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Firm characteristics and investment strategies in Africa: The case of South Africa *

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ABSTRACT

We examine the viability of quantitative techniques for investing in individual stocks in the South African market. We measure the information in various firm specific attributes in forming portfolio strategies designed to outperform standard benchmarks. This market is particularly challenging given the extremely short sample by which we can calibrate our methods. Nevertheless, our out-of-sample analysis suggests that we can achieve up to 9% out-performance of standard benchmarks with our buy portfolio. Further, the difference between our recommended stocks and those we suggest avoiding is over 24% per year.

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1. Introduction

A quantitative framework for executing bottom up strategies in emerging markets was detailed in Achour, Harvey, Hopkins and Lang (1998).¹ This paper conducts in-depth market by market analysis and evaluates the ability to select stocks in both bull and bear markets.

South Africa is a particularly challenging market. The sample that we have to work with is very short giving us little time to calibrate the parameters of our model. South Africa is also a country that experienced significant structural shifts: both economic and political. While there is a large degree of country risk, there are also substantial potential gains for investors in this emerging market. Indeed, most of the last frontier markets reside in Africa and South Africa is a good starting point for developing selection strategies for other national markets in Africa.

We follow closely the framework detailed in Achour et al. (1998). We combine historical data from the International Finance Corporation (IFC), Morgan Stanley Capital International (MSCI), Worldscope and IBES. We examine a number of standard attributes like book value to price, cash flow to price, earnings to price, dividends to price, earnings growth, revenue growth, debt/equity ratios, return on equity and market capitalization. In addition to these essentially historical measures, we examine prospective earnings to price ratios measured over different horizons, IBES revisions, prospective earnings growth as well as a number of momentum measures.

Our results suggest that significant value can be added by our stock selection mechanisms. Our out-of-sample results show that our buy list significantly outperforms the standard benchmarks. The margin is large enough to succumb the transactions costs in these markets.

Given that details of the framework are presented in Achour et al. (1998), we focus on the detailed factor by factor results in this paper. However, in the interest of being self-complete, we repeat many of the factor definitions and methodological details.

2. Asset selection process

2.1 Screening methodology

At the start of each holding period, firms are sorted on the observable characteristics defined below and assigned in equal numbers to a pre-defined number of portfolios (fractiles) on the basis of its rank. For example, if all available stocks for a given

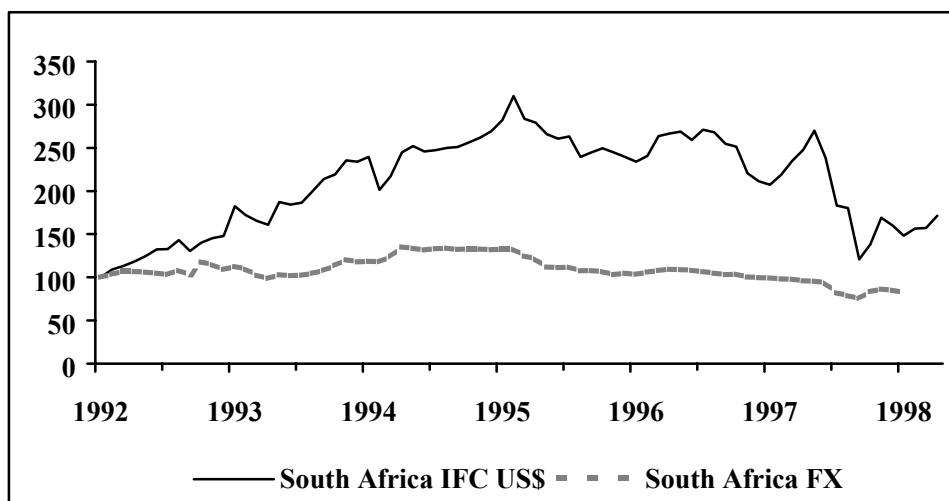
¹ An early treatment of the cross-sectional determinants of emerging market returns is contained in Bekaert, Erb, Harvey and Viskanta (1997) who detail the impact of a number of factors on country indices. Individual stock selection is the focus of Claessens, Dasgupta and Glen (1998) as well as Achour et al. (1998) and Rouwenhorst (1998).

characteristic are ranked in order of expected return, then top one third become the top “fractile” and the bottom (lowest scoring) third become the bottom “fractile”. If there is a tie around the portfolio breakpoints, stocks are assigned to lower portfolios. The number of fractiles that we choose depends on the number of securities available. With fewer securities, we focus on three fractiles. In countries with more securities, we use five fractiles. We calculate both equal and value weighted returns for each portfolio. For this paper, we focus most of our attention the top and bottom portfolio performance. Stocks for which no ranking information exists are excluded to an ‘NA’ category or not ranked portfolio and analyzed separately.

Our paper focuses on what we have termed ‘univariate’ sorts, i.e. portfolio formation based on a single attribute. However, for many attributes we did examine ‘bivariate’ sorts simultaneously based on two criteria. Given space constraints, it is not possible to report the results of bivariate sorts.

Our method involves performance screening in an ‘in-sample’ period that ends in December 1995. We then assign weights to each characteristic and develop a final selected portfolio. We call this the “scoring screen”. This scoring screen is then tested in the hold-out period (which we refer to as ‘out-of-sample’ period) from 1996 through March 1998. Our exhibits show performance statistics through March 1998, i.e. both in sample and the hold-out sample. However, we combine these periods only for the purposes of presentation in this paper. In our research, the in-sample and out-of-sample periods were separated. Further, the reader can see the year-by-year performance in the in-sample and out-of-sample periods. Top-bottom spread returns are reported as well as calculated premia over a selected investment benchmark.

Returns are calculated after adjusting for splits, dividends and rights offerings and denominated in US dollars using exchange rates supplied in the IFC’s Emerging Market Database (EMDB). Value weighted portfolio returns are constructed using relevant IFC adjustment factors to replicate the index level returns on a bottom up calculation. These adjustment factors are made for corporate actions and for government and cross ownership (from November 1996). Firms with more than one share class, which IFC have included to achieve the desired index level weighting structure, are aggregated together to form a single basket of outstanding shares in our screens. Where different classes of shares are priced differently, the fundamental data used in the analysis is linked to the most liquid class of shares available to international investors. The market capitalization has been adjusted to take all classes of shares together. Exhibit 1 presents the value of US\$100 invested in the South African market in January 1993 through March 1999.



Data through March

EXHIBIT 1

Performance of US\$100 invested in South Africa equities and foreign exchange

2.2 Diagnostics

A battery of diagnostic criteria is presented to assist the evaluation of each screening factor. Each diagnostic is carefully defined in our performance report template that is presented in Exhibit 2.

EXHIBIT 2

Performance diagnostics:

| Note | Performance Measure/Summary Statistic | Definition ² |
|------|--|--|
| 1 | Annualized average return ³ | <p><i>Stock level</i> - Annualized geometric average of post-rank portfolio US Dollar total returns over all observation periods. Total return is calculated by adding the last 12 months gross cash dividend at ex-dividend date, adjusted for the length of the return period, to the closing monthly USD market price. Returns are value weighted by the market capitalization as at observation date.</p> <p><i>Index level</i> - Similarly for the market portfolio, though the index return levels will be as sourced from database providers using the value weighted index</p> |

² Definition applicable to equal and value weighted fractiles and benchmark performance measures.

| | | |
|----|--|--|
| 2 | Cumulative return (indexed at 100 - start) | returns ⁴ . Value of \$100 if invested at the first observation date and compounded over intervening periods. |
| 3 | Std Deviation of returns | Annualized standard deviation of post-rank portfolio returns over all observation periods. |
| 4 | Average annual excess return - Rm. | Annualized geometric average of post-rank portfolio excess returns above the market portfolio over all observation periods. |
| 5 | Average annual excess return - Rf | Annualized geometric average of post-rank portfolio excess returns above annualized US 90 Day T-bill rate over all observation periods. |
| 6 | Std Deviation of excess rtns - Rm | Annualized standard deviation of post-rank portfolio excess returns above market portfolio over all observation periods. |
| 7 | Std Deviation of excess rtns - Rf | Annualized standard deviation of post-rank portfolio excess returns above annualized US 90 Day T-bill rate (as at observation date) over all observation periods. |
| 8 | T-stat | Test of whether average excess return is significantly different from zero. |
| 9 | Systematic risk (Beta) | Slope of regression line estimated by regressing average post-rank portfolio returns on the relevant market portfolio return over all observation periods. No lags are incorporated in the market portfolio return to allow for non-synchronous trading. |
| 10 | Alpha | Annualized intercept of the regression line estimation per Systematic risk (Beta) above. |
| 11 | Co-efficient of determination | Co-efficient of determination (R-Square) of average post-rank portfolio returns versus the market portfolio return over all observation periods. |
| 12 | Average market cap | Sum of all constituent market capitalizations in local currency divided by the total number of portfolio constituents over all observation periods. |
| 13 | % periods > market portfolio | Percentage of total observations that average post-rank portfolio return was greater than the market portfolio return over the holding period. |
| 14 | % periods > Bench up Mkt | Percentage of total observations that average post-rank portfolio return was greater than the market portfolio return when the market portfolio return was greater than zero. |
| 15 | % periods > Bench Dn Mkt | Percentage of total observations that average post-rank portfolio return was greater than the market portfolio return when the market portfolio return was |

³ See body of text on return calculations

⁴ Although value weighted index returns will obviously impart a known size bias (that will vary from market to market depending on the distribution of size) on the comparative benchmark returns this is unavoidable due to non-availability of an equal weighted benchmark in many markets.

| | | |
|----|--|---|
| | | less than zero. |
| 16 | Max # of consecutive bmark out-performance | Longest string of consecutive observations where average post-rank portfolio return was greater than the market portfolio return. |
| 17 | Maximum positive excess return | Highest single post-rank portfolio excess positive return above market portfolio over all observation periods. |
| 18 | Maximum negative excess return | Lowest single post-rank portfolio excess negative return above market portfolio over all observation periods. |
| 19 | % periods positive returns to negative | Ratio of portfolio post-rank average returns greater than zero to post-rank returns less than zero over all observation periods. |
| 20 | % periods of negative returns | Percentage of observations that portfolio post-rank returns were less than zero over all observation periods, indicative of the historical probability of losing money. |
| 21 | Max # of consecutive negative periods | Longest string of consecutive observations where average post-rank portfolio return was less than zero. |
| 22 | Max # of consecutive positive periods | Longest string of consecutive observations where average post-rank portfolio return was greater than zero. |
| 23 | Cumulative annual returns | Value of \$100 if invested on the 1 st January of each year of the observation period and compounded over intervening observation to 31 st December. Cumulative returns for 1998 would represent a year to last observation date return. |
| 24 | Relative Performance | Average relative performance of portfolio generated on simple scoring algorithm that assigns a weight to the portfolio in each year of the observation period based on its cumulative annual return performance rank relative to its peers. Therefore, the minimum score a portfolio could obtain would be 1, maximum r and average $(n + (n+1) + (n+2) + \dots + (n+r))/r$ where n is the number of years in the observation period and r is the number of portfolios. |
| 25 | Cumulative annual returns - last 2 and 5 years | Value of \$100 if invested two or five years preceding the most recent observation and compounded over intervening periods. |
| 26 | Factor average | Arithmetic average of constituent ranking factors over all observation periods. |
| 27 | Factor median | Median value of constituent ranking factor over all observation periods. |
| 28 | Factor standard deviation | Standard deviation of constituent ranking factors over all observation periods. |

In addition to the diagnostics, we assign a premium to consistency. Quantitative measures such as the longest strings of negative and positive absolute and relative returns, performances in up and down markets and the historical probabilities of losing money add further dimensions to traditional statistical risk and expected return measures. These measures are further complemented by the simple relative performance scoring algorithm diagnostic which assigns a weight to the portfolio in each year of the observation period based on its cumulative annual return performance rank relative to its peers. Average scores across the observed periods will deliver information regarding performance consistency.

One notable absence from the table is the analysis of transaction costs. In measuring the performance of portfolios, we adopted rudimentary assumptions for turnover costs because of the well documented difficulties on capturing costs associated with different instruments traded, bid-ask spreads, market impact and opportunity costs on execution time durations. To address the issue of the effects of implementing a trading strategy, our models are run with longer holding periods to check for robustness and to identify factors with return premia which persist on longer holding periods.

2.3 Factor selection

There are many elements that enter our algorithm for factor selection. Given the number of factor screening candidates, we need to greatly reduce the dimensionality (isolate a small number of factors) for our final portfolio selection, which we will call the final scoring screen. The factor report cards detailed in Exhibit 2 yield 28 different diagnostic pieces of information. It is also important to understand the interrelationships between the various factors. This must be supplemented by correlation analysis to eliminate potentially redundant screening factors.

We calculate (but do not report) correlations between the portfolio returns derived from each factor screen. We do this separately for the top fractile and the bottom fractile portfolio. For this analysis, we used value-weighted portfolios. As we assign weights to both top and bottom factor portfolios in arriving at a composite factor score for firms in the universe we present matrix correlation coefficients for both. Factor returns that are highly correlated in the top portfolio may exhibit weak or negative correlations in the bottom. Some of the variation may be attributed to the collection of heterogeneous groups of stocks in certain bottom portfolios due to the nature of the sort - lumping high earnings multiple and loss making firms together in an earnings yield sort, for example. This is illustrated by the high correlation coefficients obtained in top portfolios between earnings yield and book to price ratios in South Africa (0.82) and the lower observed values in the bottom portfolio (0.69).

We find high correlations among value strategies, which is due in part to price appearing in the denominator of these ratios. Unlike value screens, correlations and factor performances among growth proxies differ visibly. Estimate revision screens (change in consensus FY1 estimates and consensus forecast earnings estimate revision ratio) have higher relative correlation coefficients with growth proxies as these type of screens generally behave

better in growth oriented environments where premiums are paid for additional amounts of nominal earnings.⁵

2.4 Final portfolio selection and diagnostics

Our final portfolio selection is based on a combination of:

1. Assessment of the factor based on the 27 diagnostics presented in Exhibit 2
2. Bivariate screens that combine information in two factors (not reported)
3. Correlation analysis
4. Success ratios
5. Quadratic optimization (not reported)
6. Quantitative adjustments for high transaction costs inducing factors (not reported)
7. A final “knock-out” list.

Steps one through six are what we characterize as the “scoring screen”. This screen uses information in both the top and bottom performing fractiles. That is, our buy list is not a simple combination of the top fractiles. While it might not be possible to short stocks in the bottom fractiles, membership in this fractile is useful in penalization of a particular security or for its removal from a buy list through time.

The seventh step, the “knock out” criteria, eliminates firms that are too small for meaningful portfolio investment. It also isolates firms that have unreasonable leverage. It should be emphasized that the inputs for the scoring screen includes information, such as bivariate sorting and some additional univariate screens, which have not been included in this text.

The success ratio analysis is another diagnostic measure that gives insight into performance differentials. The success rate measures the percentage of stocks in the top portfolio that outperform the benchmark market portfolio at a particular observation and the percentage that underperform in the bottom portfolio. The average of these rates through time will reveal the depth of portfolio performance and the proportion of firms driving performance. We examine this measure for each of the screening factors. The definitions for this analysis are contained in Exhibit 3.

⁵ See, for instance, Bernstein (1995).

EXHIBIT 3
Success Rate definitions

| Performance factor | Definition |
|--|---|
| Success rate | Calculated individually for both top and bottom portfolios as the percentage of stocks in the top portfolio at a particular observation that <i>outperform</i> the Market portfolio, and the percentage of stocks that <i>underperform</i> in the bottom portfolio. For example, if 10 stocks are sorted into a top factor portfolio and eight of those stocks have returns <i>greater</i> than the market then the success ratio is 80%. In the same strategy at the same observation date, if six of the 10 stocks collected in the bottom portfolio have returns <i>less</i> than the market the success ratio for that bottom portfolio would be 60%. |
| Average success rate | Arithmetic average of the observed success rates over all observations. |
| Standard deviation of average success rate | Standard deviation of the observed success rates from the average success rate over all observations. |
| Average success rate consistency ratio | Percentage of observations that the success rate was greater than 50%. |
| Success rate - Most successful | Highest observed single success rate over all observations. |
| Success rate - Least successful | Lowest observed single success rate over all observations. |
| Universe | Those constituents of the selected index (market portfolio) for which relevant ranking information exists at a particular observation date. |

The success ratio analysis is a particularly useful tool in helping us assess the probabilities of type I error (incorrectly classifying a winner to the bottom fractile) and type II error (incorrectly assigning a loser to the top fractile). Indeed, no matter how favorable a screen might look, there is still a chance that losers will be assigned to a buy list. However, if one is able to do independent fundamental research on the individual firms, it may be possible to more accurately identify winners in the top fractile. Of course, our final portfolio is evaluated using a number of criteria, only one of which is the success ratio.

3. Data

3.1 Primary sources

Our data are drawn from a number of sources all contained within the FACTSET database system. We use constituent data from the International Finance Corporation (IFC), Worldscope and the Institutional Brokers Estimate System (I/B/E/S). In some of our analysis, we also use data from Morgan Stanley Capital International (MSCI). Our analysis uses returns and data on 21 firm characteristics.

The universe of stocks for all markets as well as benchmark returns are sourced from the IFC Global indices through time. The IFC is widely regarded as having the most complete emerging market data set and has been widely used in recent academic studies, for example Harvey (1995) and Rouwenhorst (1999). The IFC's Emerging Market Database (EMBD) generally has the longest histories and highest quality data sets for emerging markets. The selection of IFC facilitates the back testing of the chosen factors. It also has the advantage of being a 'snap shot' database which eliminates most survivorship biases. That is, for our sample, no data has been backfilled by the IFC.

