Excess co-movement in asset prices: The case of South Africa

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EXCESS CO-MOVEMENT IN ASSET PRICES: THE CASE OF SOUTH AFRICA

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Abstract

The paper investigates excess co-movement in asset prices in South Africa between 1995 and 2005 using the definition of excess co-movement as correlation between two asset prices beyond what could be explained by key economic fundamentals. The results of the study suggest that there is excess co-movement between returns on equities and bonds in South Africa. The findings suggest that there are considerable noise traders on the financial market in South Africa. The result of this behaviour would be the tendency for the equity and bond prices to move together more than would be predicted by their shared fundamentals. These results are consistent with the possibility that a fad or crowd psychology plays a role in the volatility on the market for the two asset classes.

1. Introduction

Domestic asset allocation by institutional investors in South Africa follows the traditional asset allocation view. As a result, asset allocation is mostly between equities and bonds (Marilize, 2006). At the end of 2005, the value of bonds listed on the South African Bond Exchange had a nominal market value of R637billion (US$87,15bn) and a market capitalisation of R756billion (US$104bn), while the Johannesburg Stock Exchange had a market capitalisation of R3,3trillion (US$452bn). Another way of comparing the bond market with the equities market is a consideration of asset allocation by domestic institutional investors. For example, domestic institutional investors allocate between 11% and 20% of their total assets to bonds, whereas the proportion that is assigned to equities fluctuates between 38% and 75%. Equities and bonds are, therefore, clearly the two major asset classes in South Africa.

The issue of co-movement in asset prices concerns the joint response of asset prices/returns to macroeconomic influences. The argument is that co-movement in asset prices/returns represents the response of asset markets to common business

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cycles and trend factors. The presence of excess co-movement in commodity markets, for instance, has been judged as casting doubt on the efficiency of commodity markets and on the standard commodity price models (Cooper and Lawrence, 1975). Excess co-movement behaviour can signify a 'herd' or 'fad' mentality on the part of traders, which is unrelated to market fundamentals. Excess co-movement, as a result of irrational trading behaviour, can thwart the efforts of hedgers whose activities are largely based on market fundamentals and for whom noise traders could be a serious nuisance. On the contrary, if the excess co-movement is relatively isolated or if it cannot be attributed to causes other than herd behaviour, it may be inappropriate to make strong judgment for its presence.

The question that naturally arises is whether there has been a tendency in the past for domestic equity and bond prices/returns to move together over time and the extent to which expected returns of these assets respond to the same underlying fundamentals. The purpose of this paper, therefore, is to examine the presence of excess co-movement between bond and equity prices/returns in South Africa. The selection of bonds and equities out of the five main asset classes[1] was determined by their market dominance.

Studies of financial markets in developed countries have identified high covariance of asset prices relative to the covariance of their fundamentals (Pindyck and Rotemberg, 1993; and Barberis *et al*., 2005). However, studies focusing on developing countries - including South Africa - have attracted little attention. Covariation of asset returns is extremely useful to individuals and institutional investors who desire to allocate their investments to maximise the risk-return trade-off of their portfolios (Finnerty and Schneeweis, 1979). The results of the study offer useful insights that can help in managing investments on the South African financial market.

The rest of the paper is structured as follows: Section 2 briefly discusses previous studies on asset price/return co-movement, while the methodology for the study is explained in Section 3. Data issues and the empirical analyses are the subject of Section 4. The key findings of the study are presented in Section 5. The conclusions are given in Section 6.

2. Literature review

It is instructive to note that even though co-movement in financial markets has attracted some attention in the literature, it has not been studied extensively. Among the few that have considered individual countries are Engsted and Tanggaard (2001) who focused on the Danish bond and equity markets. In addition to co-movement, the paper looked at return predictability and variance decomposition with the aid of a VAR model. Shiller and Beltratti (1992) investigated whether co-movement in equity prices and bond yields could be explained in terms of present value models in the US. Research papers have

[1]The literature suggests the existence of five major asset classes, namely, cash, equities, bonds, exotics (derivatives, hedge funds etc.,) and property.

observed a number of co-movement theories. Barberis *et al*. (2002) identify three major strands of co-movement theory in the literature. The authors present individual estimation models of co-movement from these various schools of thought and an evaluation of those using data from the S&P 500 index.

