} (3,48) (3,88) (2,12)	0,142	2,108
c	MIR1 = 2,19601 + 0,89941 $EXIFG1_t$ - 0,11629 $RMOTOR_{t-1}$ (3,21) (6,94) (2,42)	0,319	2,041
2a	MIR2 = 1,66068 + 0,87381 $EXIFG2_t$ (1,94) (7,37)	0,350	1,925
b	MIR2 = 1,74651 + 0,89914 $EXIFG2_t$ - 0,03252 RM_{t-1} (1,29) (7,85) (0,22)	0,376	1,905
c	MIR2 = 1,80882 + 1,05976 $EXIFG2_t$ - 0,27571 $RINSU_{t-1}$ (2,60) (10,24) (3,01)	0,510	1,852

NOTE: 1) t statistics in parentheses under regression coefficient
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) Regression estimates have been adjusted for autocorrelation.

TABLE 5

THE RELATION BETWEEN CHANGES IN MONTHLY INFLATION AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS

January 1966 - July 1984

No.	ESTIMATED REGRESSION	R^{-2}	DW	F
1a	$\Delta MIR1 = 0{,}21169 - 0{,}014535\ RM_{t-2}$ (1,31) (1,11)	0,001	2,348	1,22515 (0,2696)
b	$\Delta MIR1 = 0{,}126799 - 0{,}006956\ RB_{t-2}$ (0,87) (0,62)	0,000	2,341	0,37887 (0,5454)
c	$\Delta MIR1 = 0{,}0441 + 0{,}04185\ \Delta RM_{t-2}$ (0,76) (0,65)	0,000	2,331	0,42862 (0,5217)
d	$\Delta MIR1 = 0{,}043684 + 0{,}167991\ \Delta RB_{t-2}$ (0,77) (2,95)	0,034	2,327	8,71399 (0,0035)
2a	$\Delta MIR2 = 0{,}310528 - 0{,}024414\ RM_{t-2}$ (1,99) (1,92)	0,012	1,862	3,70523 (0,0555)
b	$\Delta MIR2 = 0{,}298875 - 0{,}034864\ RPROPE_{t-2}$ (2,24) (2,22)	0,017	1,866	4,93623 (0,0273)
c	$\Delta MIR2 = 0{,}029097 + 0{,}058921\ \Delta RM_{t-2}$ (0,52) (0,95)	0,000	1,822	0,896608 (0,3548)
d	$\Delta MIR2 = 0{,}029435 + 0{,}070052\ \Delta RMOTOR_{t-2}$ (0,53) (2,48)	0,023	1,863	6,16343 (0,0138)

NOTE:
1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F denotes the F test whose null is that the stock return coefficient is zero - significance level in parentheses
5) Δ denotes a change in variables.

TABLE 6

THE RELATION BETWEEN CHANGES IN MONTHLY INFLATION AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS

August 1984 - February 1989

No.	ESTIMATED REGRESSION	R^{-2}	DW	F
1a	$\Delta MIR1 = -1,31810 + 0,13051\ RM_{t-2}$ (1,95) (2,01)	0,053	2,270	4,03218 (0,0497)
b	$\Delta MIR1 = -0,81775 - 0,071898\ RBC_{t-2}$ (2,37) (2,56)	0,093	2,320	6,56538 (0,0133)
c	$\Delta MIR1 = 0,02285 - 0,13409\ \Delta RM_{t-2}$ (0,20) (0,79)	-0,007	2,155	0,62056 (0,4427)
d	$\Delta MIR1 = 0,02561 + 0,10438\ \Delta RBC_{t-2}$ (0,23) (0,93)	-0,003	2,069	0,848916 (0,3708)
2a	$\Delta MIR2 = -3,083971 + 0,312468\ RM_{t-2}$ (3,80) (4,01)	0,218	2,019	16,067 (0,0002)
b	$\Delta MIR2 = -1,599149 + 0,206887\ RBEVH_{t-2}$ (3,48) (3,91)	0,210	2,036	15,3204 (0,0003)
c	$\Delta MIR2 = 0,121599 + 0,226334\ \Delta RM_{t-2}$ (0,82) (1,01)	0,001	1,642	1,02618 (0,3157)
d	$\Delta MIR2 = 0,136078 + 0,297048\ \Delta RBEVH_{t-2}$ (0,92) (1,38)	0,017	1,675	1,90858 (0,1729)

NOTE:
1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F denotes the F test whose null is that the stock return coefficient is zero - significance level in parentheses
5) Δ denotes a change in variables.