As the principal focus of the paper is on the predictive power of local factors through time and not on the impact of investment restrictions, we have used the broader global indices that do not include adjustments made for investability. Hence, we focus on the IFC 'Global' indices rather than the IFC 'Investible' indices. The 'investible' stocks are those that are available to foreign institutional investors and which pass screens for minimum size and liquidity.

3.2 Screening factors

We classify our screening factors into three groups: historical accounting characteristics (fundamental factors); expectations (expectation factors); past returns (technical factors) and size (size factors). Fundamental, technical and size factors are from IFC where available or from Worldscope, while the expectation factors are from I/B/E/S. Each of our screening factors is detailed in Exhibit 4.

EXHIBIT 4
Details of Screening Factors

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|--|---|
| 1 Market capitalization | IFC | <p>Number of shares outstanding for index purposes * closing monthly market price</p> <p>Note 1 : Number of shares outstanding as at the balance sheet date, adjusted for corporate actions and reduced by government and cross ownership (from November 1996) per capital adjustment factor. For firms with more than one share class, we have used whenever possible the aggregate Worldscope weights for that firm. Where the Worldscope weights are missing, we used the constituent IFC weights. Therefore, the weighting in the benchmark that we use, the IFC index, could differ</p> | <ul style="list-style-type: none"> • Diagnostic screen to investigate performance differential between large and small capitalization stocks. [Certain screens in the study were not considered for incorporation into the selection model but were constructed to give insight into the behavior of specific market segments through time]. • Size is widely regarded as a proxy for trading liquidity. • Small capitalization stocks tend to have higher transaction costs. [There are well documented difficulties on capturing costs associated with different instruments traded, bid ask spreads, market impact and opportunity costs on execution time durations] • Risk, as defined by volatility of historical returns, tends to increase as size decreases.⁸ |
| Small cap effect persists through time. | | | |
| <i>Top portfolio : Small capitalization</i> | | | |
| <i>Bottom portfolio : Large capitalization</i> | | | |
| Code ⁷ : CAP | | | |

⁶ For all screening factors, stocks for which relevant ranking information does not exist are classified into a not ranked fractile and monitored separately.

⁷ Short form screen code for selected tables and text

⁸ See Bernstein (1995) for a general discussion on the behavior of market capitalization and size effects.

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-------------|---|--|
| | | <p>from the weighting that we use in our value-weighted portfolios.</p> <p>Note 2 : Market price as at date of observation in local currency (consistent across all factors).</p> | <ul style="list-style-type: none"> • If there is no risk premium associated with investing in smaller capitalization stocks, then investors are expected to migrate toward larger capitalization stocks which have lower perceived risks. • IFC selects constituents for their indices based on liquidity, track record, institutional interest, and industry representation, that is, their selection is not random. Track record may preclude the selection of small capitalization emerging growth stocks, therefore small capitalization stocks may show significant value characteristics [Emerging 'growth' stocks probably enter universe as more mature mid caps]. • Smaller stocks tend to be regarded as lower 'quality' stocks [Smaller stocks due to the inherent variability in earnings and exposures to the local economy are generally regarded as being of lower 'quality']. • Small stock effects may pervade the results of other factors described below. To this end, we examine the impact of size on all the factors below. We construct bivariate screens to test whether a candidate factor discriminates |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|--|---|
| <p>2 Change in Return on Equity</p> <p>Stocks with improving returns on equity and thus 'quality' should outperform through time</p> <p><i>Top portfolio : High change</i></p> <p><i>Bottom portfolio : Low change</i></p> <p>Code : CH_ROE</p> | IFC | $\text{Return on equity (current year)} - \text{Return on equity (previous year)}$ | <p>between high and low expected return stocks across all size categories.</p> <ul style="list-style-type: none"> To capture changes in the levels of a company's return on common equity, as compared with a more traditional 'quality' rank. Our objective is to identify companies that investors believe are higher 'quality' before subsequent shifts in valuation multiples occur. For example, a company that improves its return on equity from 10% to 15% might be very attractive although this stock might not necessarily be ranked in the top portfolio of a simple return on equity sort. This screening factor might be improved by combining it with IBES expectation data and a bivariate sort. |
| <p>3 Debt to common equity ratio</p> <p>Highly leveraged</p> | Worldscope | $\frac{\text{Total debt}/\text{common equity} * 100}{(\text{Long term debt} + \text{Short Term Debt} + \text{Current Portion of Long Term Debt})}$ | <ul style="list-style-type: none"> Diagnostic screen constructed to give insight into performance differential between leveraged and un-leveraged stocks. [Not considered for incorporation into the selection |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|---|--|
| <p>stocks expected to out-perform to compensate for the higher implied risks.</p> <p><i>Top portfolio :</i> <i>High debt to equity</i></p> <p><i>Bottom portfolio :</i> <i>Low debt to equity</i></p> <p>Code : DE</p> | | <p>Common Equity *100</p> | <p>model].</p> <ul style="list-style-type: none"> Debt/equity ratios can be used as a proxy for 'quality' and perceived risk⁹ and screens on 'good' and 'bad' companies. Formed portfolio returns expected to have a high correlation with certain value return screens [see earnings yield below, for example]. Data assimilated from most recent fiscal year end. Lag incorporated on assimilation of data to ensure data item is available for out-of-sample portfolio formations. Rank comparisons across some constituent sectors are difficult. This is the case in the banking sector, for example, since taking deposits is analogous to borrowing, and we exclude this sector from the screen for this reason. |
| <p>4 Dividend yield</p> <p>Higher yielding stocks should</p> | IFC | <p>Last 12 months cash dividends / closing monthly market price)*100</p> <p>Note: On a per share basis at ex-</p> | <ul style="list-style-type: none"> High correlation with other 'value' factors as these tend to be shorter duration strategies. [Duration refers to interest rate sensitivity and is defined by the relative change in an |

⁹Screen can be used to corroborate use of factor as part of a set of knockout criteria to control final model risk.

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-------------|---|---|
| <p>exhibit superior performance through time.</p> <p><i>Top portfolio :</i> <i>High dividend yield</i></p> <p><i>Bottom portfolio :</i> <i>Low dividend yield</i></p> <p>Code : DY</p> | | <p>dividend date, using gross cash dividends. Adjustment made by database provider to ensure all shares issued and outstanding for index purposes receive same dividend</p> | <p>instruments return to a defined change in the level of interest rates].</p> <ul style="list-style-type: none"> • Smaller capitalization stocks tend to have higher yields. • All dividends expressed in local currency terms |
| <p>5 One year historical earnings growth/momentum</p> <p>high earnings momentum stocks should outperform through time.</p> <p><i>Top portfolio :</i> <i>High earnings momentum</i></p> | <p>IFC</p> | <p>(Last 12 months trailing earnings per share- previous last 12 months trailing earnings per share)/(absolute previous last 12 months trailing earnings per share))*100</p> <p>Note 1: In hyperinflationary economies IFC uses adjusted earnings and book values, inflating trailing earnings and historical book values by intervening period inflation. Consistent across all factors with earnings and book value per</p> | <ul style="list-style-type: none"> • Earnings momentum indicator frequently used as the best growth proxy due to information deficiencies in certain emerging markets. • Assumes that analysing the past has value for subsequent forecasts. • Useful indicator to identify those stocks with rising expectations among investors prior to their establishing a track record. • We conducted the analysis excluding negative historical previous earnings for comparison purposes. • Can be screened with estimate revision ratios |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-------------|--|--|
| <p><i>Bottom portfolio :</i> <i>Low earnings momentum</i> Code : HEGR_1Y</p> | | <p>share in formulas. Reported as opposed to operating earnings have been used throughout the study due partly to the availability and quality of the reported data but also to capture the effect of any asset write-offs that may occur during periods of falling inflation.</p> | <p>[see Consensus forecast earnings estimate revision ratio below for definitions] to identify future earnings surprises and recovery situations. This directly introduces market expectations of earnings growth rather than relying on changes in historical earnings.</p> |
| <p>Note 2 : The use of absolute numbers in the rate of change calculation permits the capture of any turn around effect in earnings, though stocks reducing losses will be perceived as being short term (expected) momentum companies. The relative performance of this group, though, may be investigated by repeating the analysis and excluding this group.</p> | | | |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|---|---|
| <p>6 Three year historical earnings growth rate</p> <p>Stock exhibiting best long term track records should continue to provide superior growth rates and return premiums</p> <p><i>Top portfolio : High earnings growth</i></p> <p><i>Bottom portfolio : Low earnings growth</i></p> <p>Code : HEGR_3Y</p> | <p>IFC</p> | <p>The rate of change in reported last twelve month earnings per share over the three year time interval terminating on the date of the last interim period for which earnings were announced.</p> <p>Note : Annual growth rate is computed by fitting a least squares growth line to the logarithms of the reported or prospective (where applicable) earnings data over the specified period. The following rules hold for factor rank :</p> <p>Rates will only be generated if first and last time periods are greater than zero, Non-available or negative data in interim period is discarded.</p> | <ul style="list-style-type: none"> • A traditional growth proxy highlighting a stock's historical track record and stability. • Stocks which pass factor criteria have a visible track record, a perceived rarity in the volatile emerging markets and should therefore trade at high premiums even though it is generally accepted that naive extrapolations in these volatile markets are futile. • Does not incorporate the element of expectation but rather known growth, which is effective for identification of a 'quality' universe of stocks. • In order to include a larger number of stocks in the analysis, when less than three years of data were available, we included stocks that did include a full two-year data history. |
| <p>7 Earnings yield</p> <p>High yield 'value'</p> | <p>IFC</p> | <p>(Last 12 months trailing earnings per share/closing market price)*100</p> | <ul style="list-style-type: none"> • Traditional 'value' / 'growth' proxy used by investors. • Value stocks generally are riskier as they are |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|---|--|
| <p>companies should provide superior future returns through time.</p> <p><i>Top portfolio :</i> <i>High earnings yield</i> <i>Bottom portfolio :</i> <i>Low earnings yield</i></p> <p>Code : EY</p> | | <p>Per share data – Aggregate reported earnings divided by the total number of shares outstanding (all classes) as of the balance sheet date, adjusted for corporate actions and reduced by government and cross ownership (from Nov 96) per capital adjustment factor. This is consistent across all factors constructed using IFC per share data.</p> | <p>usually firms under distress, have high financial leverages and face substantial uncertainty in future earnings.</p> <ul style="list-style-type: none"> • Much has been written about the shortcomings of the incorporation of traditional measures such as earnings yield. One can argue that these measures may be influenced by accounting practices, may not incorporate risk or the time value of money and may be seen as a function of value and not a determinant of value. • On the other hand, for many common stocks, the average relation between price and reported may reflect the views of investors as to the quality and growth of the issue. It may give information about, inter alia, the quality of management, the firm's individual prospects, the competitive position, the stability and growth of past earnings and its financial strengths. • Though there are benefits in using yield and value ratios, data quality and history often preclude their effective implementation. • The use of earnings yield as a factor can result in sorting on incorrectly identified |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-----------------------|---|--|
| <p>8</p> <p>a) Change in Consensus FY1 estimate - last 3 months</p> <p>b) Change in</p> | <p>IBES estimates</p> | <p>a) $\left(\frac{\text{Consensus forecast earnings per share Fiscal Year 1 (FY1) at date of observation/ consensus forecast earnings per share FY1 3 months preceding date of observation} - 1 \right) * 100$</p> | <p>‘value’ companies. Anticipatory stock price movements could induce a migration into ‘value’ territory before the next round of reported financial information alters the multiple. Combining the historical factor (earnings yield) with an expectational factor [such as a revision ratio sort, for example] in a bi-variate sorting model could partially alleviate this problem [this will also apply to other ‘value’ screens below].</p> <ul style="list-style-type: none"> • Inverting traditional price to earnings ratio will result in the collection of loss making stocks in the bottom ranked portfolio. The relative performance of this group may be investigated by exclusion through time. • Without some form of relative attribution adjustment, sectoral influences could appear in ranks through time. <p>• Factor indicates the magnitude of change in Fiscal Year 1 consensus forecast earnings estimates over the preceding 3 and 6 month period from observation date.</p> <ul style="list-style-type: none"> • Good indicator to isolate companies with changing earnings expectations and those that |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|--|---|
| <p>Consensus FY1 estimate - last 6 months</p> <p>Stocks with rising earnings expectations should outperform through time.</p> <p><i>Top portfolio :</i> <i>High change in estimate</i></p> <p><i>Bottom portfolio :</i> <i>Low change in estimate</i></p> <p>Code : CH_FY1_3M</p> | | <p>b) $((\text{Consensus forecast earnings per share Fiscal Year 1 (FY1) at date of observation/ consensus forecast earnings per share FY1 6 months preceding date of observation}) - 1) * 100$</p> <p>Note : Average EPS estimate known as consensus forecast is calculated by adding current EPS estimate data for the specified periods from all contributing IBES firms and dividing by the number of EPS estimates that enter into the calculation. A composite forecast of earnings per share that distills current EPS estimate data for the specified fiscal time period into a single expectation. Gains from combining security analysts forecasts arise from using more information in the aggregate than is used by any individual, and from the reduction of individual analysts' forecasts error through diversification.</p> | <p>have provided interim earnings surprises. [The screen's design will discriminate between stocks with both rising and falling earnings expectations.]</p> <ul style="list-style-type: none"> • Should have high correlation with growth proxies as revision screens generally behave better in growth oriented environments. • Generates insight into behavioral aspects of estimates revisions as estimation precision increases with approaching fiscal year end. • Frequency of estimate revisions and magnitude of variation from mean estimates will increase in volatile macro environments. • Similar to the Consensus forecast earnings estimate revision ratio below but captures the magnitude of change in the revisions over the preceding period. • In some instances, IBES estimates are refer to a different class of share from the IFC constituent. In these cases, we have IBES data |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|----------------|--|---|
| <p>9 Consensus FY2 to FY1 estimate change</p> <p>Stocks with high changing medium term expectations should outperform through time.</p> <p><i>Top portfolio : High change in estimate</i></p> <p><i>Bottom portfolio : Low change in estimate</i></p> <p>Code : CH_FY2_FY1</p> | IBES estimates | <p>Consensus forecast earnings per share Fiscal Year 2 (FY2) / Consensus forecast earnings per share Fiscal Year 1 (FY1)-1)*100</p> <p>Consensus forecasts at date of observation.</p> | <ul style="list-style-type: none"> • Change in estimate captures the rate of change in earnings per share that is expected for the company into Fiscal Year 2. • Identifies stocks with changing medium term earnings expectations. |
| <p>10 Consensus forecast earnings estimate</p> | IBES estimates | <p>((Sum of trailing 3 months upward FY1 estimate revisions) - (Sum</p> | <ul style="list-style-type: none"> • Good proxy for isolating pre-earnings momentum stocks and stocks with changing |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-------------|--|--|
| <p>revision ratio</p> <p>Stocks exhibiting high earnings revisions and rising expectations should outperform through time.</p> <p><i>Top portfolio :</i> <i>High revision ratio</i></p> <p><i>Bottom portfolio :</i> <i>Low revision ratio</i></p> <p>Code : IREV_3M</p> | | <p>trailing 3 months downward FY1 estimate revisions) / (Total trailing 3 months FY1 estimates)</p> <p>The ratio of the number of net upward or downward current EPS estimates for fiscal year one over the preceding three months to the total number of estimates made over the same period.</p> | <p>earnings expectations.</p> <ul style="list-style-type: none"> • Similar to Change in Consensus FY1 estimate - 3 and 6 months factors above but may also measure the degree of sentiment. • Ratio also effective in isolating changing expectations of companies which suffer relative neglect by the investment research community. • The ranked universe can be split using a portfolio midpoint to isolate homogenous groups of upward, downward and zero revisions. |
| <p>11 Book to price ratio</p> <p>High book to price ratio stocks should out-perform through time.</p> | IFC | <p>(Historical book value per share/closing monthly market price)*100</p> <p>Note : Historical book value per share - most recent annual book value as reported on balance sheet at the</p> | <ul style="list-style-type: none"> • Traditional 'value'/'growth' proxy. • Conventional wisdom suggests that the book-to-price ratio is one of the most straightforward and effective investment factors in the emerging markets. • Developed market studies show high correlation between size and book value, |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|---|--|
| <p><i>Top portfolio :</i> <i>High book to price ratio</i></p> <p><i>Bottom portfolio :</i> <i>Low book to price ratio</i></p> <p>Code : BPR</p> | | <p>latest fiscal year end (with interim figures used if available). This will be adjusted between balance sheet report dates by the amount of capital raised by rights issues, and in the case of hyper inflationary economies, by intervening inflation adjustments.</p> | <p>though small capitalization stocks will tend to be small cap 'value' stocks with relatively high levels of distress.</p> <ul style="list-style-type: none"> Technically insolvent companies are included in bottom portfolios with high premium stocks, though the relative performance of this group may be investigated by exclusion through time. Without some form of relative attribution adjustment sectoral influences could appear in ranks through time. |
| <p>12 Cash earnings to price yield</p> <p>High cash earnings to price yield stocks should outperform through time.</p> <p><i>Top portfolio :</i> <i>High cash earnings to price yield</i></p> | IFC | <p>(Cash earnings per share / closing market price)*100</p> <p>Note 1: Cash earnings per share -last 12 months trailing earnings per share plus depreciation as reported in the Cash Flow Statement divided by the total number of shares outstanding.</p> | <ul style="list-style-type: none"> Traditional 'value' proxy which facilitates cross sectional comparisons by removing the effect of depreciation policies on earnings. Not a true cash flow per share factor though should provide some information regarding a company's ability to leverage itself, to pay dividends and to enjoy financial flexibility. Obvious shortcomings in availability and "quality" of data and noise inherent in reduced samples of firms [companies that do not report depreciation figures are excluded from the factor sort]. There is potential |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-------------|---|---|
| <p><i>Bottom portfolio : Low cash earnings to price yield</i></p> <p>Code : CEY</p> | IFC | <p>a) One month USD price change b) Last 52 week USD price change</p> | <p>information in investigating stocks collected in bottom portfolio and premiums paid for higher quality cash earnings.</p> <ul style="list-style-type: none"> • Inverting the traditional price-to-cash earnings ratio will result in the collection of deficit cash flow stocks in the bottom ranked portfolio, though the relative performance of this group may be investigated by exclusion through time. |
| <p>13 a) One month price momentum b) One year price momentum</p> <p>A firm's past return helps to predict future returns, and past momentum stocks should continue to outperform.</p> | | | <ul style="list-style-type: none"> • Momentum or relative strength portfolios are formed by ranking stocks on past one and twelve month returns. • As shown in other research for developed markets, momentum returns accrue gradually over a period of up to one year after ranking. • Strategy has higher implied portfolio turnover. • Previous research has introduced a one month lag in portfolio formation after observation date to compensate for bid-ask bounce. We check the sensitivity of our results by excluding the first lagged month in the one-year momentum screen. |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|---------------------------|--|---|
| <p><i>Top portfolio :</i> <i>High momentum</i></p> <p><i>Bottom portfolio :</i> <i>Low momentum</i></p> <p>Code : PM_12M, PM_1M</p> | <p>IBES Estimates</p> | <p>((Rolling 12 month consensus forecast earnings per share - historical trailing earnings per share) / absolute¹⁴(historical trailing earnings per share))*100</p> <p>The rate of change in earnings per share that is expected for the stock over the specified period, expressed as a percentage.</p> <p>Note 1: Rolling 12 month forward IBES estimates calculated as follows :</p> | <ul style="list-style-type: none"> • Collection of extreme rankings in outlier portfolios of one month momentum strategies may pre-empt a degree of reversal. • Momentum effects more evident with longer horizon (52 week) price changes. |
| <p>14 12 months prospective earnings growth rate</p> <p>Stocks with highest expected short to medium term growth rates should outperform through time.</p> <p><i>Top portfolio :</i> <i>High prospective growth</i></p> | | <p>((Rolling 12 month consensus forecast earnings per share - historical trailing earnings per share) / absolute¹⁴(historical trailing earnings per share))*100</p> <p>The rate of change in earnings per share that is expected for the stock over the specified period, expressed as a percentage.</p> <p>Note 1: Rolling 12 month forward IBES estimates calculated as follows :</p> | <ul style="list-style-type: none"> • Traditional short to medium term growth proxy that discriminates on differential earnings expectations. • Trends over short term period may be dominated by the business cycle, or in some cases the industry cycle. • The use of rolling 12-month forward estimates reduces the inherent redundancy that accrues as fiscal year end is approached. • Stocks with the highest expected earnings could have the greatest propensity to disappoint or torpedo, as surprises are more likely on the down side. • When the IBES database had missing financial ratios, we elected to use the IFC data |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|---|------------------------------|
| <p><i>Bottom portfolio :</i> <i>Low prospective growth</i></p> <p>Code : PEGR_1Y</p> | | $((M1 * F1) + ((12 - M1) * F2)) / 12$ <p>Where :</p> <p>M1 = number of month ends to end of current fiscal year. Note that the current fiscal year will be FY1 if the date is before the FY1 year end, and FY2 if the date is after year end</p> <p>F1 = Consensus EPS forecast for current fiscal year</p> <p>F2 = Consensus EPS forecast for next fiscal year</p> | to fill in the missing data. |
| | | <p>Rolling 24 month data will be constructed on the same principle as above but will access FY3 estimates to preserve the two year forward window.</p> | |
| | | <p>Note 2 : See factor 5 for explanation on use of absolute numbers</p> | |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-----------------------|--|--|
| <p>15 Three year prospective earnings growth rate</p> <p>Stocks with highest expected medium to longer term growth rates should outperform through time.</p> <p><i>Top portfolio : High prospective growth</i></p> <p><i>Bottom portfolio : Low prospective growth</i></p> <p>Code : PEGR_3Y</p> | <p>IBES Estimates</p> | <p>The expected rate of change in Consensus forecast earnings per share over a three year time horizon.</p> <p>A composite forecast of the anticipated annual growth rate in earnings per share over the longer term.</p> <p>Note 1 : See factor 6 for definitions of rate function</p> <p>Note 2: Due to the fact that certain markets have infrequent fiscal year three estimates, the best expectation of longer term growth in those markets will be constructed using FY2 data.</p> | <ul style="list-style-type: none"> • Growth rate provides a more robust view of a stock's longer term earnings expectations. • Longer forecasts are often used to justify the high multipliers of earnings some-times commanded by growth stocks. • Provides insight into extrapolation of past growth trends. • Higher premia paid for 'growth' stocks built on the rationale that a dollar of retained earnings in a firm with greater opportunities to invest at higher rates, has a higher perceived investment value. • Three years forward is the maximum available time window, longer forecasts incrementally lose value in volatile markets. |
| <p>16 a) 12 month prospective earnings yield</p> | <p>IBES Estimates</p> | <p>a) (Rolling 12 month consensus forecast earnings per share / Closing market price)*100</p> | <ul style="list-style-type: none"> • Traditional 'value' proxy incorporating earnings expectations. • Stocks might have perceived 'value' due to |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|---|--|
| <p>b) 24 month prospective earnings yield</p> <p>Stocks with the greatest perceived expected 'value' should outperform through time.</p> <p><i>Top portfolio : High prospective yield</i></p> <p><i>Bottom portfolio : Low prospective yield</i></p> <p>Code : PEY_12M, PEY_24M</p> | | <p>b) (Rolling 24 month consensus forecast earnings per share / Closing market price)*100</p> | <p>the lag on estimate revisions after anticipatory price movements. However this should be a temporary phenomenon as analysts revise forecasts in response to price changes - further abated by the inclusion of estimate revision factors.</p> <ul style="list-style-type: none"> • Can provide powerful results if implemented with other 'growth' and 'quality' factors in bivariate screening models. • Inverting price to prospective earnings ratio will result in the collection of prospective loss making stocks in the bottom portfolio, though the relative performance of this group may be investigated by exclusion through time. |
| <p>17 Revenue growth</p> <p>Stocks with real perceived growth</p> | Worldscope | <p>((Current years Net Sales or Revenues/Previous years Net sales or Revenues)-1)*100</p> | <ul style="list-style-type: none"> • Revenue growth often used as a proxy for 'quality' and real short term 'growth'. • Does not provide any insight on profit margin performance though screen can be |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|--|-------------|--|---|
| <p>rates should outperform through time.</p> <p><i>Top portfolio : High growth</i></p> <p><i>Bottom portfolio : Low growth</i></p> <p>Code : RGR</p> | | <p>For industrial companies revenue represents gross sales and other operating revenues less discounts, returns and other allowances; banks, insurance and other financial companies revenues represent the total operating revenue of the company.</p> | <p>constructed with earnings factors in a bivariate sort to discriminate on 'quality' of growth.</p> <ul style="list-style-type: none"> • Reduced universe of companies with available data and vagaries in definition and recognition of revenue will impart some noise in results through time. • Lag incorporated on assimilation of data to ensure data item is available at the time of portfolio formation. |
| <p>18 Rate of re-investment</p> <p>Growth and emerging growth stocks with high internal growth rates should outperform through time.</p> <p><i>Top portfolio : High rate of re-investment</i></p> | <p>IFC</p> | <p>(Last 12 months trailing earnings per share - Last 12 months dividend per share) / (Last year book value per share)*100</p> <p>Note : See earnings yield, dividend yield and book to price ratio factors above for definitions on ratio constituents.</p> | <ul style="list-style-type: none"> • Rate of reinvestment used to discriminate 'growth' companies that provide higher rates of returns on invested capital but reinvest earnings to generate internal growth rather than returning capital to shareholders. • It is generally considered sound corporate policy, usually in the interest of shareholders, to retain an appreciable amount of an average years' earnings to, inter alia, strengthen liquidity, invest in infrastructure and product expansion, prepare for 'rainy days' and maintain dividend rate in low earning years. • If the firm has good prospects, we would |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-------------|--|--|
| <p><i>Bottom portfolio :</i> <i>Low rate of re-investment</i></p> <p>Code : RIR</p> | IFC | <p>(Last 12 months trailing Earnings per share / last year book value per share)*100</p> <p>Note : See earnings yield and book to price ratio factors above for definitions on ratio constituents.</p> | <ul style="list-style-type: none"> • expect a high reinvestment rate. • Usually has high correlation with other growth and “quality” proxies. |
| <p>19 Return on equity</p> <p>High ‘quality’ stocks should outperform poorer ‘quality’ through time.</p> <p><i>Top portfolio :</i> <i>High return on equity</i></p> <p><i>Bottom portfolio :</i> <i>Low return on equity</i></p> <p>Code : ROE</p> | IFC | <p>(Last 12 months trailing Earnings per share / last year book value per share)*100</p> <p>Note : See earnings yield and book to price ratio factors above for definitions on ratio constituents.</p> | <ul style="list-style-type: none"> • Return on equity fundamental in screening of companies providing returns on invested capital. • Good traditional ‘quality’ and risk proxy to investigate the performance differential between perceived ‘good’ and ‘bad’ stocks through time. • While nominal ROE does not provide significant insight into a stocks ability to create intrinsic value. It is thought to be a good and simple proxy for management quality and the ability of management to leverage rate of return on equity by incurring debt. • Return on equity will to a degree demonstrate the efficiency of the company’s management of assets, the ability to meet competitive challenges and implement a pricing strategy, |