Finnerty and Scheeweis (1979) examined the co-movement in returns of international equities and long-term bonds for nine developed economies. The empirical analysis was based on a study of correlation of rates of return. Grubel (1968) used the Markowitz-Tobin model in one of the seminal works that explored the return-risk relationships of international diversified portfolios. These studies indicated the absence of correlation between international equity returns.

The more traditional view of co-movement is based on the assertion that it is due to changes in fundamental values, in the case of economies without friction (i.e., arbitrage) and with rational investors (Pindyck and Rotemberg, 1990 and 1993; Bekaert and Hodrik, 2002). In this view, changes in the fundamental value of assets may be due to revision of rational expectations about the future cash flows or an application of varying discount rates to those cash flows. Consequently, correlation in returns may be due to either correlated changes in rationally expected cash flows or in rationally applied discount rates. It is also asserted that common movements in discount rates might also emerge as a result of interest rate changes or risk aversion or because of changes in rationally perceived asset risk. In an investigation of seven largely unrelated[2] commodities, Pindyck and Rotemberg (1990) showed the existence of excess co-movement in the commodity prices even after controlling for forecasts of aggregate production and inflation. In another study, Pindyck and Rotemberg (1993) tested whether co-movement of individual stock prices could be justified by changes in key macroeconomic variables. The theoretical framework underlying the test was the present value model of security valuation based on the assumption that variations in discount rates were solely due to changes in macroeconomic fundamentals. Latent variable modeling was also used to capture unobserved expectations in the direction of future macroeconomic fundamentals. Kallberg and Pasquariello (2003) also investigated excess co-movement of industry indices on the US stock market. However, unlike Pindyck and Rotemberg (1993), the fundamental factors considered by Kallberg and Pasquariello were the sector groupings and the three Fama-French factors[3].

Other papers that are associated with the fundamental view are Yuan (2000), Deb *et al*. (1996) and Kyle and Xiong (2001). Drawing on this theory of co-movement, Shohet (1974) demonstrated the importance of basic economic factors such as wages and price levels in driving anticipated within-country returns on securities. In the paper by Branch (1974), the economic factors used in testing the hypothesis of co-movement are inflation and real GNP.

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[2]Two commodities are deemed unrelated if their cross-price elasticities of demand and supply are insignificant.

[3]The Fama-French factors are related to microeconomic fundamentals (Fama and French, 1992; 1993 and 1995).

One of the recent theories of co-movement is the category-based school of thought. The proponents of this argument are of the opinion that investors group different securities into categories and tend to move resources in and out of these categories in a coordinated manner (Froot and Dabora, 1999). The strand of literature underlying the category-based explanation of co-movement claims that the traditional view of co-movement is rather incomplete. Hardouvelis *et al*. (1994) provide empirical support for this assertion, using data based on closed-end country funds which are traded in countries. According to the fundamental view, it would be expected that returns on funds and their underlying assets, that together represent claims to similar cash flow streams, be highly correlated. On the contrary, Barberis *et al*. (2002) indicate that closed-end country funds typically comove much more with the national equity markets in the country where their assets are traded.

A variation of the "category-based" co-movement is the "habitat-based" explanation of co-movement. The habitat phenomenon is due to a situation where a number of investors limit their trading activities to a defined set of securities and then move in and out of that set at the same time. Fama and French (1995) found that the strong common factors in the returns of value stocks and small stocks earlier observed by Fama and French (1993) could not be associated with cash flow factors. Barberis and Shleifer (2003) suggest that to simplify investment decisions, many investors usually group assets into categories like oil industry stocks, small cap stocks or junk bonds and then allocate funds at the level of these clusters and not at the individual asset level. Merton (1987) argues that the question of preferred habitats may be due to transaction cost limits imposed by international trading or the absence of information. The understanding here is that as these investors' perception of risk or sentiments changes, they, accordingly, change the portfolios of the investments in the associated habitat. For instance, Lee *et al*. (1991) found that closed-end mutual funds were a preferred habitat of individual investors. As a result, their prices move together with changes in demand of individual investors, even in situations where their fundamentals do not.

These two non-traditional views of co-movement suggest that, in certain instances, co-movement in returns may have little to do with co-movement of views about fundamentals. In the present study, however, we test the traditional view of co-movement in key asset prices in South Africa. The value addition is the use of the theoretical framework in Pindyck and Rotemberg (1993), as well as Finnerty and Schneeweis (1979), in testing the fundamental view of asset price co-movement in emerging markets.