TABLE 7

CHANGES IN MONTHLY INFLATION REGRESSED ON MONTHLY NOMINAL STOCK RETURNS

January 1983 - February 1989

No.	ESTIMATED REGRESSION	R^{-2}	DW	F
1a	Δ MIR1 = -0,71279 + 0,06715 RM_{t-1} (1,17) (1,18)	0,005	2,025	1,38389 (0,243)
b	Δ MIR1 = -0,81386 + 0,08036 $RPROPE_{t-1}$ (2,87) (3,01)	0,099	2,228	9,05318 (0,004)
c	Δ MIR2 = -1,81020 + 0,17210 RM_{t-1} (2,31) (2,35)	0,071	1,797	5,5155 (0,022)
d	Δ MIR2 = -1,39722 + 0,13940 $RPROPE_{t-1}$ (3,93) (4,16)	0,182	2,012	17,2652 (0,000)

NOTE: 1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F denotes the F test whose null is that the stock return coefficient is zero - significance level in parentheses.

TABLE 8

THE RELATION BETWEEN INTEREST RATE CHANGES AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS

January 1966 - February 1989

No.	ESTIMATED REGRESSION	R^{-2}	DW	F^*
1a	$\Delta TBR = -0,04300 + 0,15593\ RM_{t-1} - 0,14854\ RM_{t-2}$ (0,45) (4,19) (3,99)	0,054	1,385	8,90377 (0,000)
b	$\Delta TBR = 0,12923 + 0,12207\ RPROPE_{t-1} - 0,13318\ RPROPE_{t-2}$ (1,64) (3,95) (4,32)	0,058	1,437	9,58815 (0,000)
c	$\Delta GVTST = 0,09361 + 0,06995\ RM_{t-1} - 0,07489\ RM_{t-2}$ (1,74) (3,31) (3,55)	0,039	1,441	6,55177 (0,002)
d	$\Delta GVTST = 0,08145 + 0,07086\ RIND_{t-1} - 0,07430\ RIND_{t-2}$ (1,73) (3,39) (3,55)	0,039	1,421	6,55935 (0,002)
2a	$\Delta TBR = 0,04036 + 0,19807\ \Delta RM_{t-1} - 0,04588\ \Delta RM_{t-2}$ (1,26) (4,00) (1,39)	0,051	1,381	10,8519 (0,000)
b	$\Delta TBR = 0,03553 + 0,12153\ \Delta RPROPE_{t-1} + 0,06200\ \Delta RPROPE_{t-2}$ (1,12) (3,97) (2,03)	0,067	1,430	10,8997 (0,000)
c	$\Delta GVTST = 0,03782 + 0,06921\ \Delta RM_{t-1} + 0,02675\ \Delta RM_{t-2}$ (2,07) (3,27) (1,26)	0,040	1,440	6,75768 (0,001)
d	$\Delta GVTST = 0,03817 + 0,06792\ \Delta RIND_{t-1} + 0,02026\ \Delta RIND_{t-2}$ (2,11) (3,17) (0,94)	0,038	1,411	6,50705 (0,002)

NOTE:
1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F^* denotes the F test whose null is that the stock return coefficients are zero - significance level in parentheses.
5) Δ denotes a change in variables

TABLE 9

THE RELATION BETWEEN INTEREST RATE CHANGES AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS: ADJUSTED FOR AUTOCORRELATION