| Factor, hypothesis and ranking strategy | Data source | Formula and definitions ⁶ | Interpretation |
|---|-------------|--------------------------------------|---|
| | | | <p>the ability to weather credit market conditions and to instill an overall financial policy and the ability to take advantage of fiscal incentives.</p> <ul style="list-style-type: none"> • Though there are perceived benefits in the use of advanced return and value ratios, data quality and history often preclude their effective implementation. • High ROE stocks are visible 'quality' stocks and some-times trade on high multiples. |

4. Results

4.1 Market settings in South Africa

While parallels between developments in both Latin American countries and Asian countries are visible, the characteristics of the South African market are relatively unique. The closed nature of the economy and markets prior to the transition from Apartheid make it difficult to draw inference from the closed period that would be appropriate for the open period. As a result, we have a very short sample for this country.

Even within this short period (since 1993), it covers a time of very rapid transformation. In January 1993, the new IFC index covered 62 companies and had a market capitalization of US\$66 billion. The index peaked at US\$120 billion in January 1996 but has subsequently fallen to US\$92 billion (end 1997) or 73% GDP.

The liberalization of the economy initially led to a surge in domestic demand, fuelled by easy monetary policy, however, by 1996 the inflationary impact became clear and the South Africa Reserve Bank moved quickly to tighten policy. Credit growth failed to respond quickly and with increasing pressure on the Rand, following the 1997 Asian crisis, interest rates have been forced to stay high, despite clear signs of economic deceleration. Falling international gold and other industrial commodity prices have further dampened market sentiment (mining stocks represented 20% of the IFCG index at end 1997).

Another unique characteristic of the economy and equity market is the mismatch between different sectors. The regulatory environment of the market and accounting practices of the majority of corporations are advanced relative to other emerging markets, however, the economy is very sensitive to changes in international commodity prices. There is also substantial political risk as the country struggles to deal with the years of Apartheid.

For an up-to-date detailed chronology of important, financial, economic and political events in South Africa, see

http://www.duke.edu/~charvey/Country_risk/chronology/chronology_index.htm

4.2. Screening results for South Africa

Due to the nature of the South African economy, with a large mining and commodity cyclical influence, the process of screening will be influenced by important exogenous factors such as the price of gold and other commodity prices. To assess the sensitivity to these exogenous influences, screens were re-run (but not reported) excluding metal mining firms.

During our sample, the South African index return averaged 18.86% per year. However, the index performance is significantly different in the in-sample and out-of-sample periods. The market returned an average 41% per year for the years 1993 through the end of 1995. Since the beginning of 1996, the average market return is -1.9% per year. Over the entire sample (63 observations) since January 1993, the market increased in 40 months

(63% of the time) and decreased in 23 months (37% of the time). During the out of sample period the market increased in 13 months and decreased in 15 months.

Factor screens

Exhibit 5A-V presents an example of the factor by factor Exhibit 24 summarizes these results. These exhibits only contain the value-weighted portfolio returns. Exhibit 6 summarizes these results. The average returns of the highest and lowest fractile portfolios are presented in Exhibit 7. Further, the percent of periods that the top and bottom fractile outperformed the benchmark is presented in Exhibit 8.

Some general observations are:

- The highest average annualized excess returns are earned from earnings yield and change in consensus FY1 estimate over the preceding three month strategies with excess returns over the benchmark of 8.0% and 7.85% respectively. The benchmark return is 18.86%.
- The greatest average annualized underperformance against the benchmark are obtained from bottom portfolio change in consensus FY1 estimate over the last three and six months with -12.93% and -8.71% respectively. Though these two factors do exhibit high correlations, the different horizons produce different behavior in various stages of a dichotomous market. Book to price ratio delivered marginally worse results with a -8.42% bottom portfolio average annual excess return.
- The greatest top minus bottom spread differential is produced by change in consensus FY1 estimate over the preceding three months and consensus forecast estimate revision ratio with 20.78% and 15.44% respectively.
- These two strategies are also the most successful in terms of benchmark outperformance, beating the benchmark in 61.90% (consensus revision ratio) and 60.32% (last three months estimate change). Earnings yield and rate of re-investment produced similar results to the latter. Although rate of re-investment outperformed consistently over the sample period the average annual excess returns over the benchmark was disappointing due mainly to poor performance in the large bull market of 1993. Exogenous factors such as the price of gold may confound these results. These factors were also the best performers in an up market.
- The best performers in a down market are market capitalization with outperformance in 73.91% of down markets, though the strategy was particularly hard hit in the last quarter of 1997. Return on equity, as expected performed well in down markets outperforming in almost 70% of observed down markets.
- 'Growth' and forecast earnings revision related factors have exhibited the greatest last two year performance where the value of \$100 increased to \$136.44 for companies exhibiting high revenue growth, and to \$132.11 for top portfolio consensus revision. During this period a passive investment in the benchmark rose in value to \$101.59.

EXHIBIT 5 A

Factor Performance for South Africa

Screen Name: Market Capitalization
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note ^a | Portfolios - value weighted | | | Market portfolio |
|---|-------------------|-----------------------------|---------|----------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 24.75 | 11.98 | 18.74 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 319.32 | 181.11 | 246.43 | 247.68 |
| STD Deviation of returns | 3 | 25.55 | 22.21 | 23.29 | 22.01 |
| Average annual excess return | Rm 4 | 5.89 | -6.88 | -0.11 | |
| | Rf 5 | 19.34 | 7.08 | 13.58 | |
| STD Deviation of excess rtns | Rm 6 | 13.97 | 9.17 | 3.59 | |
| | Rf 7 | 25.64 | 22.26 | 23.32 | |
| Systematic risk (Beta) | 9 | 0.97 | 0.92 | 1.05 | |
| Alpha | 10 | 5.41 | -4.68 | -0.90 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7026.16 |
| % periods > Benchmark | 13 | 57.14 | 41.27 | 52.38 | |
| % periods > Bench up Mkt | 14 | 47.50 | 32.50 | 65.00 | |
| % periods > Bench Dn Mkt | 15 | 73.91 | 56.52 | 30.43 | |
| Max # of consecutive benchmark outperformance | 16 | 6 | 3 | 6 | |
| Maximum positive excess return | 17 | 12.88 | 5.16 | 2.25 | |
| Maximum negative excess return | 18 | -10.95 | -6.11 | -2.52 | |
| % periods positive returns to negative | 19 | 142.31 | 125.00 | 162.50 | |
| % periods of negative returns | 20 | 41.27 | 44.44 | 38.10 | 36.51 |
| Max # consecutive negative periods | 21 | 7 | 8 | 6 | 6 |
| Max # consecutive positive periods | 22 | 10 | 9 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> | | | | | |
| 1993 | | 236.56 | 158.83 | 161.77 | 167.26 |
| 1994 | | 151.57 | 145.06 | 123.50 | 131.32 |
| 1995 | | 117.41 | 116.97 | 117.74 | 117.78 |
| <i>Out of sample</i> | | | | | |
| 1996 | | 86.19 | 73.07 | 85.76 | 82.94 |
| 1997 | | 68.94 | 74.55 | 92.12 | 88.51 |
| <i>Through March</i> | | | | | |
| 1998 | | 127.66 | 123.35 | 132.59 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 1 | 2 | |
| 1994 | | 3 | 2 | 1 | |
| 1995 | | 2 | 1 | 3 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 1 | 2 | 3 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.33 | 1.33 | 2.33 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 71.75 | 76.00 | 110.16 | 101.59 |
| Last five years | | 241.02 | 153.66 | 222.16 | 216.53 |
| Factor average | 26 | 2164.49 | 4417.00 | 14496.99 | 7026.16 |
| Factor median | 27 | 2075.81 | 4215.17 | 10516.48 | 4294.60 |
| Factor standard deviation | 28 | 963.34 | 1457.98 | 9939.80 | 1566.64 |