3. Methodology

This section of the paper discusses the analytical framework that underpins the empirical analysis of asset price co-movement in South Africa. Relevant data issues are also discussed, drawing on earlier studies.

3.1 Theoretical framework

We use a modification of the standard framework (Pindyck and Rotemberg, 1993) in which the price of asset *i* at time *t* is the expected present discounted value of earnings:

$$P_{i,t} = E_t \sum_{j=0}^{\infty} \frac{A_{i,t+j}}{R_{t,t+j}} \qquad \dots (1)$$

where

$P_{i,t}$	=	Price of asset i at time t
$A_{i,t+j}$	=	Earnings per unit of asset i at time t+j
E_t	=	Expectations conditional on information at time t
$R_{t,t+j}$	=	The rate at which investors discount back to t the earnings they receive at t+j in a particular state of nature

Following Pindyck and Rotemberg (1993), who cited the Arrow-Debreu framework, it is also assumed that there is only one discount rate at which investors discount earnings that accrue in a particular state. Given that earnings at time *t* are paid out at *t*, for the sake of simplicity, we have:

$$P_{i,t-1} = A_{i,t-1} + E_{t-1} \sum_{j=0}^{\infty} \frac{A_{i,t+j}}{R_{t-1,t+j}} \qquad \dots (2)$$

Since we know with certainty the R's for any given state of nature, $R_{t-1,t} R_{t,t+j} = R_{t-1,t+j}$ for $j \succ 1$. When equations (1) and (2) are combined after dividing (1) by $R_{t-1,t}$, we obtain:

$$\frac{P_{i,t}}{R_{t-1,t}} - (P_{i,t-1} - A_{i,t-1}) = \sum_{j=0}^{\infty} (E_t - E_{t-1}) \frac{A_{i,t+j}}{R_{t-1,t+j}} \qquad \dots (3)$$

Expectation of the right hand side of (3) at time *t-1* is zero. Defining the return on an individual asset as the ratio of its total payoff to its cost, [$Q_{i,t} = P_{i,t} / (P_{i,t-1} - A_{i,t-1})$], the returns may also be given as follows, drawing on Equation (3):

$$Q_{i,t} = R_{t-1,t} + R_{t-1,t} \frac{\sum_{j=0}^{\infty} (E_t - E_{t-1}) A_{i,t+j} / R_{t-1,t+j}}{P_{i,t-1} - A_{i,t-1}} \qquad \dots (4)$$

Next, equation (4) is linearised around the trajectories for expected future earnings and discount factors, $\{\bar{A}_{i,\tau}\}$ and $\{\bar{R}_{t-1,\tau}\}$. Since expectational revisions of $\bar{A}_{i,t+j} / \bar{R}_{t-1,t+j}$ are zero, we obtain:

$$Q_{i,t} \approx R_{t-1,t} + \left[\frac{\bar{R}_{t-1,t}}{\bar{P}_{i,t-1} - \bar{A}_{i,t-1}} \right] \sum_{j=0}^{\infty} \frac{\bar{A}_{i,t+j}}{\bar{R}_{t-1,t+j}} \times \left[\frac{(E_t - E_{t-1})A_{i,t+j}}{\bar{A}_{i,t+j}} - \frac{(E_t - E_{t-1})R_{t-1,t+j}}{\bar{R}_{t-1,t+j}} \right] \quad \ldots (5)$$

Equation (5) implies that we can approximate an asset's return as the present value of revisions of expectations of percentage deviations of earnings and discount rates from their mean paths (Pindyck and Rotemberg, 1993).

If models where the *R's* are related to macroeconomic variables are considered, expectational revisions of future discount rates can depend only on macroeconomic variables, denoted by M_t. Expectational revisions of future earnings will depend on macroeconomic variables and also on asset-specific variables that are uncorrelated with the macroeconomic variables. These asset-specific variables are denoted by $z_{i,t}$. Thus the return on asset *i* can be written as:

$$Q_{i,t} \approx \bar{Q}_i + \sum_{j=0}^{\infty} \left[a_j E_t z_{i,t+j} + b_j E_t M_{t+j} \right] \quad \ldots (6)$$

If the assets are unrelated, then $E_t(z_{i,t} z_{j,t+s}) = 0$ for all *t* and *s*, such that asset *i* and *j* are only correlated through the common effect of macroeconomic variables on earnings and discount rates.