January 1966 - February 1989

No.	ESTIMATED REGRESSION	R^{-2}	DW	P(1)
1a	$\Delta TBR = -0,04074 + 0,10994\ RM_{t-1} - 0,10267\ RM_{t-2}$ (0,31) (3,13) (2,92)	0,027	2,035	-0,02
b	$\Delta TBR = 0,13899 + 0,07338\ RPROPE_{t-1} - 0,08541\ RPROPE_{t-2}$ (1,34) (2,49) (2,90)	0,024	1,998	-0,00
c	$\Delta GVTST = 0,10154 + 0,03828\ RM_{t-1} - 0,04390\ RM_{t-2}$ (1,43) (1,90) (2,17)	0,011	1,827	0,09
d	$\Delta GVTST = 0,08595 + 0,04433\ RIND_{t-1} - 0,04811\ RIND_{t-2}$ (1,37) (2,16) (2,34)	0,014	1,836	0,08
2a	$\Delta TBR = 0,04073 + 0,11716\ \Delta RM_{t-1} + 0,06301\ \Delta RM_{t-2}$ (0,93) (3,34) (1,79)	0,037	2,043	-0,02
b	$\Delta TBR = 0,03745 + 0,08747\ \Delta RPROPE_{t-1} + 0,04949\ \Delta RPROPE_{t-2}$ (0,89) (3,00) (1,70)	0,030	2,009	-0,01
c	$\Delta GVTST = 0,03804 + 0,04352\ \Delta RM_{t-1} + 0,01647\ \Delta RM_{t-2}$ (1,58) (2,15) (0,81)	0,010	1,835	0,08
d	$\Delta GVTST = 0,03827 + 0,04713\ \Delta RIND_{t-1} + 0,01813\ \Delta RIND_{t-2}$ (1,57) (2,31) (0,89)	0,006	1,848	0,08

NOTE:
1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) P(1) first order autoregressive statistic
5) Δ denotes a change in variables.
6) Regression estimates have been adjusted for autocorrelation

TABLE 10

THE RELATION BETWEEN INTEREST RATE CHANGES AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS

January 1966 - December 1982

No.	ESTIMATED REGRESSION	R^{-2}	DW	F^*
1a	$\Delta TBR = -0,03663 + 0,08017\ RM_{t-1} - 0,07298\ RM_{t-2}$ (0,59) (3,18) (2,89)	0,044	1,110	5,71598 (0,004)
b	$\Delta TBR = 0,01481 + 0,04624\ RBC_{t-1} - 0,04426\ RBC_{t-2}$ (0,28) (2,66) (2,54)	0,025	1,101	3,6400 (0,028)
c	$\Delta GVTST = 0,08791 + 0,07917\ RM_{t-1} - 0,08475\ RM_{t-2}$ (2,21) (4,87) (5,21)	0,116	1,359	14,2707 (0,000)
d	$\Delta GVTST = 0,07987 + 0,05063\ RBC_{t-1} - 0,05443\ RBC_{t-2}$ (2,39) (4,54) (4,87)	0,105	1,355	12,8954 (0,000)
2a	$\Delta TBR = 0,04483 + 0,07080\ \Delta RM_{t-1} + 0,04888\ \Delta RM_{t-2}$ (1,97) (2,81) (1,94)	0,052	1,110	6,59658 (0,002)
b	$\Delta TBR = 0,04362 + 0,04086\ \Delta RBC_{t-1} + 0,02243\ \Delta RBC_{t-2}$ (1,89) (2,32) (1,22)	0,031	1,094	4,20735 (0,016)
c	$\Delta GVTST = 0,02282 + 0,07738\ \Delta RM_{t-1} + 0,03559\ \Delta RM_{t-2}$ (1,56) (4,77) (2,19)	0,123	1,339	15,2767 (0,000)
d	$\Delta GVTST = 0,02098 + 0,04796\ \Delta RBC_{t-1} + 0,02134\ \Delta RBC_{t-2}$ (1,41) (4,22) (1,88)	0,104	1,334	12,7896 (0,000)

NOTE:
1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F^* denotes F test whose null is that the stock return coefficients are zero - significance level in parentheses
5) Δ denotes a change in variables.