*All definitions in Exhibit 2

EXHIBIT 5 B

Factor Performance for South Africa

Screen Name: Change in return on equity
Sample period: 1 /93 - 3 /98
Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 18.53 | 16.48 | 20.93 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 244.15 | 222.73 | 271.19 | 247.68 |
| STD Deviation of returns | 3 | 21.82 | 24.59 | 23.02 | 22.01 |
| Average annual excess return | Rm 4 | -0.32 | -2.38 | 2.07 | |
| | Rf 5 | 13.37 | 11.40 | 15.67 | |
| STD Deviation of excess rtns | Rm 6 | 5.30 | 6.14 | 7.10 | |
| | Rf 7 | 21.87 | 24.64 | 23.06 | |
| Systematic risk (Beta) | 9 | 0.96 | 1.09 | 0.99 | |
| Alpha | 10 | 0.38 | -3.53 | 1.85 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7457.20 |
| % periods > Benchmark | 13 | 53.97 | 44.44 | 50.79 | |
| % periods > Bench up Mkt | 14 | 50.00 | 45.00 | 55.00 | |
| % periods > Bench Dn Mkt | 15 | 60.87 | 43.48 | 43.48 | |
| Max # of consecutive benchmark outperformance | 16 | 6 | 7 | 6 | |
| Maximum positive excess return | 17 | 3.16 | 6.15 | 6.31 | |
| Maximum negative excess return | 18 | -4.74 | -4.20 | -5.17 | |
| % periods positive returns to negative | 19 | 162.50 | 142.31 | 186.36 | |
| % periods of negative returns | 20 | 38.10 | 41.27 | 34.92 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 6 | 3 | 6 |
| Max # consecutive positive periods | 22 | 10 | 10 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 156.24 | 184.98 | 165.23 | 167.26 |
| 1994 | | 148.40 | 131.26 | 126.44 | 131.32 |
| 1995 | | 112.27 | 116.89 | 128.16 | 117.78 |
| <i>Out of sample</i> 1996 | | 82.97 | 81.56 | 80.66 | 82.94 |
| 1997 | | 89.29 | 79.05 | 94.34 | 88.51 |
| <i>Through March</i> 1998 | | 126.60 | 121.73 | 133.10 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 3 | 2 | |
| 1994 | | 3 | 2 | 1 | |
| 1995 | | 1 | 2 | 3 | |
| 1996 | | 3 | 2 | 1 | |
| 1997 | | 2 | 1 | 3 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.00 | 1.83 | 2.17 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 104.27 | 79.55 | 110.16 | 101.59 |
| Last five years | | 219.94 | 194.57 | 234.67 | 216.53 |
| Factor average | 26 | 15.53 | -0.47 | -8.75 | 1.99 |
| Factor median | 27 | 5.33 | -0.01 | -5.19 | -0.25 |
| Factor standard deviation | 28 | 60.78 | 2.87 | 15.42 | 24.33 |

*All definitions in Exhibit 2

EXHIBIT 5 C

Factor Performance for South Africa

Screen Name:

Debt to Common equity

Sample period:

1 /93 - 3 /98

Number of observations:

63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 16.18 | 19.08 | 14.72 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 219.78 | 250.14 | 205.62 | 247.68 |
| STD Deviation of returns | 3 | 22.79 | 25.78 | 26.54 | 22.01 |
| Average annual excess return | Rm 4 | -2.67 | 0.22 | -4.14 | |
| | Rf 5 | 11.12 | 13.90 | 9.71 | |
| STD Deviation of excess rtns | Rm 6 | 9.35 | 11.33 | 10.51 | |
| | Rf 7 | 22.82 | 25.84 | 26.59 | |
| Systematic risk (Beta) | 9 | 0.95 | 1.05 | 1.11 | |
| Alpha | 10 | -1.36 | -0.73 | -5.56 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7159.46 |
| % periods > Benchmark | 13 | 46.03 | 50.79 | 47.62 | |
| % periods > Bench up Mkt | 14 | 45.00 | 50.00 | 57.50 | |
| % periods > Bench Dn Mkt | 15 | 47.83 | 52.17 | 30.43 | |
| Max # of consecutive benchmark outperformance | 16 | 3 | 4 | 7 | |
| Maximum positive excess return | 17 | 5.05 | 9.24 | 7.39 | |
| Maximum negative excess return | 18 | -9.08 | -9.40 | -7.46 | |
| % periods positive returns to negative | 19 | 162.50 | 162.50 | 110.00 | |
| % periods of negative returns | 20 | 38.10 | 38.10 | 47.62 | 36.51 |
| Max # consecutive negative periods | 21 | 5 | 7 | 6 | 6 |
| Max # consecutive positive periods | 22 | 8 | 10 | 5 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 139.17 | 194.28 | 182.67 | 167.26 |
| 1994 | | 143.01 | 142.48 | 119.77 | 131.32 |
| 1995 | | 130.36 | 108.64 | 109.86 | 117.78 |
| <i>Out of sample</i> 1996 | | 75.98 | 88.99 | 89.24 | 82.94 |
| 1997 | | 87.34 | 85.45 | 70.91 | 88.51 |
| <i>Through March</i> 1998 | | 127.64 | 109.38 | 135.19 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 3 | 2 | |
| 1994 | | 3 | 2 | 1 | |
| 1995 | | 3 | 1 | 2 | |
| 1996 | | 1 | 2 | 3 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.17 | 1.83 | 2.00 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 96.54 | 84.35 | 82.51 | 101.59 |
| Last five years | | 226.82 | 209.17 | 159.37 | 216.53 |
| Factor average | 26 | 63.16 | 23.55 | 3.24 | 29.68 |
| Factor median | 27 | 55.50 | 22.84 | 2.72 | 22.07 |
| Factor standard deviation | 28 | 24.05 | 8.66 | 3.41 | 28.79 |

*All definitions in Exhibit 2

EXHIBIT 5 D

Factor Performance for South Africa

Screen Name: Dividend Yield
Sample period: 2 /93 - 3 /98
Number of observations: 62 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 18.42 | 20.73 | 16.29 | 18.32 |
| Cumulative return (indexed at 100 - start) | 2 | 239.49 | 264.73 | 218.13 | 238.53 |
| STD Deviation of returns | 3 | 27.34 | 22.40 | 24.90 | 22.17 |
| Average annual excess return | Rm 4 | 0.09 | 2.41 | -2.03 | |
| | Rf 5 | 13.24 | 15.46 | 11.20 | |
| STD Deviation of excess rtns | Rm 6 | 17.03 | 8.69 | 7.03 | |
| | Rf 7 | 27.42 | 22.43 | 24.95 | |
| Systematic risk (Beta) | 9 | 0.97 | 0.93 | 1.08 | |
| Alpha | 10 | 0.67 | 3.17 | -3.12 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7258.02 |
| % periods > Benchmark | 13 | 50.00 | 58.06 | 50.00 | |
| % periods > Bench up Mkt | 14 | 46.15 | 53.85 | 51.28 | |
| % periods > Bench Dn Mkt | 15 | 56.52 | 65.22 | 47.83 | |
| Max # of consecutive benchmark outperformance | 16 | 4 | 6 | 3 | |
| Maximum positive excess return | 17 | 24.22 | 7.98 | 5.64 | |
| Maximum negative excess return | 18 | -9.92 | -7.18 | -6.41 | |
| % periods positive returns to negative | 19 | 129.63 | 148.00 | 129.63 | |
| % periods of negative returns | 20 | 43.55 | 40.32 | 43.55 | 37.10 |
| Max # consecutive negative periods | 21 | 4 | 5 | 6 | 6 |
| Max # consecutive positive periods | 22 | 7 | 6 | 7 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 212.09 | 144.49 | 174.16 | 161.08 |
| 1994 | | 140.96 | 137.86 | 121.75 | 131.32 |
| 1995 | | 98.10 | 125.93 | 120.66 | 117.78 |
| <i>Out of sample</i> 1996 | | 87.70 | 87.71 | 76.17 | 82.94 |
| 1997 | | 71.54 | 95.12 | 85.44 | 88.51 |
| <i>Through March</i> 1998 | | 130.15 | 126.49 | 131.01 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 1 | 2 | |
| 1994 | | 3 | 2 | 1 | |
| 1995 | | 1 | 3 | 2 | |
| 1996 | | 2 | 3 | 1 | |
| 1997 | | 1 | 3 | 2 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.00 | 2.17 | 1.83 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 72.07 | 110.73 | 98.64 | 101.59 |
| Last five years | | 165.72 | 241.16 | 185.39 | 216.53 |
| Factor average | 26 | 5.40 | 2.39 | 1.42 | 3.04 |
| Factor median | 27 | 4.38 | 2.36 | 1.52 | 2.32 |
| Factor standard deviation | 28 | 3.39 | 0.54 | 0.49 | 2.40 |

*All definitions in Exhibit 2

EXHIBIT 5 E

Factor Performance for South Africa

Screen Name: **One year historical earnings momentum**
 Sample period: **1 /93 - 3 /98**
 Number of observations: **63 Monthly**

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 12.59 | 18.40 | 23.76 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 186.40 | 242.74 | 306.27 | 247.68 |
| STD Deviation of returns | 3 | 20.67 | 23.26 | 26.17 | 22.01 |
| Average annual excess return | Rm 4 | -6.26 | -0.45 | 4.91 | |
| | Rf 5 | 7.67 | 13.25 | 18.40 | |
| STD Deviation of excess rtns | Rm 6 | 6.08 | 8.41 | 9.46 | |
| | Rf 7 | 20.72 | 23.29 | 26.22 | |
| Systematic risk (Beta) | 9 | 0.90 | 0.99 | 1.11 | |
| Alpha | 10 | -3.79 | -0.14 | 2.12 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7264.25 |
| % periods > Benchmark | 13 | 42.86 | 49.21 | 55.56 | |
| % periods > Bench up Mkt | 14 | 37.50 | 47.50 | 62.50 | |
| % periods > Bench Dn Mkt | 15 | 52.17 | 52.17 | 43.48 | |
| Max # of consecutive benchmark outperformance | 16 | 9 | 6 | 4 | |
| Maximum positive excess return | 17 | 3.94 | 5.67 | 7.41 | |
| Maximum negative excess return | 18 | -6.35 | -5.95 | -5.20 | |
| % periods positive returns to negative | 19 | 125.00 | 133.33 | 152.00 | |
| % periods of negative returns | 20 | 44.44 | 42.86 | 39.68 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 6 | 5 | 6 |
| Max # consecutive positive periods | 22 | 10 | 6 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 155.14 | 150.93 | 182.05 | 167.26 |
| 1994 | | 128.77 | 141.27 | 138.83 | 131.32 |
| 1995 | | 108.36 | 127.09 | 117.97 | 117.78 |
| <i>Out of sample</i> 1996 | | 80.61 | 79.58 | 89.25 | 82.94 |
| 1997 | | 86.85 | 86.14 | 84.14 | 88.51 |
| <i>Through March</i> 1998 | | 122.99 | 130.67 | 136.81 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 2 | 1 | 3 | |
| 1994 | | 1 | 3 | 2 | |
| 1995 | | 1 | 3 | 2 | |
| 1996 | | 2 | 1 | 3 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 1 | 2 | 3 | |
| Average Relative Performance - | | 1.67 | 2.00 | 2.33 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 97.62 | 94.68 | 101.59 | 101.59 |
| Last five years | | 169.29 | 236.27 | 242.53 | 216.53 |
| Factor average | 26 | 74.52 | 13.36 | -13.38 | 24.23 |
| Factor median | 27 | 38.94 | 12.80 | -3.22 | 12.61 |
| Factor standard deviation | 28 | 118.58 | 10.76 | 24.30 | 64.83 |

*All definitions in Exhibit 2

EXHIBIT 5 F

Factor Performance for South Africa

Screen Name: Three year historical earnings growth rate
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|-------------|--------------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 13.12 | 19.40 | 19.22 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 191.06 | 253.62 | 251.62 | 247.68 |
| STD Deviation of returns | 3 | 21.60 | 22.06 | 25.90 | 22.01 |
| Average annual excess return | Rm | 4 | -5.73 | 0.54 | 0.36 |
| | Rf | 5 | 8.18 | 14.20 | 14.03 |
| STD Deviation of excess rtns | Rm | 6 | 7.91 | 6.74 | 8.97 |
| | Rf | 7 | 21.62 | 22.09 | 25.97 |
| Systematic risk (Beta) | 9 | 0.92 | 0.96 | 1.11 | |
| Alpha | 10 | -3.56 | 1.24 | -1.60 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7341.63 |
| % periods > Benchmark | 13 | 50.79 | 49.21 | 53.97 | |
| % periods > Bench up Mkt | 14 | 42.50 | 42.50 | 57.50 | |
| % periods > Bench Dn Mkt | 15 | 65.22 | 60.87 | 47.83 | |
| Max # of consecutive benchmark outperformance | 16 | 8 | 7 | 6 | |
| Maximum positive excess return | 17 | 4.65 | 6.16 | 8.54 | |
| Maximum negative excess return | 18 | -7.22 | -6.72 | -4.79 | |
| % periods positive returns to negative | 19 | 133.33 | 152.00 | 133.33 | |
| % periods of negative returns | 20 | 42.86 | 39.68 | 42.86 | 36.51 |
| Max # consecutive negative periods | 21 | 5 | 6 | 10 | 6 |
| Max # consecutive positive periods | 22 | 6 | 10 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> | | | | | |
| 1993 | | 139.77 | 162.68 | 195.85 | 167.26 |
| 1994 | | 126.36 | 125.47 | 145.75 | 131.32 |
| 1995 | | 112.10 | 126.94 | 115.89 | 117.78 |
| <i>Out of sample</i> | | | | | |
| 1996 | | 78.66 | 85.38 | 82.18 | 82.94 |
| 1997 | | 91.89 | 90.04 | 72.48 | 88.51 |
| <i>Through March</i> | | | | | |
| 1998 | | 133.51 | 127.32 | 127.70 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 2 | 3 | |
| 1994 | | 2 | 1 | 3 | |
| 1995 | | 1 | 3 | 2 | |
| 1996 | | 1 | 3 | 2 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 1.83 | 2.00 | 2.17 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 108.46 | 102.97 | 78.20 | 101.59 |
| Last five years | | 186.62 | 225.16 | 193.19 | 216.53 |
| Factor average | 26 | 31.26 | 11.19 | -7.45 | 11.49 |
| Factor median | 27 | 23.80 | 11.18 | -3.34 | 11.07 |
| <u>Factor standard deviation</u> | 28 | <u>27.48</u> | <u>6.12</u> | <u>13.89</u> | <u>22.39</u> |

*All definitions in Exhibit 2

EXHIBIT 5 G

Factor Performance for South Africa

Screen Name: Earnings yield
Sample period: 1 /93 - 3 /98
Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 26.86 | 12.51 | 12.00 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 348.72 | 185.69 | 181.33 | 247.68 |
| STD Deviation of returns | 3 | 25.82 | 21.92 | 23.49 | 22.01 |
| Average annual excess return | Rm 4 | 8.00 | -6.35 | -6.85 | |
| | Rf 5 | 21.37 | 7.59 | 7.11 | |
| STD Deviation of excess rtns | Rm 6 | 10.94 | 6.98 | 9.06 | |
| | Rf 7 | 25.87 | 21.95 | 23.54 | |
| Systematic risk (Beta) | 9 | 1.06 | 0.95 | 0.98 | |
| Alpha | 10 | 5.51 | -4.61 | -5.75 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7208.17 |
| % periods > Benchmark | 13 | 60.32 | 41.27 | 49.21 | |
| % periods > Bench up Mkt | 14 | 62.50 | 40.00 | 45.00 | |
| % periods > Bench Dn Mkt | 15 | 56.52 | 43.48 | 56.52 | |
| Max # of consecutive benchmark outperformance | 16 | 7 | 3 | 6 | |
| Maximum positive excess return | 17 | 13.78 | 3.72 | 7.25 | |
| Maximum negative excess return | 18 | -12.42 | -6.18 | -5.44 | |
| % periods positive returns to negative | 19 | 186.36 | 162.50 | 125.00 | |
| % periods of negative returns | 20 | 34.92 | 38.10 | 44.44 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 6 | 6 | 6 |
| Max # consecutive positive periods | 22 | 10 | 8 | 10 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 190.38 | 140.40 | 162.12 | 167.26 |
| 1994 | | 145.06 | 130.86 | 120.84 | 131.32 |
| 1995 | | 120.35 | 119.35 | 113.30 | 117.78 |
| <i>Out of sample</i> 1996 | | 98.24 | 72.20 | 73.44 | 82.94 |
| 1997 | | 81.29 | 91.68 | 84.07 | 88.51 |
| <i>Through March</i> 1998 | | 131.39 | 127.93 | 132.31 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 1 | 2 | |
| 1994 | | 3 | 2 | 1 | |
| 1995 | | 3 | 2 | 1 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 1 | 3 | 2 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.50 | 1.67 | 1.83 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 100.96 | 100.00 | 90.02 | 101.59 |
| Last five years | | 285.25 | 173.49 | 167.41 | 216.53 |
| Factor average | 26 | 9.77 | 5.73 | 3.24 | 6.22 |
| Factor median | 27 | 8.66 | 5.59 | 3.51 | 5.53 |
| Factor standard deviation | 28 | 4.51 | 1.24 | 1.93 | 3.67 |