3.2. Data issues and empirical analysis

In this section of the paper, the dataset used in the empirical analysis is described. The frequency of the data series is monthly covering the period June 1995 to September 2005. The paper focuses on equities and bonds because they are the dominant asset classes on the South African financial market. While the variable for equities is represented by the Johannesburg Stock Exchange's All Share Index (ALSH), the Government of South Africa long-term bond (BOND) was used as a proxy for bonds. The government bond index was used to represent bonds because it accounts for more than seventy percent of bonds traded in the country. The other consideration was the paucity of data, particularly with respect to Bond Exchange of South Africa's (BESA) bond indices.

The data on the All Share Index was obtained from the McGregor's database, while the data on the government bond index and the macroeconomic variables were obtained from the International Monetary Fund's International Financial Statistics (IFS) CD Rom. The macroeconomic variables used are the consumer price index (CPI), money plus quasi money, that is, M2+ in billions of rand (MONEY), the rand/US dollar exchange rate (R/USD), and the Government of South Africa 3-month Treasury bill discount rate (TBILL). The CPI is used as a measure of the general price level in the country, MONEY accounts for the money stock, the nominal R/USD exchange rate is the price of one US dollar in rand terms, and TBILL represents the interest rate.

All the data series were transformed into logarithms as a way of scaling them down. The standard augmented Dickey-Fuller (ADF) unit root tests suggested that all the variables were non-stationary in log levels. These unit root test results are presented in Table 1. The ADF tests for the data series in log levels were formulated to include a constant and a trend. This was warranted by the fact that all the series crossed the Y-axis at values other than zero and exhibited clear trends. On the other hand, the first log difference series were tested for unit roots using test equations with neither a constant nor a trend, except for the CPI and MONEY, where constants were used. Whereas all the other first log differences fluctuated around the zero line, the first log differences of the CPI and MONEY fluctuated above the zero line and thus the inclusion of a constant in the equation specification. [See Appendix 1 and 2 for graphical representations of all the variables in log levels and first log differences, respectively]. The results of the ADF tests suggest that all variables became stationary after first differencing. We refer to the log first-differences of equity and bond prices as equity and bond returns and the first log differences of the CPI as inflation hereafter.

Table 1. Unit-root test for stationarity

	LOG LEVELS			FIRST LOG DIFFERENCES		
Variable	**ADF test statistic**	**p-value**	**Lag length**	**ADF test statistic**	**p-value**	**Lag length**
ALSH	-2,409539	0,372800	0	-10,89976	0,000000	0
BOND	-2,904502	0,164800	1	-8,444051	0,000000	0
CPI	-1,226244	0,900200	1	-8,032416†	0,000000	0
MONEY	-1,730616	0,731800	0	-12,4391†	0,000000	0
R/USD	-1,005929	0,938600	1	-7,619507	0,000000	0
TBILL	-2,847869	0,183400	1	-6,432257	0,000000	0

Notes: The test equation for the log levels include a constant and a trend
The test equation for the first log differences does not include a constant nor a trend except if marked with a † the sign.