TABLE 11

THE RELATION BETWEEN INTEREST RATE CHANGES AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS

January 1983 - February 1989

No.	ESTIMATED REGRESSION	R^{-2}	DW	F^*
1a	$\Delta TBR = -0,29854 + 0,51137\ RM_{t-1} - 0,47836\ RM_{t-2}$ (0,45) (3,49) (3,46)	0,128	1,597	6,34191 (0,003)
b	$\Delta TBR = 0,54609 + 0,29341\ RPROPE_{t-1} - 0,34618\ RPROPE_{t-2}$ (1,69) (3,07) (3,62)	0,146	1,794	7,25123 (0,001)
c	$\Delta GVTST = -0,13745 + 0,05408\ RM_{t-1} - 0,03408\ RM_{t-2}$ (0,37) (0,66) (0,44)	-0,020	1,508	0,288246 (0,750)
d	$\Delta GVTST = -0,22615 + 0,15987\ RINSU_{t-1} - 0,10823\ RINSU_{t-2}$ (1,00) (1,33) (0,94)	0,012	1,584	1,4303 (0,246)
2a	$\Delta TBR = 0,06116 + 0,46247\ \Delta RM_{t-1} + 0,21858\ \Delta RM_{t-2}$ (0,63) (3,39) (1,60)	0,155	1,569	7,67830 (0,001)
b	$\Delta TBR = 0,01178 + 0,29005\ \Delta RPROPE_{t-1} + 0,10714\ \Delta RPROPE_{t-2}$ (0,12) (2,92) (1,08)	0,125	1,705	6,1937 (0,003)
c	$\Delta GVTST = 0,07409 + 0,03883\ \Delta RM_{t-1} - 0,0077\ \Delta RM_{t-2}$ (1,33) (0,50) (0,10)	-0,025	1,480	0,12684 (0,881)
d	$\Delta GVTST = 0,07719 + 0,10797\ \Delta RINSU_{t-1} + 0,02458\ \Delta RINSU_{t-2}$ (1,40) (0,89) (0,21)	-0,014	1,505	0,499662 (0,609)

NOTE:
1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F^* denotes F test whose null is that the stock return coefficients are zero - significance level in parentheses
5) Δ denotes a change in variables.

TABLE 12

THE RELATION BETWEEN INTEREST RATE CHANGES AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS

October 1979 - December 1982

No.	ESTIMATED REGRESSION	R^{-2}	DW	F^*
1a	$\Delta TBR = 0{,}446682 + 0{,}13093\ RM_{t-1} - 0{,}14372\ RM_{t-2}$ (1,16) (2,10) (2,31)	0,081	1,017	2,67492 (0,083)
b	$\Delta TBR = 0{,}46258 + 0{,}24024\ RPROPE_{t-1} - 0{,}26910\ RPROPE_{t-2}$ (2,14) (3,33) (3,72)	0,240	1,223	7,00217 (0,003)
2a	$\Delta GVTST = 0{,}83495 + 0{,}10270\ RM_{t-1} - 0{,}15288\ RM_{t-2}$ (3,90) (2,96) (4,41)	0,407	1,425	14,0434 (0,000)
b	$\Delta GVTST = 1{,}06756 + 0{,}12050\ RIND_{t-1} - 0{,}18678\ RIND_{t-2}$ (5,65) (3,15) (4,85)	0,538	1,703	23,0869 (0,000)
3a	$\Delta TBR = 0{,}24845 + 0{,}12041\ \Delta RM_{t-1} + 0{,}04229\ \Delta RM_{t-2}$ (3,04) (1,81) (0,64)	0,084	1,044	2,74875 (0,078)
b	$\Delta TBR = 0{,}23866 + 0{,}23478\ \Delta RPROPE_{t-1} + 0{,}11920\ \Delta RPROPE_{t-2}$ (3,28) (3,34) (1,71)	0,273	1,314	8,14596 (0,001)
4a	$\Delta GVTST = 0{,}05375 + 0{,}11889\ \Delta RM_{t-1} + 0{,}02259\ \Delta RM_{t-2}$ (1,01) (2,73) (0,52)	0,184	1,025	5,27482 (0,010)
b	$\Delta GVTST = 0{,}14748 + 0{,}14667\ \Delta RIND_{t-1} + 0{,}00741\ \Delta RIND_{t-2}$ (0,87) (2,59) (0,13)	0,145	0,920	4,23100 (0,022)

NOTE:
1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) F^* denotes F test whose null is that the stock return coefficients are zero - significance level in parentheses
5) Δ denotes a change in variables.