*All definitions in Exhibit 2

EXHIBIT 5 H

Factor Performance for South Africa

Screen Name: Change in Consensus FY1 estimate - Last 3 months
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 26.71 | 17.74 | 5.93 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 346.50 | 235.72 | 135.31 | 247.68 |
| STD Deviation of returns | 3 | 24.25 | 23.67 | 23.73 | 22.01 |
| Average annual excess return | Rm 4 | 7.85 | -1.11 | -12.93 | |
| | Rf 5 | 21.22 | 12.62 | 1.28 | |
| STD Deviation of excess rtns | Rm 6 | 8.24 | 8.35 | 11.60 | |
| | Rf 7 | 24.30 | 23.71 | 23.78 | |
| Systematic risk (Beta) | 9 | 1.04 | 1.01 | 0.94 | |
| Alpha | 10 | 5.87 | -1.07 | -10.62 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7308.74 |
| % periods > Benchmark | 13 | 60.32 | 49.21 | 34.92 | |
| % periods > Bench up Mkt | 14 | 62.50 | 47.50 | 32.50 | |
| % periods > Bench Dn Mkt | 15 | 56.52 | 52.17 | 39.13 | |
| Max # of consecutive benchmark outperformance | 16 | 9 | 5 | 3 | |
| Maximum positive excess return | 17 | 6.89 | 9.42 | 9.06 | |
| Maximum negative excess return | 18 | -8.29 | -6.63 | -12.36 | |
| % periods positive returns to negative | 19 | 186.36 | 133.33 | 103.23 | |
| % periods of negative returns | 20 | 34.92 | 42.86 | 49.21 | 36.51 |
| Max # consecutive negative periods | 21 | 4 | 7 | 10 | 6 |
| Max # consecutive positive periods | 22 | 10 | 8 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 187.00 | 155.13 | 148.48 | 167.26 |
| 1994 | | 130.06 | 141.69 | 131.26 | 131.32 |
| 1995 | | 119.02 | 134.16 | 100.72 | 117.78 |
| <i>Out of sample</i> 1996 | | 90.22 | 75.29 | 78.26 | 82.94 |
| 1997 | | 101.25 | 80.88 | 69.65 | 88.51 |
| <i>Through March</i> 1998 | | 131.05 | 131.26 | 126.44 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 2 | 1 | |
| 1994 | | 1 | 3 | 2 | |
| 1995 | | 2 | 3 | 1 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 2 | 3 | 1 | |
| Average Relative Performance - | | 2.33 | 2.33 | 1.33 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 125.72 | 91.74 | 67.11 | 101.59 |
| Last five years | | 292.39 | 225.20 | 116.28 | 216.53 |
| Factor average | 26 | 7.39 | -1.13 | -14.24 | -2.39 |
| Factor median | 27 | 3.40 | -0.74 | -8.73 | -0.64 |
| Factor standard deviation | 28 | 24.13 | 2.01 | 29.96 | 16.95 |

*All definitions in Exhibit 2

EXHIBIT 5 I

Factor Performance for South Africa

Screen Name:

Change in Consensus FY1 estimate - Last 6 months

Sample period:

1 /93 - 3 /98

Number of observations:

63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 23.70 | 17.14 | 10.14 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 305.49 | 229.43 | 166.02 | 247.68 |
| STD Deviation of returns | 3 | 25.14 | 23.44 | 23.98 | 22.01 |
| Average annual excess return | Rm 4 | 4.85 | -1.72 | -8.72 | |
| | Rf 5 | 18.34 | 12.03 | 5.32 | |
| STD Deviation of excess rtns | Rm 6 | 8.40 | 9.05 | 11.39 | |
| | Rf 7 | 25.18 | 23.48 | 24.03 | |
| Systematic risk (Beta) | 9 | 1.08 | 0.98 | 0.96 | |
| Alpha | 10 | 2.68 | -1.17 | -7.01 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7341.69 |
| % periods > Benchmark | 13 | 50.79 | 50.79 | 42.86 | |
| % periods > Bench up Mkt | 14 | 52.50 | 55.00 | 35.00 | |
| % periods > Bench Dn Mkt | 15 | 47.83 | 43.48 | 56.52 | |
| Max # of consecutive benchmark outperformance | 16 | 5 | 6 | 5 | |
| Maximum positive excess return | 17 | 9.97 | 8.25 | 10.19 | |
| Maximum negative excess return | 18 | -7.09 | -8.70 | -9.54 | |
| % periods positive returns to negative | 19 | 186.36 | 162.50 | 85.29 | |
| % periods of negative returns | 20 | 34.92 | 38.10 | 53.97 | 36.51 |
| Max # consecutive negative periods | 21 | 4 | 4 | 6 | 6 |
| Max # consecutive positive periods | 22 | 8 | 7 | 6 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 175.72 | 160.86 | 152.31 | 167.26 |
| 1994 | | 131.69 | 139.86 | 135.86 | 131.32 |
| 1995 | | 113.68 | 126.41 | 117.16 | 117.78 |
| <i>Out of sample</i> 1996 | | 87.45 | 75.66 | 83.04 | 82.94 |
| 1997 | | 97.09 | 85.05 | 67.69 | 88.51 |
| <i>Through March</i> 1998 | | 136.76 | 125.37 | 121.82 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 2 | 1 | |
| 1994 | | 1 | 3 | 2 | |
| 1995 | | 1 | 3 | 2 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 2 | 1 | |
| Average Relative Performance - | | 2.33 | 2.17 | 1.50 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 122.81 | 91.94 | 66.33 | 101.59 |
| Last five years | | 274.00 | 211.00 | 138.26 | 216.53 |
| Factor average | 26 | 10.20 | -2.73 | -22.60 | -4.74 |
| Factor median | 27 | 6.12 | -2.19 | -15.25 | -2.21 |
| Factor standard deviation | 28 | 22.39 | 4.39 | 34.95 | 21.62 |

*All definitions in Exhibit 2

EXHIBIT 5 J

Factor Performance for South Africa

Screen Name: Consensus FY2 to FY1 estimate change
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 20.59 | 14.45 | 19.47 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 267.22 | 203.13 | 254.41 | 247.68 |
| STD Deviation of returns | 3 | 22.38 | 22.75 | 26.03 | 22.01 |
| Average annual excess return | Rm | 1.73 | -4.41 | 0.61 | |
| | Rf | 15.35 | 9.46 | 14.27 | |
| STD Deviation of excess rtns | Rm | 8.40 | 8.06 | 9.35 | |
| | Rf | 22.42 | 22.78 | 26.07 | |
| Systematic risk (Beta) | 9 | 0.94 | 0.97 | 1.11 | |
| Alpha | 10 | 2.44 | -3.25 | -1.37 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7345.30 |
| % periods > Benchmark | 13 | 50.79 | 42.86 | 53.97 | |
| % periods > Bench up Mkt | 14 | 42.50 | 40.00 | 62.50 | |
| % periods > Bench Dn Mkt | 15 | 65.22 | 47.83 | 39.13 | |
| Max # of consecutive benchmark outperformance | 16 | 6 | 3 | 4 | |
| Maximum positive excess return | 17 | 8.64 | 4.30 | 11.16 | |
| Maximum negative excess return | 18 | -6.11 | -7.18 | -10.55 | |
| % periods positive returns to negative | 19 | 162.50 | 186.36 | 152.00 | |
| % periods of negative returns | 20 | 38.10 | 34.92 | 39.68 | 36.51 |
| Max # consecutive negative periods | 21 | 4 | 5 | 6 | 6 |
| Max # consecutive positive periods | 22 | 8 | 12 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> | | | | | |
| 1993 | | 151.16 | 155.90 | 181.26 | 167.26 |
| 1994 | | 162.30 | 113.55 | 134.98 | 131.32 |
| 1995 | | 105.63 | 129.05 | 117.09 | 117.78 |
| <i>Out of sample</i> | | | | | |
| 1996 | | 82.77 | 79.39 | 89.35 | 82.94 |
| 1997 | | 92.64 | 90.14 | 75.99 | 88.51 |
| <i>Through March</i> 1998 | | 134.48 | 124.25 | 130.79 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 2 | 3 | |
| 1994 | | 3 | 1 | 2 | |
| 1995 | | 1 | 3 | 2 | |
| 1996 | | 2 | 1 | 3 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.17 | 1.67 | 2.17 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 109.44 | 102.44 | 86.47 | 101.59 |
| Last five years | | 246.48 | 182.72 | 217.78 | 216.53 |
| Factor average | 26 | 42.22 | 20.65 | 10.92 | 24.44 |
| Factor median | 27 | 28.86 | 20.59 | 14.29 | 20.58 |
| Factor standard deviation | 28 | 141.88 | 2.46 | 14.50 | 29.47 |

*All definitions in Exhibit 2

EXHIBIT 5 K

Factor Performance for South Africa

Screen Name: Consensus forecast earnings estimate revision ratio
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 26.69 | 16.33 | 11.25 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 346.28 | 221.26 | 175.05 | 247.68 |
| STD Deviation of returns | 3 | 23.51 | 23.07 | 23.50 | 22.01 |
| Average annual excess return | Rm 4 | 7.83 | -2.53 | -7.60 | |
| | Rf 5 | 21.21 | 11.26 | 6.39 | |
| STD Deviation of excess rtns | Rm 6 | 6.85 | 5.91 | 10.58 | |
| | Rf 7 | 23.56 | 23.12 | 23.54 | |
| Systematic risk (Beta) | 9 | 1.02 | 1.01 | 0.95 | |
| Alpha | 10 | 6.11 | -2.40 | -5.90 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7285.03 |
| % periods > Benchmark | 13 | 61.90 | 42.86 | 38.10 | |
| % periods > Bench up Mkt | 14 | 62.50 | 45.00 | 30.00 | |
| % periods > Bench Dn Mkt | 15 | 60.87 | 39.13 | 52.17 | |
| Max # of consecutive benchmark outperformance | 16 | 6 | 6 | 6 | |
| Maximum positive excess return | 17 | 7.00 | 4.06 | 10.38 | |
| Maximum negative excess return | 18 | -4.02 | -5.59 | -9.80 | |
| % periods positive returns to negative | 19 | 173.91 | 142.31 | 142.31 | |
| % periods of negative returns | 20 | 36.51 | 41.27 | 41.27 | 36.51 |
| Max # consecutive negative periods | 21 | 4 | 6 | 5 | 6 |
| Max # consecutive positive periods | 22 | 8 | 8 | 7 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 184.59 | 162.22 | 147.20 | 167.26 |
| 1994 | | 126.00 | 142.95 | 134.17 | 131.32 |
| 1995 | | 119.31 | 126.54 | 110.27 | 117.78 |
| <i>Out of sample</i> 1996 | | 89.64 | 77.73 | 82.26 | 82.94 |
| 1997 | | 99.10 | 83.46 | 77.40 | 88.51 |
| <i>Through March</i> 1998 | | 140.48 | 116.24 | 126.23 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 2 | 1 | |
| 1994 | | 1 | 3 | 2 | |
| 1995 | | 2 | 3 | 1 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.50 | 2.00 | 1.50 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 132.11 | 85.08 | 78.72 | 101.59 |
| Last five years | | 302.57 | 198.16 | 154.14 | 216.53 |
| Factor average | 26 | 0.14 | -0.03 | -0.21 | -0.03 |
| Factor median | 27 | 0.13 | 0.00 | -0.20 | 0.00 |
| Factor standard deviation | 28 | 0.12 | 0.07 | 0.10 | 0.00 |

*All definitions in Exhibit 2

EXHIBIT 5 L

Factor Performance for South Africa

Screen Name: Book to price yield
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note ^a | Portfolios - value weighted | | | Market portfolio |
|---|-------------------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 17.76 | 19.54 | 10.44 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 235.90 | 255.22 | 168.44 | 247.68 |
| STD Deviation of returns | 3 | 26.07 | 23.41 | 21.88 | 22.01 |
| Average annual excess return | Rm 4 | -1.10 | 0.68 | -8.42 | |
| | Rf 5 | 12.63 | 14.34 | 5.61 | |
| STD Deviation of excess rtns | Rm 6 | 11.89 | 5.84 | 8.17 | |
| | Rf 7 | 26.13 | 23.45 | 21.91 | |
| Systematic risk (Beta) | 9 | 1.06 | 1.03 | 0.93 | |
| Alpha | 10 | -1.91 | 0.05 | -6.12 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7208.50 |
| % periods > Benchmark | 13 | 49.21 | 55.56 | 42.86 | |
| % periods > Bench up Mkt | 14 | 45.00 | 57.50 | 37.50 | |
| % periods > Bench Dn Mkt | 15 | 56.52 | 52.17 | 52.17 | |
| Max # of consecutive benchmark outperformance | 16 | 5 | 6 | 4 | |
| Maximum positive excess return | 17 | 11.83 | 3.60 | 4.76 | |
| Maximum negative excess return | 18 | -11.52 | -6.12 | -6.67 | |
| % periods positive returns to negative | 19 | 152.00 | 162.50 | 117.24 | |
| % periods of negative returns | 20 | 39.68 | 38.10 | 46.03 | 36.51 |
| Max # consecutive negative periods | 21 | 5 | 6 | 6 | 6 |
| Max # consecutive positive periods | 22 | 8 | 8 | 5 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 188.54 | 162.33 | 143.60 | 167.26 |
| 1994 | | 143.53 | 127.53 | 124.39 | 131.32 |
| 1995 | | 112.42 | 127.35 | 112.06 | 117.78 |
| <i>Out of sample</i> 1996 | | 88.31 | 83.74 | 71.70 | 82.94 |
| 1997 | | 67.60 | 93.30 | 89.29 | 88.51 |
| <i>Through March</i> 1998 | | 129.89 | 123.91 | 131.44 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 2 | 1 | |
| 1994 | | 3 | 2 | 1 | |
| 1995 | | 2 | 3 | 1 | |
| 1996 | | 3 | 2 | 1 | |
| 1997 | | 1 | 3 | 2 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.33 | 2.17 | 1.50 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 72.86 | 108.30 | 96.97 | 101.59 |
| Last five years | | 185.30 | 231.38 | 166.19 | 216.53 |
| Factor average | 26 | 105.04 | 37.87 | 18.92 | 53.66 |
| Factor median | 27 | 77.52 | 36.36 | 19.46 | 36.23 |
| Factor standard deviation | 28 | 99.31 | 9.11 | 6.82 | 59.44 |

*All definitions in Exhibit 2

EXHIBIT 5 M

Factor Performance for South Africa

Screen Name: Cash Earnings to price yield
Sample period: 1 /93 - 3 /98
Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 17.93 | 20.66 | 12.38 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 237.65 | 268.03 | 184.55 | 247.68 |
| STD Deviation of returns | 3 | 25.81 | 24.93 | 22.33 | 22.01 |
| Average annual excess return | Rm | -0.93 | 1.80 | -6.48 | |
| | Rf | 12.79 | 15.42 | 7.47 | |
| STD Deviation of excess rtns | Rm | 14.72 | 10.02 | 6.48 | |
| | Rf | 25.85 | 24.98 | 22.36 | |
| Systematic risk (Beta) | 9 | 0.96 | 1.04 | 0.97 | |
| Alpha | 10 | -0.17 | 0.87 | -5.17 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7861.98 |
| % periods > Benchmark | 13 | 50.79 | 53.97 | 38.10 | |
| % periods > Bench up Mkt | 14 | 52.50 | 60.00 | 35.00 | |
| % periods > Bench Dn Mkt | 15 | 47.83 | 43.48 | 43.48 | |
| Max # of consecutive benchmark outperformance | 16 | 7 | 6 | 6 | |
| Maximum positive excess return | 17 | 10.86 | 8.04 | 3.32 | |
| Maximum negative excess return | 18 | -12.22 | -8.53 | -4.94 | |
| % periods positive returns to negative | 19 | 162.50 | 142.31 | 117.24 | |
| % periods of negative returns | 20 | 38.10 | 41.27 | 46.03 | 36.51 |
| Max # consecutive negative periods | 21 | 7 | 8 | 6 | 6 |
| Max # consecutive positive periods | 22 | 9 | 8 | 4 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 154.87 | 182.56 | 144.29 | 167.26 |
| 1994 | | 174.93 | 125.13 | 125.10 | 131.32 |
| 1995 | | 126.22 | 128.44 | 108.66 | 117.78 |
| <hr/> | | | | | |
| <i>Out of sample</i> 1996 | | 80.83 | 86.88 | 79.58 | 82.94 |
| 1997 | | 68.97 | 87.49 | 95.26 | 88.51 |
| <i>Through March</i> 1998 | | 124.66 | 120.18 | 124.11 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 2 | 3 | 1 | |
| 1994 | | 3 | 2 | 1 | |
| 1995 | | 2 | 3 | 1 | |
| 1996 | | 2 | 3 | 1 | |
| 1997 | | 1 | 2 | 3 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.17 | 2.33 | 1.50 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 76.49 | 98.88 | 101.82 | 101.59 |
| Last five years | | 219.98 | 232.00 | 179.70 | 216.53 |
| Factor average | 26 | 14.68 | 8.34 | 5.41 | 9.41 |
| Factor median | 27 | 12.39 | 7.92 | 5.53 | 7.98 |
| <u>Factor standard deviation</u> | 28 | 7.66 | 1.99 | 1.67 | 5.05 |