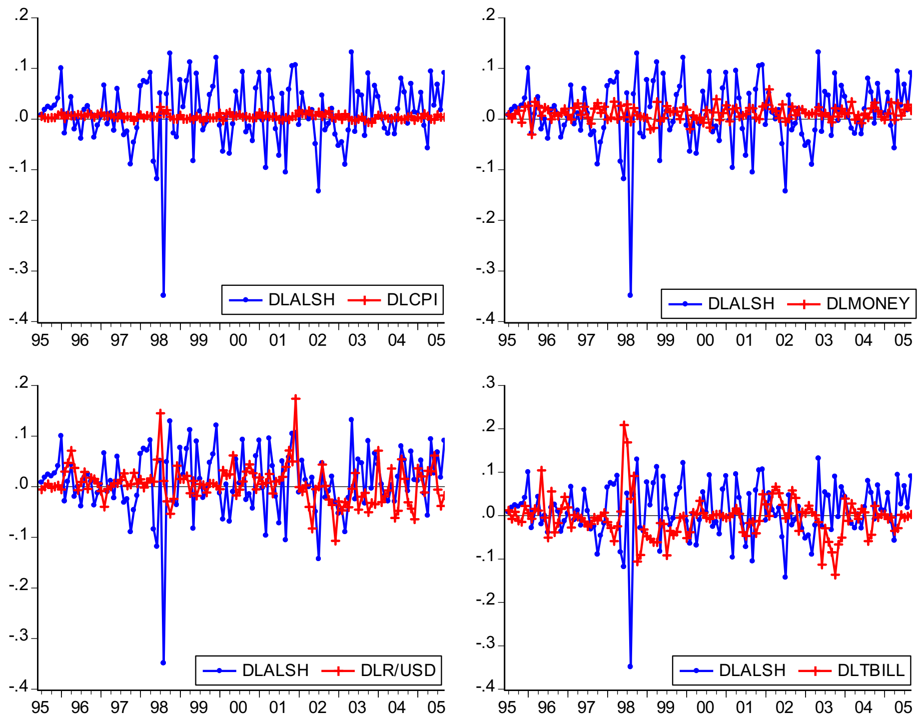
To better appreciate the behaviour of the data used in the analysis we examined the normality and other associated statistics of all the variables under discussion. The approach offers one the opportunity to identify any outliers, if any. In addition to the estimation of the first and second moments, other aspects of the distribution such as skewness, kurtosis and normality were examined. Results of the various statistics are as presented in Table 2. A review of all the statistics suggests that the data are not normally distributed as evidenced by the significance of the Jarque-Bera statistics, and slightly skewed, except for DLMONEY. However, this should not significantly affect our results due to the large sample size used.

Table 2. Descriptive statistics of variables

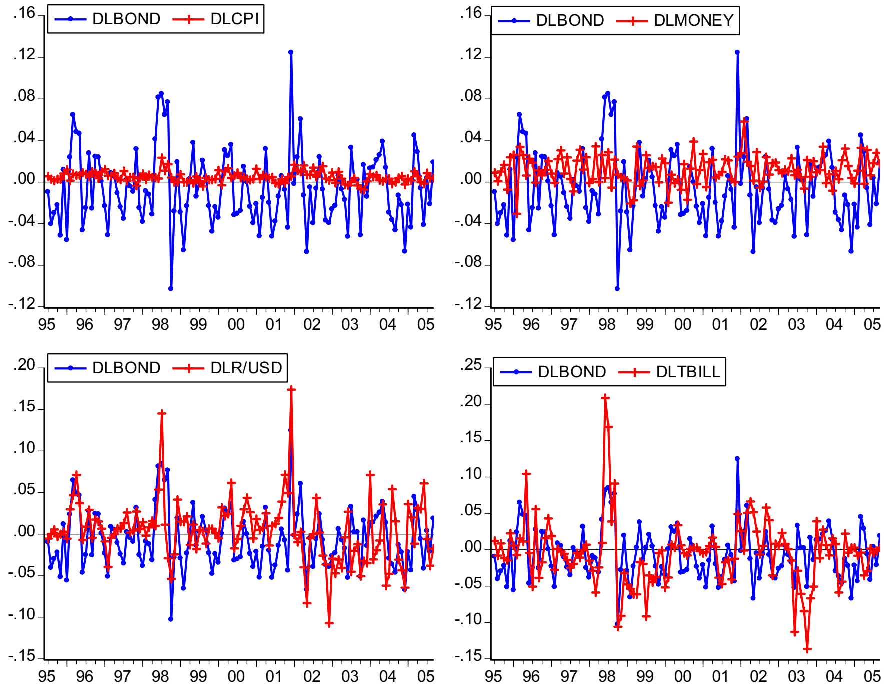
Statistic	**DLALSH**	**DLBOND**	**DLCPI**	**DLMONEY**	**DLR/USD**	**DLTBILL**
Mean	0,010082	-0,005951	0,004727	0,011591	0,004480	-0,005832
Median	0,010425	-0,009581	0,004075	0,011360	0,004255	-0,004421
Maximum	0,131332	0,124361	0,023426	0,058182	0,173738	0,208599
Minimum	-0,348832	-0,102935	-0,007428	-0,030435	-0,106924	-0,136265
Std. Dev.	0,064481	0,035750	0,005032	0,013817	0,036956	0,045035

Skewness	-1,412046	0,613215	0,559890	-0,029311	0,876382	1,023241
Kurtosis	9,453568	3,933528	4,031837	3,583339	7,357572	8,347636
Jarque-Bera	254,3231	12,17498	11,88280	1,761572	113,0607	168,0247
Probability	0,000000	0,002271	0,002628	0,414457	0,000000	0,000000

In order to visually determine if equity and bond returns co-move with the macroeconomic variables, the equity and bond return series were each plotted on the same graph with the log-differences of the macroeconomic variables. These graphs are presented in Panel 1 and 2, respectively. An examination of the two panels suggests that returns on the two asset classes, equities and bonds, tend to move together with changes in the Tbill, R/USD and Money. However, the movements are less apparent between inflation and equity returns (See Panel 1 and 2).