TABLE 13

THE RELATION BETWEEN INTEREST RATE CHANGES AND NOMINAL STOCK RETURNS AND CHANGES IN NOMINAL STOCK RETURNS: ADJUSTED FOR AUTOCORRELATION

October 1979 - December 1982

No.	ESTIMATED REGRESSION	R^{-2}	DW
1a	$\Delta TBR = \underset{(0,89)}{0,50828} + \underset{(0,98)}{0,05905}\ RM_{t-1} - \underset{(1,26)}{0,07641}\ RM_{t-2}$	-0,010	1,817
b	$\Delta TBR = \underset{(1,56)}{0,46096} + \underset{(2,31)}{0,15413}\ RPROPE_{t-1} - \underset{(2,73)}{0,18325}\ RPROPE_{t-2}$	0,126	1,694
c	$\Delta GVTST = \underset{(3,06)}{0,82825} + \underset{(1,98)}{0,07188}\ RM_{t-1} - \underset{(3,37)}{0,12186}\ RM_{t-2}$	0,273	1,657
d	$\Delta GVTST = \underset{(5,00)}{1,06767} + \underset{(2,68)}{0,10669}\ RIND_{t-1} - \underset{(4,32)}{0,17301}\ RIND_{t-2}$	0,472	1,810
2a	$\Delta TBR = \underset{(1,83)}{0,23835} + \underset{(1,19)}{0,06920}\ \Delta RM_{t-1} + \underset{(0,04)}{0,00206}\ \Delta RM_{t-2}$	-0,015	1,799
b	$\Delta TBR = \underset{(2,39)}{0,23561} + \underset{(2,80)}{0,18249}\ \Delta RPROPE_{t-1} + \underset{(1,05)}{0,06842}\ \Delta RPROPE_{t-2}$	0,146	1,710
c	$\Delta GVTST = \underset{(0,50)}{0,04536} + \underset{(1,88)}{0,07010}\ \Delta RM_{t-1} + \underset{(0,57)}{0,02132}\ \Delta RM_{t-2}$	0,045	1,711
d	$\Delta GVTST = \underset{(0,39)}{0,03906} + \underset{(2,02)}{0,09469}\ \Delta RIND_{t-1} + \underset{(0,65)}{0,03004}\ \Delta RIND_{t-2}$	0,056	1,749

NOTE: 1) t statistics in parentheses under regression coefficients
2) R^{-2} denotes adjusted coefficient of determination
3) DW denotes Durbin-Watson statistic
4) Δ denotes a change in variables
5) Regression estimates have been adjusted for autocorrelation.

APPENDIX III

THE CHOW TEST FOR STRUCTURAL BREAKPOINT: DECEMBER 1982

	$RM_t = \beta_0 + \beta_1 MIR_{e,t}$				
No.	Proxy	Index	SSE	(df)	F
1.	MIR_{t-1}		3431,470	(276)	
		CPI	1899,590	(202)	96,6853
			112,133	(72)	**
			3650,560	(276)	
		PPI	2837,840	(202)	30,9163
			140,588	(72)	**
2.	TBR_{t-1}		3968,150	(276)	
			2061,550	(202)	113,2775
			110,585	(72)	**
3.	FAMA/ GIBBONS		2888,520	(276)	
		CPI	1439,450	(202)	110,4493
			159,773	(72)	**
			2944,170	(276)	
		PPI	2120,200	(202)	43,6638
			112,407	(72)	**

NOTE:
1) SSE denotes error sums of squares
2) df denotes degrees of freedom
3) F denotes F the test whose null is that the regression parameters did not change over the sample period.
4) ** indicates 1% level of significance