*All definitions in Exhibit 2

EXHIBIT 5 N

Factor Performance for South Africa

Screen Name: One month price momentum
 Sample period: 2 /93 - 3 /98
 Number of observations: 62 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 16.61 | 17.23 | 19.99 | 18.32 |
| Cumulative return (indexed at 100 - start) | 2 | 221.25 | 227.37 | 256.42 | 238.53 |
| STD Deviation of returns | 3 | 25.10 | 22.77 | 23.31 | 22.17 |
| Average annual excess return | Rm 4 | -1.71 | -1.09 | 1.67 | |
| | Rf 5 | 11.51 | 12.10 | 14.75 | |
| STD Deviation of excess rtns | Rm 6 | 9.42 | 5.36 | 11.14 | |
| | Rf 7 | 25.15 | 22.80 | 23.35 | |
| Systematic risk (Beta) | 9 | 1.05 | 1.00 | 0.93 | |
| Alpha | 10 | -2.34 | -0.91 | 2.67 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7094.60 |
| % periods > Benchmark | 13 | 43.55 | 46.77 | 53.23 | |
| % periods > Bench up Mkt | 14 | 41.03 | 56.41 | 51.28 | |
| % periods > Bench Dn Mkt | 15 | 47.83 | 30.43 | 56.52 | |
| Max # of consecutive benchmark outperformance | 16 | 5 | 5 | 5 | |
| Maximum positive excess return | 17 | 7.69 | 4.41 | 6.21 | |
| Maximum negative excess return | 18 | -5.19 | -4.35 | -8.87 | |
| % periods positive returns to negative | 19 | 121.43 | 158.33 | 158.33 | |
| % periods of negative returns | 20 | 45.16 | 38.71 | 38.71 | 37.10 |
| Max # consecutive negative periods | 21 | 4 | 6 | 5 | 6 |
| Max # consecutive positive periods | 22 | 9 | 8 | 7 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 172.61 | 150.86 | 158.54 | 161.08 |
| 1994 | | 131.07 | 126.56 | 140.98 | 131.32 |
| 1995 | | 118.80 | 115.54 | 120.84 | 117.78 |
| <i>Out of sample</i> 1996 | | 80.23 | 83.10 | 91.24 | 82.94 |
| 1997 | | 79.62 | 93.33 | 82.86 | 88.51 |
| <i>Through March</i> 1998 | | 128.86 | 132.87 | 125.57 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 1 | 2 | |
| 1994 | | 2 | 1 | 3 | |
| 1995 | | 2 | 1 | 3 | |
| 1996 | | 1 | 2 | 3 | |
| 1997 | | 1 | 3 | 2 | |
| 1998 | | 2 | 3 | 1 | |
| Average Relative Performance - | | 1.83 | 1.83 | 2.33 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 86.24 | 106.07 | 103.27 | 101.59 |
| Last five years | | 174.62 | 215.51 | 251.29 | 216.53 |
| Factor average | 26 | 11.23 | 0.89 | -8.03 | 1.32 |
| Factor median | 27 | 9.70 | 0.73 | -7.13 | 0.62 |
| Factor standard deviation | 28 | 10.75 | 6.25 | 7.62 | 9.26 |

*All definitions in Exhibit 2

EXHIBIT 5 O

Factor Performance for South Africa

Screen Name: One year price momentum
Sample period: 1 /93 - 3 /98
Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 18.21 | 15.61 | 17.65 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 240.65 | 214.15 | 234.72 | 247.68 |
| STD Deviation of returns | 3 | 24.98 | 23.21 | 26.23 | 22.01 |
| Average annual excess return | Rm | -0.65 | -3.25 | -1.21 | |
| | Rf | 13.06 | 10.57 | 12.52 | |
| STD Deviation of excess rtns | Rm | 9.82 | 7.86 | 12.91 | |
| | Rf | 25.01 | 23.26 | 26.28 | |
| Systematic risk (Beta) | 9 | 1.04 | 0.99 | 1.04 | |
| Alpha | 10 | -1.33 | -2.68 | -1.70 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7223.75 |
| % periods > Benchmark | 13 | 46.03 | 33.33 | 58.73 | |
| % periods > Bench up Mkt | 14 | 45.00 | 27.50 | 57.50 | |
| % periods > Bench Dn Mkt | 15 | 47.83 | 43.48 | 60.87 | |
| Max # of consecutive benchmark outperformance | 16 | 4 | 3 | 9 | |
| Maximum positive excess return | 17 | 8.20 | 8.73 | 11.58 | |
| Maximum negative excess return | 18 | -6.94 | -9.00 | -12.89 | |
| % periods positive returns to negative | 19 | 152.00 | 152.00 | 152.00 | |
| % periods of negative returns | 20 | 39.68 | 39.68 | 39.68 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 5 | 5 | 6 |
| Max # consecutive positive periods | 22 | 8 | 8 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 149.88 | 173.20 | 167.81 | 167.26 |
| 1994 | | 132.53 | 120.36 | 151.05 | 131.32 |
| 1995 | | 129.04 | 111.30 | 112.09 | 117.78 |
| <i>Out of sample</i> 1996 | | 75.66 | 88.15 | 88.74 | 82.94 |
| 1997 | | 91.72 | 83.91 | 70.38 | 88.51 |
| <i>Through March</i> 1998 | | 135.29 | 124.78 | 132.27 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 3 | 2 | |
| 1994 | | 2 | 1 | 3 | |
| 1995 | | 3 | 1 | 2 | |
| 1996 | | 1 | 2 | 3 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.17 | 1.67 | 2.17 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 109.32 | 92.38 | 80.38 | 101.59 |
| Last five years | | 243.08 | 188.16 | 191.54 | 216.53 |
| Factor average | 26 | 62.05 | 9.60 | -21.50 | 16.39 |
| Factor median | 27 | 44.31 | 2.79 | -25.26 | 5.51 |
| Factor standard deviation | 28 | 104.12 | 27.69 | 24.64 | 50.95 |

*All definitions in Exhibit 2

EXHIBIT 5 P

Factor Performance for South Africa

Screen Name: 12 months prospective earnings growth rate
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 16.31 | 16.55 | 24.04 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 221.00 | 223.47 | 309.94 | 247.68 |
| STD Deviation of returns | 3 | 21.76 | 25.16 | 22.93 | 22.01 |
| Average annual excess return | Rm 4 | -2.55 | -2.31 | 5.19 | |
| | Rf 5 | 11.24 | 11.47 | 18.67 | |
| STD Deviation of excess rtns | Rm 6 | 6.95 | 7.56 | 10.02 | |
| | Rf 7 | 21.81 | 25.19 | 22.99 | |
| Systematic risk (Beta) | 9 | 0.94 | 1.09 | 0.94 | |
| Alpha | 10 | -1.14 | -3.62 | 5.40 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7325.54 |
| % periods > Benchmark | 13 | 42.86 | 49.21 | 50.79 | |
| % periods > Bench up Mkt | 14 | 42.50 | 52.50 | 42.50 | |
| % periods > Bench Dn Mkt | 15 | 43.48 | 43.48 | 65.22 | |
| Max # of consecutive benchmark outperformance | 16 | 4 | 6 | 7 | |
| Maximum positive excess return | 17 | 5.05 | 5.92 | 10.70 | |
| Maximum negative excess return | 18 | -5.57 | -7.29 | -8.00 | |
| % periods positive returns to negative | 19 | 162.50 | 152.00 | 133.33 | |
| % periods of negative returns | 20 | 38.10 | 39.68 | 42.86 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 6 | 4 | 6 |
| Max # consecutive positive periods | 22 | 5 | 7 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 144.78 | 158.33 | 184.78 | 167.26 |
| 1994 | | 147.67 | 127.08 | 138.99 | 131.32 |
| 1995 | | 102.34 | 124.36 | 127.84 | 117.78 |
| <i>Out of sample</i> 1996 | | 83.28 | 80.01 | 87.48 | 82.94 |
| 1997 | | 90.98 | 86.54 | 83.90 | 88.51 |
| <i>Through March</i> 1998 | | 133.32 | 128.99 | 128.62 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 2 | 3 | |
| 1994 | | 3 | 1 | 2 | |
| 1995 | | 1 | 2 | 3 | |
| 1996 | | 2 | 1 | 3 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 2 | 1 | |
| Average Relative Performance - | | 2.17 | 1.67 | 2.17 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 109.60 | 100.07 | 92.65 | 101.59 |
| Last five years | | 205.38 | 213.84 | 240.37 | 216.53 |
| Factor average | 26 | 172.05 | 35.16 | -4.04 | 66.68 |
| Factor median | 27 | 95.55 | 34.50 | 4.73 | 34.18 |
| Factor standard deviation | 28 | 222.11 | 13.07 | 48.54 | 142.40 |

*All definitions in Exhibit 2

EXHIBIT 5 Q

Factor Performance for South Africa

Screen Name:

Three year prospective earnings growth rate

Sample period:

1 /93 - 3 /98

Number of observations:

63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 16.57 | 17.12 | 20.38 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 223.64 | 229.24 | 264.76 | 247.68 |
| STD Deviation of returns | 3 | 21.69 | 22.80 | 25.43 | 22.01 |
| Average annual excess return | Rm 4 | -2.29 | -1.74 | 1.52 | |
| | Rf 5 | 11.49 | 12.02 | 15.14 | |
| STD Deviation of excess rtns | Rm 6 | 7.52 | 6.61 | 8.62 | |
| | Rf 7 | 21.74 | 22.83 | 25.48 | |
| Systematic risk (Beta) | 9 | 0.93 | 0.99 | 1.09 | |
| Alpha | 10 | -0.71 | -1.34 | -0.29 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7359.14 |
| % periods > Benchmark | 13 | 44.44 | 50.79 | 47.62 | |
| % periods > Bench up Mkt | 14 | 47.50 | 52.50 | 52.50 | |
| % periods > Bench Dn Mkt | 15 | 39.13 | 47.83 | 39.13 | |
| Max # of consecutive benchmark outperformance | 16 | 4 | 6 | 4 | |
| Maximum positive excess return | 17 | 6.66 | 3.80 | 8.98 | |
| Maximum negative excess return | 18 | -5.78 | -6.36 | -6.85 | |
| % periods positive returns to negative | 19 | 173.91 | 152.00 | 162.50 | |
| % periods of negative returns | 20 | 36.51 | 39.68 | 38.10 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 5 | 6 | 6 |
| Max # consecutive positive periods | 22 | 7 | 6 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 141.67 | 153.42 | 194.99 | 167.26 |
| 1994 | | 144.22 | 129.06 | 132.60 | 131.32 |
| 1995 | | 104.96 | 128.63 | 121.03 | 117.78 |
| <i>Out of sample</i> 1996 | | 80.72 | 81.63 | 85.61 | 82.94 |
| 1997 | | 94.98 | 88.19 | 75.65 | 88.51 |
| <i>Through March</i> 1998 | | 136.02 | 125.03 | 130.64 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 2 | 3 | |
| 1994 | | 3 | 1 | 2 | |
| 1995 | | 1 | 3 | 2 | |
| 1996 | | 1 | 2 | 3 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.00 | 1.83 | 2.17 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 112.92 | 97.46 | 88.95 | 101.59 |
| Last five years | | 213.31 | 219.44 | 206.46 | 216.53 |
| Factor average | 26 | 52.50 | 20.64 | 7.26 | 26.52 |
| Factor median | 27 | 38.14 | 20.71 | 10.87 | 20.48 |
| Factor standard deviation | 28 | 38.93 | 4.42 | 12.18 | 28.90 |

*All definitions in Exhibit 2

EXHIBIT 5 R

Factor Performance for South Africa

Screen Name: 24 month prospective earnings yield
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 23.07 | 14.63 | 15.36 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 297.41 | 204.82 | 211.72 | 247.68 |
| STD Deviation of returns | 3 | 24.24 | 23.64 | 23.62 | 22.01 |
| Average annual excess return | Rm 4 | 4.22 | -4.22 | -3.50 | |
| | Rf 5 | 17.73 | 9.63 | 10.33 | |
| STD Deviation of excess rtns | Rm 6 | 10.04 | 7.89 | 8.63 | |
| | Rf 7 | 24.28 | 23.68 | 23.67 | |
| Systematic risk (Beta) | 9 | 1.00 | 1.01 | 1.00 | |
| Alpha | 10 | 3.50 | -3.88 | -3.01 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7329.23 |
| % periods > Benchmark | 13 | 58.73 | 46.03 | 44.44 | |
| % periods > Bench up Mkt | 14 | 60.00 | 42.50 | 40.00 | |
| % periods > Bench Dn Mkt | 15 | 56.52 | 52.17 | 52.17 | |
| Max # of consecutive benchmark outperformance | 16 | 7 | 4 | 5 | |
| Maximum positive excess return | 17 | 11.79 | 4.79 | 8.22 | |
| Maximum negative excess return | 18 | -9.42 | -5.14 | -4.99 | |
| % periods positive returns to negative | 19 | 162.50 | 152.00 | 133.33 | |
| % periods of negative returns | 20 | 38.10 | 39.68 | 42.86 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 4 | 6 | 6 |
| Max # consecutive positive periods | 22 | 10 | 8 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 163.39 | 164.94 | 163.34 | 167.26 |
| 1994 | | 142.52 | 123.61 | 132.20 | 131.32 |
| 1995 | | 119.42 | 122.91 | 115.67 | 117.78 |
| <i>Out of sample</i> 1996 | | 99.13 | 71.45 | 73.24 | 82.94 |
| 1997 | | 81.38 | 93.21 | 86.14 | 88.51 |
| <i>Through March</i> 1998 | | 132.57 | 122.74 | 134.35 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 2 | 3 | 1 | |
| 1994 | | 3 | 1 | 2 | |
| 1995 | | 2 | 3 | 1 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 1 | 3 | 2 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.17 | 2.00 | 1.83 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 101.67 | 98.19 | 95.81 | 101.59 |
| Last five years | | 251.92 | 187.38 | 189.18 | 216.53 |
| Factor average | 26 | 12.89 | 8.32 | 5.62 | 8.91 |
| Factor median | 27 | 11.82 | 8.19 | 5.82 | 8.14 |
| Factor standard deviation | 28 | 4.51 | 1.43 | 1.69 | 3.66 |

*All definitions in Exhibit 2

EXHIBIT 5 S

Factor Performance for South Africa

Screen Name: 12 month prospective earnings yield
 Sample period: 1 /93 - 3 /98
 Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 20.73 | 19.18 | 13.01 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 268.81 | 251.20 | 190.06 | 247.68 |
| STD Deviation of returns | 3 | 24.25 | 24.05 | 24.11 | 22.01 |
| Average annual excess return | Rm 4 | 1.87 | 0.32 | -5.85 | |
| | Rf 5 | 15.48 | 13.99 | 8.07 | |
| STD Deviation of excess rtns | Rm 6 | 10.55 | 8.38 | 8.60 | |
| | Rf 7 | 24.29 | 24.09 | 24.15 | |
| Systematic risk (Beta) | 9 | 0.99 | 1.02 | 1.02 | |
| Alpha | 10 | 1.73 | -0.15 | -5.52 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7330.48 |
| % periods > Benchmark | 13 | 47.62 | 52.38 | 44.44 | |
| % periods > Bench up Mkt | 14 | 50.00 | 50.00 | 37.50 | |
| % periods > Bench Dn Mkt | 15 | 43.48 | 56.52 | 56.52 | |
| Max # of consecutive benchmark outperformance | 16 | 4 | 5 | 5 | |
| Maximum positive excess return | 17 | 11.89 | 5.32 | 7.15 | |
| Maximum negative excess return | 18 | -9.42 | -7.51 | -6.37 | |
| % periods positive returns to negative | 19 | 162.50 | 173.91 | 125.00 | |
| % periods of negative returns | 20 | 38.10 | 36.51 | 44.44 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 4 | 6 | 6 |
| Max # consecutive positive periods | 22 | 10 | 8 | 10 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 171.62 | 166.26 | 155.63 | 167.26 |
| 1994 | | 134.51 | 135.53 | 127.98 | 131.32 |
| 1995 | | 116.44 | 131.94 | 112.96 | 117.78 |
| <i>Out of sample</i> 1996 | | 97.63 | 70.69 | 74.25 | 82.94 |
| 1997 | | 78.70 | 98.13 | 84.39 | 88.51 |
| <i>Through March</i> 1998 | | 130.17 | 121.80 | 134.82 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 3 | 2 | 1 | |
| 1994 | | 2 | 3 | 1 | |
| 1995 | | 2 | 3 | 1 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 1 | 3 | 2 | |
| 1998 | | 2 | 1 | 3 | |
| Average Relative Performance - | | 2.17 | 2.17 | 1.67 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 94.86 | 106.08 | 92.94 | 101.59 |
| Last five years | | 226.57 | 228.21 | 171.94 | 216.53 |
| Factor average | 26 | 11.17 | 7.10 | 4.64 | 7.60 |
| Factor median | 27 | 10.25 | 7.03 | 4.88 | 6.94 |
| Factor standard deviation | 28 | 3.74 | 1.19 | 1.62 | 3.25 |