Panel 1: Equities and fundamentals



Panel 2: Bonds and fundamentals

The graphical presentations above were validated by computing correlations between the variables. Some of the correlations between the macroeconomic variables and the bond and equity returns are significant (See Tables 3). This is consistent with the *a priori* assumption that changing macroeconomic conditions can influence returns on assets by affecting expected future earnings. Of particular interest is the correlation between the equity and bond returns themselves, which is negative and statistically significant. However, one empirical question that requires a response is whether the returns will continue to be correlated when we account for movements in the underlying fundamentals, namely, the macroeconomic effects. Given that investors form expectations of future earnings based on performance of current and past macroeconomic variables, standard Ordinary Least Square (OLS) regressions can be used to filter out the effects of various macroeconomic influences systematically (Pindyck and Rotemberg, 1993).

Table 3: Correlations

	DLALSH	DLBOND	DLCPI	DLMONEY	DLR/USD	DLTBILL
DLALSH	1,0000					
DLBOND	-0,2661***	1,0000				
DLCPI	-0,0859	0,2340***	1,0000			
DLMONEY	0,1579*	0,2061**	0,2681***	1,0000		
DLR/USD	0,0248	0,4523***	0,0750	-0,0280	1,0000	
DLTBILL	-0,2162**	0,5170***	0,5224***	0,1218	0,2407***	1,0000

Notes: *, ** and *** denote 2-tailed significance at the 10% level, 5% level, and 1% level, respectively.

5. Results

The first stage of the empirical analysis involves the running of two OLS regressions with returns on equities and bonds as dependent variables against the four identified macroeconomic variables. The assumption here is that the performance of macroeconomic variables is expected to influence expectations about the discount rate in the future (Bekaert and Hodrik, 2002).

After the preliminary analyses, a subset of variables (in this case a particular macroeconomic variable and its lag) is excluded from the regression to ascertain its usefulness as an explanatory variable. The hypothesis tested at this stage is that the coefficient of the omitted variable in the regression is not significantly different from zero. The appropriate lag length in each of the regressions was ascertained using the F-test statistic, an approach which shows the marginal significance of all lags. The exercise suggested lag one as the most appropriate as higher order lags were found to be statistically insignificant.

The results of the exclusion tests are presented in Table 4. For both the bond and equity returns equations, inflation did not directly influence returns on equities and bonds. Equity returns were only significantly affected by change in money supply, but at the 10% level of significance. The macroeconomic variables appear to be more useful and relevant in explaining returns on bonds than on equities in South Africa. These results are consistent with the findings of Pindyck and Rotemberg (1993) where exclusion tests using chi-square statistics gave comparable results regarding the equity market in the United States.

Table 4: Chi-square statistics for explanatory variables exclusions in OLS regressions

Variable	DLALSH	DLBOND
DLCPI	0,9893	3,2561
DLMONEY	5,4409*	6,8741**
DLR/USD	1,3010	25,4653***
DLTBILL	4,1459	40,2833***

Notes: *, ** and *** denote 2-tailed significance at the 10% level, 5% level, and 1% level, respectively.

The unexplained movements in the asset returns, as captured by the residuals of the equity and bond equations, are strongly correlated. In order to ensure that the correlation did not happen by chance, we test the null hypothesis that the product moment correlation coefficient is zero, by using the Student's t-test (Speigel, *et al.*, 2000). It was found at the 1% level of significance that the two residuals are strongly correlated and that the non-zero correlation of -0.3237 did not happen by chance (See Table 5).

Table 5: Correlation coefficient for regression residuals

	DLALSH residual	DBOND residual
DLALSH residual	1,0000	
DBOND residual	-0,3237***	1,0000

Note: *** denotes 2-tailed significance at the 1% level

It can, therefore, be asserted that changes in macroeconomic fundamentals do not explain to a considerable degree the co-movement of bond and equities returns on the South African financial market. The negative co-movement between bond and stock returns in South Africa means that the two asset classes offer good diversification opportunities to South African investors. Therefore, portfolios in which the two asset classes are components will deliver consistent returns in different market conditions. The negative co-movement could also reflect what is known as the "flight-to-safety" phenomenon. This refers to a situation whereby investors disinvest from equities and invest in bonds when the level of uncertainty on the equities market increases. This uncertainty could be caused by factors such as irrational trading or herding other than changes in macroeconomic fundamentals, which appears to be the case in South Africa. Some investors tend to go long on bonds and sell equities short during equity market corrections, thus contributing to the negative correlations.

Investors are always looking for assets with low or negative correlation to each other to include in their portfolio holdings. However, in order to diversify effectively, they need to mix assets so that when some are declining under the changing macroeconomic environment, others will be rising. The South African financial market can thus be considered to offer attractive investment opportunities to investors. This is because government bonds, which are relatively safe in comparison to other asset classes, offer one of the effective diversification opportunities for equities on the South African market. However, such a diversification opportunity may not persist since it is driven by fad behaviour, rather than macroeconomic fundamentals.

6. Conclusions

The paper examines excess co-movement in asset prices in South Africa using the definition of co-movement as correlation between two asset prices beyond what could be explained by key economic fundamentals. Subsequently, we test the null hypothesis that when underlying macroeconomic fundamentals are controlled for, contemporaneous correlation between asset returns from unrelated asset groups in South Africa is zero. This paper focuses on equities and bonds because the two are the most important asset classes on the financial market in South Africa. The JSE All Share Index and the Government of South Africa long-term bond index were considered as proxies for equities and bonds, respectively. The choice of the government bond index as a proxy for bonds in the country was based on the fact that long term government bonds account for more than seventy percent of the bonds traded in the country. The macroeconomic variables that were considered in the study include the stock of money, CPI, the rand/US dollar exchange rate and the

Treasury bill rate. The results of the study suggest that there is excess co-movement between equity returns and bond yields in South Africa. The findings imply that there are considerable *noise traders* on the market for equities and bonds in South Africa. The result of this behaviour would be the tendency for the equity and bond prices to move together more than would be predicted by their shared fundamentals. These results are consistent with the possibility that a fad or crowd psychology plays a role in the volatility on the market for the two asset classes.

References

Barberies, N, Shleifer, A and Wurgler, J (2002): "Comovement", *NBER Working Paper* No. 8895, Cambridge, Massachusetts.

Barberies, N and Shleifer, A (2003): "Style Investing", *Journal of Financial Economics*, 68(2), 161-199.

Barberies, N, Shleifer A and Wurgler J (2005): "Comovement", *Journal of Financial Economics*, 75(2), 283-317.

Bekaert, G and Hodrik, R J (2002): "Expectations Hypothesis Tests", *NBER Working paper* No. 7609, Cambridge, Massachusetts.

Branch, B (1974): "Common Stock Performance and Inflation: An International Comparison", *Journal of Business*, 47(1), 48-52.

Cooper, R M and Lawrence, R Z (1975): "The 1972-75 Commodity Price Boom", *Brookings Papers on Economic Activity*, 1975(3), 671-723.

Deb, P, Trivendi, P and Varganis, P (1996): "The Excess Comovement of Commodity Prices Reconsidered", *Journal of Applied Econometrics*, 11(3), 275-291.

Engsted, T and Tanggaard, C (2001): "The Danish Stock and Bond Markets: Comovement, Return Predictability and Variance Decomposition", *Journal of Empirical Finance*, 8(3), 243-271.

Fama, E F and French, K R (1992): "The Cross-section of Expected Stock Returns", *Journal of Finance* 47(2), 427-465.

Fama, E F and French, K R (1993): "Common Risk Factors in Returns on Stocks and Bonds", *Journal of Financial Economics* 33, 3-56.

Fama, E F and French, K R (1995): "Size and Book-to-market Factors in Earnings and Returns", *Journal of Finance*, 50(1), 131-155.

Finnerty, J E and Schneeweis, T (1979): "The Comovement of International Asset Returns", *Journal of International Business Studies*, 10(3), 66-78.

Froot, K and Dabora, E (1999): "How are Stock Prices Affected by the Location of Trade?" *Journal of Financial Economics*, 53(2), 189-216.