*All definitions in Exhibit 2

EXHIBIT 5 T

Factor Performance for South Africa

Screen Name: Revenue Growth
Sample period: 1 /93 - 3 /98
Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|-------------|--------------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 20.04 | 15.39 | 17.94 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 260.88 | 212.06 | 237.77 | 247.68 |
| STD Deviation of returns | 3 | 23.05 | 22.77 | 22.83 | 22.01 |
| Average annual excess return | Rm 4 | 1.18 | -3.46 | -0.92 | |
| | Rf 5 | 14.82 | 10.36 | 12.80 | |
| STD Deviation of excess rtns | Rm 6 | 8.86 | 8.73 | 9.20 | |
| | Rf 7 | 23.09 | 22.82 | 22.88 | |
| Systematic risk (Beta) | 9 | 0.97 | 0.96 | 0.95 | |
| Alpha | 10 | 1.57 | -2.24 | 0.07 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 6469.58 |
| % periods > Benchmark | 13 | 52.38 | 50.79 | 52.38 | |
| % periods > Bench up Mkt | 14 | 55.00 | 42.50 | 50.00 | |
| % periods > Bench Dn Mkt | 15 | 47.83 | 65.22 | 56.52 | |
| Max # of consecutive benchmark outperformance | 16 | 7 | 4 | 5 | |
| Maximum positive excess return | 17 | 6.25 | 5.22 | 5.23 | |
| Maximum negative excess return | 18 | -5.77 | -8.52 | -6.70 | |
| % periods positive returns to negative | 19 | 142.31 | 162.50 | 133.33 | |
| % periods of negative returns | 20 | 41.27 | 38.10 | 42.86 | 36.51 |
| Max # consecutive negative periods | 21 | 4 | 6 | 5 | 6 |
| Max # consecutive positive periods | 22 | 6 | 10 | 7 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 157.63 | 149.14 | 174.73 | 167.26 |
| 1994 | | 125.03 | 145.54 | 140.41 | 131.32 |
| 1995 | | 105.96 | 126.71 | 128.46 | 117.78 |
| <i>Out of sample</i> 1996 | | 81.60 | 79.28 | 80.31 | 82.94 |
| 1997 | | 111.98 | 81.41 | 75.69 | 88.51 |
| <i>Through March</i> 1998 | | 136.72 | 119.46 | 124.12 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 2 | 1 | 3 | |
| 1994 | | 1 | 3 | 2 | |
| 1995 | | 1 | 2 | 3 | |
| 1996 | | 3 | 1 | 2 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.17 | 1.67 | 2.17 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 136.44 | 88.28 | 77.09 | 101.59 |
| Last five years | | 247.32 | 197.04 | 190.65 | 216.53 |
| Factor average | 26 | 39.22 | 12.67 | -1.26 | 16.75 |
| Factor median | 27 | 25.86 | 13.30 | 1.76 | 12.80 |
| <u>Factor standard deviation</u> | 28 | <u>58.29</u> | <u>4.83</u> | <u>14.91</u> | <u>29.39</u> |

*All definitions in Exhibit 2

EXHIBIT 5 U

Factor Performance for South Africa

Screen Name: **Rate of re-investment**
 Sample period: **1 /93 - 3 /98**
 Number of observations: **63 Monthly**

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 18.35 | 21.11 | 13.84 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 242.13 | 273.35 | 197.53 | 247.68 |
| STD Deviation of returns | 3 | 21.55 | 24.42 | 23.61 | 22.01 |
| Average annual excess return | Rm 4 | -0.51 | 2.25 | -5.01 | |
| | Rf 5 | 13.19 | 15.85 | 8.87 | |
| STD Deviation of excess rtns | Rm 6 | 8.81 | 6.28 | 9.03 | |
| | Rf 7 | 21.57 | 24.47 | 23.67 | |
| Systematic risk (Beta) | 9 | 0.90 | 1.07 | 0.99 | |
| Alpha | 10 | 1.32 | 0.61 | -4.21 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7238.10 |
| % periods > Benchmark | 13 | 60.32 | 46.03 | 49.21 | |
| % periods > Bench up Mkt | 14 | 55.00 | 55.00 | 50.00 | |
| % periods > Bench Dn Mkt | 15 | 69.57 | 30.43 | 47.83 | |
| Max # of consecutive benchmark outperformance | 16 | 8 | 3 | 6 | |
| Maximum positive excess return | 17 | 7.07 | 6.11 | 3.59 | |
| Maximum negative excess return | 18 | -7.26 | -3.27 | -7.97 | |
| % periods positive returns to negative | 19 | 125.00 | 152.00 | 133.33 | |
| % periods of negative returns | 20 | 44.44 | 39.68 | 42.86 | 36.51 |
| Max # consecutive negative periods | 21 | 6 | 6 | 5 | 6 |
| Max # consecutive positive periods | 22 | 6 | 8 | 8 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 137.72 | 187.83 | 171.75 | 167.26 |
| 1994 | | 137.32 | 125.69 | 141.42 | 131.32 |
| 1995 | | 126.96 | 120.48 | 105.35 | 117.78 |
| <i>Out of sample</i> 1996 | | 81.66 | 83.18 | 82.64 | 82.94 |
| 1997 | | 95.47 | 90.00 | 73.92 | 88.51 |
| <i>Through March</i> 1998 | | 129.36 | 128.37 | 126.37 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 3 | 2 | |
| 1994 | | 2 | 1 | 3 | |
| 1995 | | 3 | 2 | 1 | |
| 1996 | | 1 | 3 | 2 | |
| 1997 | | 3 | 2 | 1 | |
| 1998 | | 3 | 2 | 1 | |
| Average Relative Performance - | | 2.17 | 2.17 | 1.67 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 118.54 | 100.20 | 74.17 | 101.59 |
| Last five years | | 233.00 | 234.18 | 158.53 | 216.53 |
| Factor average | 26 | 20.83 | 9.37 | -8.49 | 7.11 |
| Factor median | 27 | 17.07 | 9.56 | 2.10 | 9.48 |
| Factor standard deviation | 28 | 17.07 | 2.53 | 69.26 | 30.03 |

*All definitions in Exhibit 2

EXHIBIT 5 V

Factor Performance for South Africa

Screen Name: Return on equity
Sample period: 1 /93 - 3 /98
Number of observations: 63 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 19.92 | 18.65 | 18.29 | 18.86 |
| Cumulative return (indexed at 100 - start) | 2 | 259.52 | 245.38 | 241.53 | 247.68 |
| STD Deviation of returns | 3 | 20.99 | 25.10 | 24.27 | 22.01 |
| Average annual excess return | Rm 4 | 1.06 | -0.21 | -0.57 | |
| | Rf 5 | 14.71 | 13.48 | 13.14 | |
| STD Deviation of excess rtns | Rm 6 | 6.97 | 6.48 | 8.68 | |
| | Rf 7 | 21.03 | 25.14 | 24.34 | |
| Systematic risk (Beta) | 9 | 0.90 | 1.11 | 1.03 | |
| Alpha | 10 | 2.56 | -2.04 | -1.01 | |
| Co-efficient of determination | 11 | | | | |
| Average market cap | 12 | | | | 7328.00 |
| % periods > Benchmark | 13 | 53.97 | 53.97 | 50.79 | |
| % periods > Bench up Mkt | 14 | 45.00 | 57.50 | 52.50 | |
| % periods > Bench Dn Mkt | 15 | 69.57 | 47.83 | 47.83 | |
| Max # of consecutive benchmark outperformance | 16 | 6 | 7 | 5 | |
| Maximum positive excess return | 17 | 4.25 | 5.98 | 4.35 | |
| Maximum negative excess return | 18 | -4.17 | -5.80 | -6.18 | |
| % periods positive returns to negative | 19 | 162.50 | 152.00 | 162.50 | |
| % periods of negative returns | 20 | 38.10 | 39.68 | 38.10 | 36.51 |
| Max # consecutive negative periods | 21 | 5 | 6 | 5 | 6 |
| Max # consecutive positive periods | 22 | 10 | 8 | 10 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | |
| <i>In Sample</i> 1993 | | 153.94 | 173.22 | 186.97 | 167.26 |
| 1994 | | 146.84 | 120.98 | 138.78 | 131.32 |
| 1995 | | 128.00 | 119.81 | 109.27 | 117.78 |
| <i>Out of sample</i> 1996 | | 79.96 | 82.29 | 87.71 | 82.94 |
| 1997 | | 85.28 | 94.96 | 74.00 | 88.51 |
| <i>Through March</i> 1998 | | 131.53 | 125.06 | 131.25 | 130.42 |
| Relative Performance - | 24 | | | | |
| 1993 | | 1 | 2 | 3 | |
| 1994 | | 3 | 1 | 2 | |
| 1995 | | 3 | 2 | 1 | |
| 1996 | | 1 | 2 | 3 | |
| 1997 | | 2 | 3 | 1 | |
| 1998 | | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.17 | 1.83 | 2.00 | |
| Cumulative annual returns - | 25 | | | | |
| Last two years | | 103.10 | 104.33 | 82.09 | 101.59 |
| Last five years | | 237.42 | 213.86 | 202.70 | 216.53 |
| Factor average | 26 | 59.79 | 17.37 | 8.03 | 28.20 |
| Factor median | 27 | 27.76 | 16.93 | 7.95 | 16.91 |
| Factor standard deviation | 28 | 158.49 | 3.70 | 3.83 | 74.31 |

*All definitions in Exhibit 2

EXHIBIT 6
Factor performance summary - South Africa

| | Sample Period | Number of observations | Average Annualised Return | | Return Spread | Annualised Excess Returns | | Std Deviation of Annualised Returns | | Std Deviation of Top/Bottom returns | % Periods Benchmark Outperformance | |
|---|---------------|------------------------|---------------------------|--------|---------------|---------------------------|--------|-------------------------------------|--------|-------------------------------------|------------------------------------|--------|
| | | | Top | Bottom | | Top | Bottom | Top | Bottom | | Top | Bottom |
| Market Capitalization | 1/93 - 3/98 | 63 | 24.75 | 18.74 | 6.01 | 5.89 | -0.11 | 25.55 | 23.29 | 16.84 | 57.14 | 52.38 |
| Change in return on equity | 1/93 - 3/98 | 63 | 18.53 | 20.93 | -2.40 | -0.32 | 2.07 | 21.82 | 23.02 | 10.34 | 53.97 | 50.79 |
| Debt to Common equity | 1/93 - 3/98 | 63 | 16.18 | 14.72 | 1.47 | -2.67 | -4.14 | 22.79 | 26.54 | 17.86 | 46.03 | 47.62 |
| Dividend Yield | 2/93 - 3/98 | 62 | 18.42 | 16.29 | 2.12 | 0.09 | -2.03 | 27.34 | 24.90 | 19.51 | 50.00 | 50.00 |
| One year historical earnings momentum | 1/93 - 3/98 | 63 | 12.59 | 23.76 | -11.17 | -6.26 | 4.91 | 20.67 | 26.17 | 13.44 | 42.86 | 55.56 |
| Three year historical earnings growth rate | 1/93 - 3/98 | 63 | 13.12 | 19.22 | -6.09 | -5.73 | 0.36 | 21.60 | 25.90 | 15.44 | 50.79 | 53.97 |
| Earnings yield | 1/93 - 3/98 | 63 | 26.86 | 12.00 | 14.86 | 8.00 | -6.85 | 25.82 | 23.49 | 18.39 | 60.32 | 49.21 |
| Change in Consensus FY1 estimate - Last 3 months | 1/93 - 3/98 | 63 | 26.71 | 5.93 | 20.78 | 7.85 | -12.93 | 24.25 | 23.73 | 18.68 | 60.32 | 34.92 |
| Change in Consensus FY1 estimate - Last 6 months | 1/93 - 3/98 | 63 | 23.70 | 10.14 | 13.57 | 4.85 | -8.72 | 25.14 | 23.98 | 18.41 | 50.79 | 42.86 |
| Change in Consensus FY2 to FY1 estimate change | 1/93 - 3/98 | 63 | 20.59 | 19.47 | 1.12 | 1.73 | 0.61 | 22.38 | 26.03 | 15.89 | 50.79 | 53.97 |
| Consensus forecast earnings estimate revision ratio | 1/93 - 3/98 | 63 | 26.69 | 11.25 | 15.44 | 7.83 | -7.60 | 23.51 | 23.50 | 16.65 | 61.90 | 38.10 |
| Book to price yield | 1/93 - 3/98 | 63 | 17.76 | 10.44 | 7.32 | -1.10 | -8.42 | 26.07 | 21.88 | 18.58 | 49.21 | 42.86 |
| Cash Earnings to price yield | 1/93 - 3/98 | 63 | 17.93 | 12.38 | 5.55 | -0.93 | -6.48 | 25.81 | 22.33 | 17.59 | 50.79 | 38.10 |
| One month price momentum | 2/93 - 3/98 | 62 | 16.61 | 19.99 | -3.38 | -1.71 | 1.67 | 25.10 | 23.31 | 18.83 | 43.55 | 53.23 |
| One year price momentum | 1/93 - 3/98 | 63 | 18.21 | 17.65 | 0.56 | -0.65 | -1.21 | 24.98 | 26.23 | 21.15 | 46.03 | 58.73 |
| 12 months prospective earnings growth rate | 1/93 - 3/98 | 63 | 16.31 | 24.04 | -7.74 | -2.55 | 5.19 | 21.76 | 22.93 | 14.63 | 42.86 | 50.79 |
| Three year prospective earnings growth rate | 1/93 - 3/98 | 63 | 16.57 | 20.38 | -3.81 | -2.29 | 1.52 | 21.69 | 25.43 | 14.92 | 44.44 | 47.62 |
| 24 month prospective earnings yield | 1/93 - 3/98 | 63 | 23.07 | 15.36 | 7.72 | 4.22 | -3.50 | 24.24 | 23.62 | 17.37 | 58.73 | 44.44 |
| 12 month prospective earnings yield | 1/93 - 3/98 | 63 | 20.73 | 13.01 | 7.71 | 1.87 | -5.85 | 24.25 | 24.11 | 18.09 | 47.62 | 44.44 |
| Revenue Growth | 1/93 - 3/98 | 63 | 20.04 | 17.94 | 2.10 | 1.18 | -0.92 | 23.05 | 22.83 | 16.80 | 52.38 | 52.38 |
| Rate of re-investment | 1/93 - 3/98 | 63 | 18.35 | 13.84 | 4.50 | -0.51 | -5.01 | 21.55 | 23.61 | 15.20 | 60.32 | 49.21 |
| Return on equity | 1/93 - 3/98 | 63 | 19.92 | 18.29 | 1.63 | 1.06 | -0.57 | 20.99 | 24.27 | 12.65 | 53.97 | 50.79 |

EXHIBIT 7
Average Factor Returns: Top and Bottom Fractiles

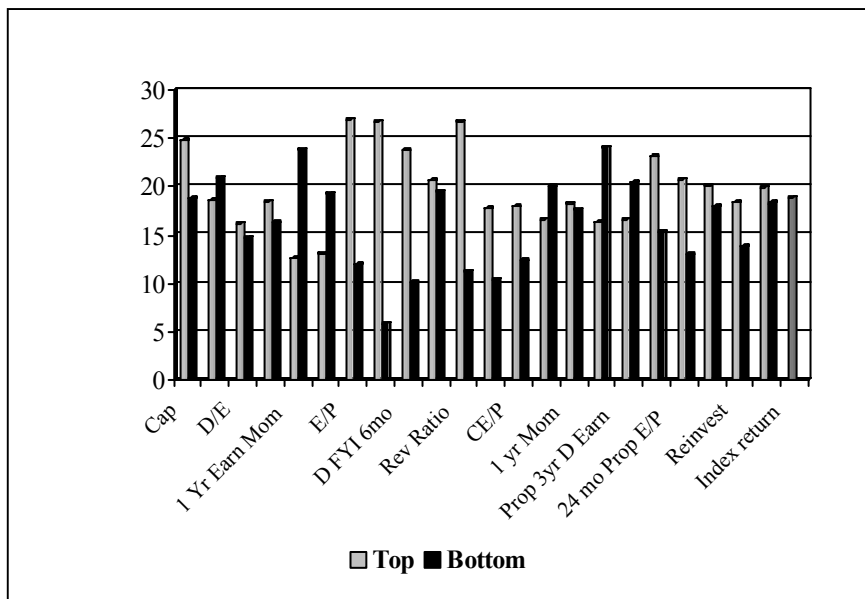
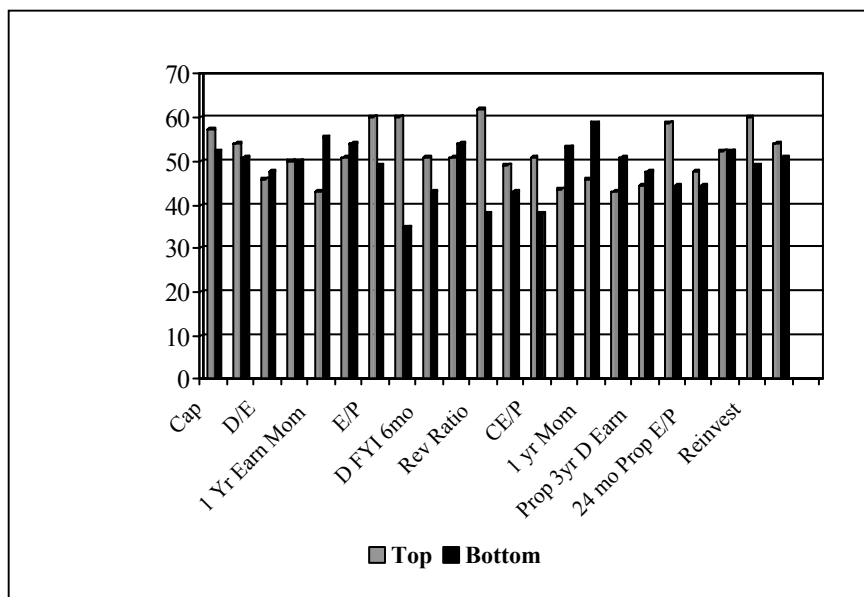


EXHIBIT 8
Percent of Periods Benchmark Outperformance



Fundamental factors

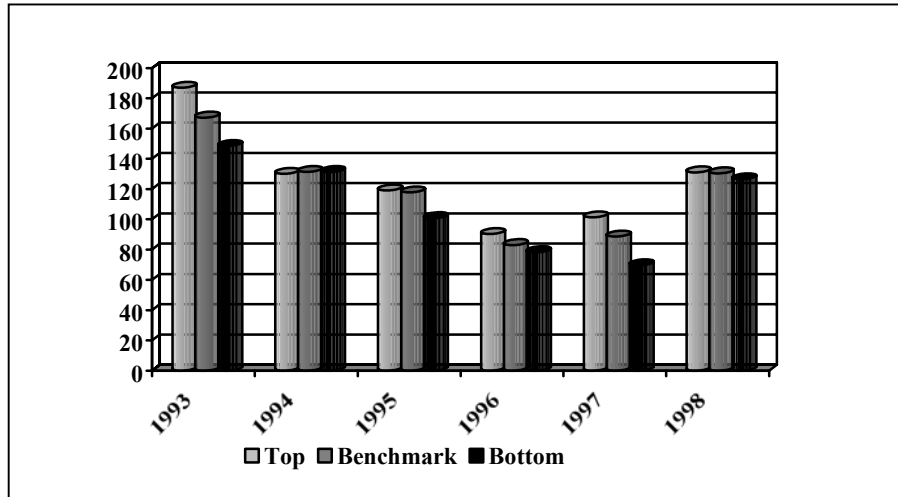
Our 'value' and 'growth' screens as expected perform differently through time with 'growth' proxies showing outperformance in the last two years. What is remarkable is the shift in factor performance through our sample period. However, the earnings yield factor does deliver consistent performance and outperforms the benchmark on a value-weighted basis in five out of six years and a factor relative score of 2.5. Book to price yield provided average equal weighted annual outperformance of 6.06% a year though this turned into a -1.10% average annual underperformance when the post rank returns were value-weighted. As seen in Malaysia, this reflects a 'size effect' occurring within the top portfolio. For example, the average small capitalization-large capitalization annualized spread within that portfolio is 17.2%, while the same spread in the bottom portfolio is 11.5% (these numbers are based on our unreported bivariate analysis of size and the screening factor). The longer horizon 24 months prospective earnings yield screen generates higher average excess annual returns over the benchmark than the shorter 12 month expectation (4.22% compared to 1.87%) though this factor does underperform in the volatile markets of 1997.