Grubel, H G (1968): "Internationally Diversified Portfolios: Welfare Gains and Capital Flows" *American Economic Review*, 58(5), 1299-1314.

Hardouvelis, G, Rafael La Porta, A and Wizman, T A (1994): "What Moves the Discount on Country Equity Funds?" In J Frankel, ed, *The Internationalization of Equity Markets*, Chicago: University of Chicago Press.

Kallberg, J and Pasquariello, P (2003): Time-series and Cross-sectional Excess Comovement in Stock Indexes, Working paper, Stern School of Business, New York University.

Kyle, A and Xiong, W (2001): "Contagion as a Wealth Effect", *Journal of Finance*, 56(4), 1401-1439.

Lee C, Shleifer, A and Thaler, R (1991): "Investor Sentiment and the Closed-end Fund Puzzle", Journal *of Finance*, 46(1), 75-110.

Marilize, P (2006): "Bonds as Key Asset Class", A paper presented at the Asset Allocation Summit, March 29-31, Bond Exchange of South Africa, Johannesburg.

Merton, R (1987): "An Intertemporal Capital Asset Pricing Model", *Econometrica,* 41(5), 867-887.

Pindyck, R and Rotemberg, J (1990): "The Excess Comovement of Commodity Prices", *Economic Journal*, 100(403), 1173-1189.

Pindyck, R and Rotemberg, J (1993): "The Comovement of Stock Prices", *Quarterly Journal of Economics*, 108, 1073-1104.

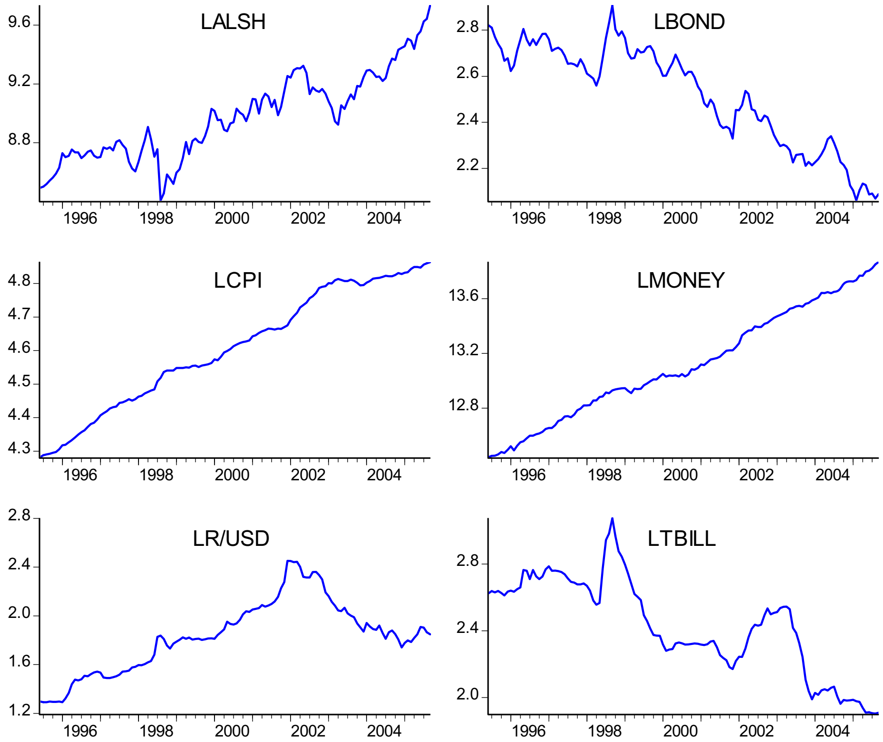
Shiller, R J and Beltratti, A E (1992): "Stock Prices and Bond Yields: Can their Comovements be Explained in Terms of Present Value Models?" *Journal of Monetary Economics*, 30(1), 25-46.

Shohet, R (1974): "Investing in Foreign Securities", *Financial Analysts Journal*, 30(5), 55-72.

Spiegel, M R, Schiller, R A and Srinivasa, RA (2000): *Schaum's Outline of Probability and Statistics* (2ed), McGraw-Hill Publishers, New York.

Yuan, K (2000): "Asymmetric Price Movements and Borrowing Constraints: A REE Model of Crisis, Contagion, and Confusion", W*orking paper*, MIT.

Appendix 1: Variables in log levels



Appendix 2: Variables in first log differences