Expectation factors

Expectation revision screens (change in consensus FY1 forecasts over the preceding three or six months and consensus estimate revision ratios) provide the highest top minus bottom return spreads and on average the highest annualized benchmark outperformance. They are strong in both up and down markets with all factors providing more than 5% excess returns a year in both down markets of 1996 and 1997, while also outperforming substantially in the bull markets of 1993. This is consistent across all capitalizations (not reported) in the top portfolio and seems to be particularly effective at discriminating on large capitalization's in the bottom portfolio, with this group underperforming by an average annual -13.89%. Though the frequency of estimate revisions and magnitude of variation from mean estimates will increase in volatile macroeconomic environments, the consensus revision screen seems to have worked better in these type of markets (1997 through 1998). Exhibit 9 presents the year by year performance of the change in consensus earnings.

EXHIBIT 9

Change in Consensus FY1-3 Month Screen: Index=100 (each year)



Technical indicators

There seems to be little information in the momentum indicators.

Size effect

Small capitalization firms outperformed larger capitalization firms by on average 14.07% a year on an equal weighted basis and by 6.01% after value weighting the portfolio returns. Despite a massive outperformance of almost 70% in 1993 and over 20% in 1994, smaller capitalization stocks underperformed by almost 30% over the last two years of the sample. This is evidenced by the higher risk adjusted returns associated with this strategy.

The scoring screen

As mentioned previously, South Africa has a short in-sample screening window. Nevertheless, our final scoring model has delivered significant outperformance, before and after considering the effects of potential transaction costs [shown by the robust performance of longer-horizon holding periods]. Our monthly holding-period top portfolio has outperformed by 8.64% a year on average while the bottom portfolio has underperformed by -15.63% a year resulting in a top bottom spread of 24.27% a year. Though the average annual excess returns decrease incrementally with longer holding periods, during the out-of-sample period this difference is trivial. All screens outperform by more than 5% during the first part of 1998. For the purpose of the scoring screen, we report result through May 1998. The performance of the screens is presented in Exhibit 10. The scoring screens are summarized in Exhibits 11 and 12.

EXHIBIT 10 A

Scoring Screen Performance for South Africa

Screen Name: Scoring model
 Sample period: 1 /93 - 5 /98
 Number of observations: 65 Monthly

| Performance Measure/ Summary Statistic | Note* | Portfolios - equal weighted | | | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|---------|---------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 24.06 | 10.40 | -5.46 | 18.69 | 8.98 | -5.58 | 10.05 |
| Cumulative return (indexed at 100 - start) | 2 | 321.54 | 170.91 | 73.77 | 252.97 | 159.32 | 73.27 | 168.02 |
| STD Deviation of returns | 3 | 27.44 | 24.89 | 25.69 | 26.50 | 24.33 | 26.28 | 24.74 |
| Average annual excess return | Rm 4 | 14.01 | 0.35 | -15.52 | 8.64 | -1.07 | -15.63 | |
| | Rf 5 | 18.67 | 5.56 | -9.66 | 13.51 | 4.19 | -9.78 | |
| STD Deviation of excess rtns | Rm 6 | 9.38 | 8.13 | 10.97 | 5.77 | 5.53 | 10.03 | |
| | Rf 7 | 27.52 | 24.96 | 25.74 | 26.55 | 24.38 | 26.32 | |
| T-stat: Average XS return Rm = 0 | 8 | 3.19 | 0.08 | -3.15 | 3.24 | -0.47 | -3.45 | |
| Systematic risk (Beta) | 9 | 1.04 | 0.95 | 0.94 | 1.05 | 0.96 | 0.98 | |
| Alpha | 10 | 11.72 | 0.78 | -14.66 | 7.19 | -0.59 | -15.17 | |
| Co-efficient of determination | 11 | 0.88 | 0.90 | 0.82 | | | | |
| Average market cap | 12 | 8477.36 | 6921.67 | 5838.13 | | | | 7079.05 |
| % periods > Benchmark | 13 | 66.15 | 43.08 | 38.46 | 66.15 | 44.62 | 30.77 | |
| % periods > Bench up Mkt | 14 | 67.50 | 32.50 | 30.00 | 72.50 | 37.50 | 27.50 | |
| % periods > Bench Dn Mkt | 15 | 64.00 | 60.00 | 52.00 | 56.00 | 56.00 | 36.00 | |
| Max # of consecutive bmark outperformance | 16 | 10 | 4 | 3 | 8 | 3 | 2 | |
| Maximum positive excess return | 17 | 7.04 | 5.16 | 7.82 | 4.72 | 3.86 | 7.94 | |
| Maximum negative excess return | 18 | -8.02 | -6.29 | -8.49 | -3.64 | -4.12 | -9.72 | |
| % periods positive returns to negative | 19 | 195.45 | 132.14 | 91.18 | 150.00 | 103.13 | 85.71 | |
| % periods of negative returns | 20 | 33.85 | 43.08 | 52.31 | 40.00 | 49.23 | 53.85 | 38.46 |
| Max # of consecutive negative periods | 21 | 4 | 7 | 12 | 6 | 7 | 12 | 6 |
| Max # of consecutive positive periods | 22 | 10 | 6 | 7 | 7 | 5 | 5 | 8 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | | | | |
| <i>In sample</i> | | | | | | | | |
| 1993 | | 244.35 | 180.51 | 135.64 | 188.90 | 170.16 | 131.44 | 167.26 |
| 1994 | | 154.65 | 133.04 | 138.79 | 137.79 | 125.58 | 126.88 | 131.32 |
| 1995 | | 124.79 | 116.38 | 102.12 | 122.35 | 120.39 | 102.56 | 117.78 |
| <hr/> | | | | | | | | |
| <i>Out of sample</i> | | | | | | | | |
| 1996 | | 83.52 | 80.91 | 74.86 | 94.06 | 76.97 | 73.54 | 82.94 |
| 1997 | | 87.38 | 81.07 | 67.21 | 90.29 | 92.68 | 72.92 | 88.51 |
| 1998 | | 93.43 | 93.22 | 76.26 | 93.53 | 86.82 | 79.88 | 88.47 |
| Relative Performance - | 24 | | | | | | | |
| 1993 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| 1994 | | 3 | 1 | 2 | 3 | 1 | 2 | |
| 1995 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| 1996 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| 1997 | | 3 | 2 | 1 | 2 | 3 | 1 | |
| 1998 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| Average Relative Performance - | | 3.00 | 1.83 | 1.17 | 2.83 | 2.00 | 1.17 | |
| Cumulative annual returns - | 25 | | | | | | | |
| Last two years | | 74.62 | 65.61 | 42.58 | 80.01 | 67.53 | 47.97 | 69.57 |
| Last five years | | 214.98 | 129.25 | 67.95 | 198.30 | 127.41 | 68.33 | 137.90 |
| Factor average | 26 | 2.41 | -0.46 | -3.33 | | | | -0.28 |
| Factor median | 27 | 2.00 | -0.50 | -3.00 | | | | 0.00 |
| Factor standard deviation | 28 | 1.12 | 0.78 | 1.33 | | | | 2.44 |

*All definitions are in Exhibit 2

EXHIBIT 10 B

Scoring Screen Performance for South Africa

Screen Name: Scoring model
 Sample period: 3 /93 - 3 /98
 Number of observations: 21 Quarterly

| Performance Measure/ Summary Statistic | Note* | Portfolios - equal weighted | | | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|---------|---------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 20.71 | 5.55 | -4.35 | 14.99 | 8.44 | -4.73 | 8.70 |
| Cumulative return (indexed at 100 - start) | 2 | 268.63 | 132.78 | 79.19 | 208.17 | 152.98 | 77.54 | 154.94 |
| STD Deviation of returns | 3 | 31.41 | 24.72 | 24.71 | 29.86 | 24.59 | 25.34 | 25.91 |
| Average annual excess return | Rm 4 | 12.01 | -3.15 | -13.05 | 6.29 | -0.26 | -13.43 | |
| | Rf 5 | 15.57 | 0.90 | -8.66 | 10.03 | 3.69 | -9.03 | |
| STD Deviation of excess returns | Rm 6 | 10.42 | 7.99 | 9.31 | 6.73 | 5.13 | 7.86 | |
| | Rf 7 | 31.63 | 24.92 | 24.90 | 29.99 | 24.77 | 25.52 | |
| T-stat: Average XS return Rm = 0 | 8 | 2.68 | -0.94 | -3.22 | 2.68 | -0.94 | -3.22 | |
| Systematic risk (Beta) | 9 | 1.15 | 0.91 | 0.89 | 1.13 | 0.93 | 0.93 | |
| Alpha | 10 | 9.55 | -2.21 | -11.92 | 4.69 | 0.34 | -12.67 | |
| Co-efficient of determination | 11 | 0.91 | 0.91 | 0.87 | | | | |
| Average market cap | 12 | 8754.16 | 6995.01 | 5780.97 | | | | 7176.71 |
| % periods > Benchmark | 13 | 71.43 | 52.38 | 28.57 | 57.14 | 42.86 | 19.05 | |
| % periods > Bench up Mkt | 14 | 69.23 | 53.85 | 30.77 | 53.85 | 53.85 | 23.08 | |
| % periods > Bench Dn Mkt | 15 | 75.00 | 50.00 | 25.00 | 62.50 | 25.00 | 12.50 | |
| Max # of consecutive bmark outperformance | 16 | 8 | 4 | 4 | 7 | 4 | 1 | |
| Maximum positive excess return | 17 | 19.78 | 5.02 | 4.29 | 9.67 | 5.43 | 3.99 | |
| Maximum negative excess return | 18 | -6.55 | -10.73 | -11.36 | -3.37 | -7.32 | -11.20 | |
| % periods positive returns to negative | 19 | 200.00 | 162.50 | 90.91 | 200.00 | 162.50 | 75.00 | |
| % periods of negative returns | 20 | 33.33 | 38.10 | 52.38 | 33.33 | 38.10 | 57.14 | 38.10 |
| Max # of consecutive negative periods | 21 | 3 | 3 | 4 | 3 | 4 | 5 | 4 |
| Max # of consecutive positive periods | 22 | 8 | 8 | 3 | 8 | 7 | 3 | 7 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | | | | |
| <i>In sample</i> | | | | | | | | |
| 1993 | | 214.47 | 157.27 | 132.87 | 164.39 | 155.14 | 136.39 | 154.24 |
| 1994 | | 142.40 | 138.14 | 145.54 | 126.97 | 134.16 | 135.51 | 131.32 |
| 1995 | | 128.06 | 116.89 | 98.24 | 123.31 | 124.52 | 94.96 | 117.78 |
| <i>Out of sample</i> | | | | | | | | |
| 1996 | | 85.71 | 80.56 | 70.79 | 95.02 | 78.56 | 67.77 | 82.94 |
| 1997 | | 84.96 | 77.00 | 74.33 | 88.79 | 92.57 | 77.72 | 88.51 |
| 1998 | | 94.32 | 84.29 | 79.22 | 95.86 | 81.17 | 83.88 | 88.47 |
| Relative Performance - | 24 | | | | | | | |
| 1993 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| 1994 | | 2 | 1 | 3 | 1 | 2 | 3 | |
| 1995 | | 3 | 2 | 1 | 2 | 3 | 1 | |
| 1996 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| 1997 | | 3 | 2 | 1 | 2 | 3 | 1 | |
| 1998 | | 3 | 2 | 1 | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.83 | 1.83 | 1.33 | 2.33 | 2.17 | 1.50 | |
| Cumulative annual returns - | 25 | | | | | | | |
| Last two years | | 72.20 | 55.77 | 49.50 | 79.27 | 64.50 | 54.59 | 69.57 |
| Last five years | | 203.30 | 115.99 | 74.01 | 185.85 | 136.19 | 71.72 | 137.90 |
| Factor average | 26 | 2.49 | -0.44 | -3.34 | | | | -0.27 |
| Factor median | 27 | 2.50 | -0.50 | -3.00 | | | | 0.00 |
| Factor standard deviation | 28 | 1.12 | 0.80 | 1.31 | | | | 2.45 |

*All definitions are in Exhibit 2

EXHIBIT 10 C

Scoring Screen Performance for South Africa

Screen Name: Scoring model
 Sample period: 6 /93 - 12/98
 Number of observations: 10 Semi-annual

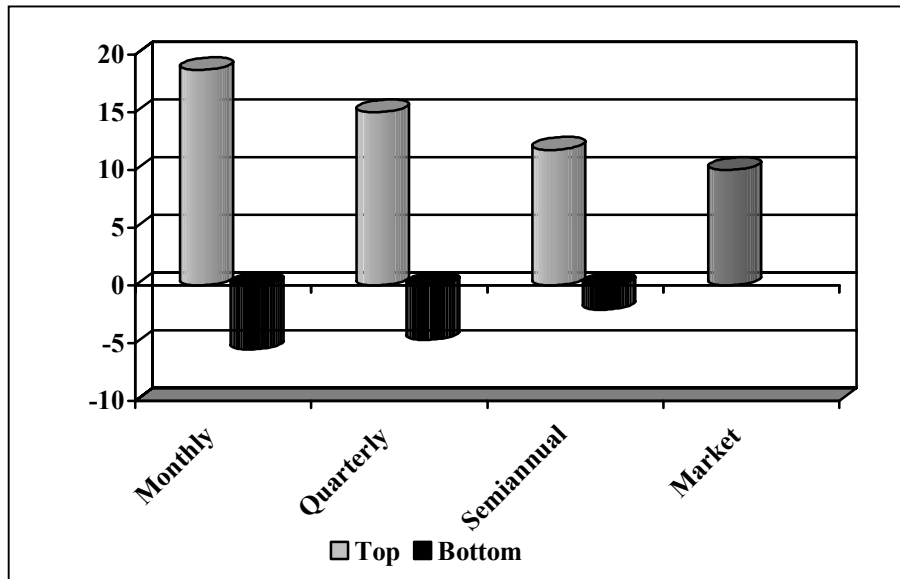
| Performance Measure/ Summary Statistic | Note* | Portfolios - equal weighted | | | Portfolios - value weighted | | | Market portfolio |
|---|-------|-----------------------------|---------|---------|-----------------------------|--------|--------|---------------------|
| | | -1- | -2- | -3- | -1- | -2- | -3- | |
| Annualized average return (USD) | 1 | 12.88 | 3.63 | -2.45 | 11.76 | 4.61 | -2.11 | 6.64 |
| Cumulative return (indexed at 100 - start) | 2 | 183.23 | 119.51 | 88.35 | 174.37 | 125.25 | 89.90 | 137.90 |
| STD Deviation of returns | 3 | 31.17 | 25.29 | 29.32 | 27.19 | 26.41 | 26.77 | 25.64 |
| Average annual excess return | Rm 4 | 6.24 | -3.01 | -9.08 | 5.12 | -2.03 | -8.75 | |
| | Rf 5 | 8.03 | -1.02 | -6.95 | 6.94 | -0.06 | -6.62 | |
| STD Deviation of excess rtns | Rm 6 | 8.74 | 7.57 | 9.84 | 6.26 | 5.45 | 5.93 | |
| | Rf 7 | 31.51 | 25.65 | 29.70 | 27.45 | 26.72 | 27.13 | |
| T-stat: Average XS return Rm = 0 | 8 | 1.86 | -0.89 | -1.80 | 1.89 | -0.70 | -3.13 | |
| Systematic risk (Beta) | 9 | 1.18 | 0.94 | 1.08 | 1.03 | 1.01 | 1.02 | |
| Alpha | 10 | 4.77 | -2.56 | -9.52 | 4.69 | -2.03 | -8.77 | |
| Co-efficient of determination | 11 | 0.94 | 0.91 | 0.89 | | | | |
| Average market cap | 12 | 8783.44 | 7173.67 | 6120.64 | | | | 7359.25 |
| % periods > Benchmark | 13 | 80.00 | 40.00 | 30.00 | 70.00 | 50.00 | 10.00 | |
| % periods > Bench up Mkt | 14 | 83.33 | 33.33 | 50.00 | 66.67 | 66.67 | 16.67 | |
| % periods > Bench Dn Mkt | 15 | 75.00 | 50.00 | 0.00 | 75.00 | 25.00 | 0.00 | |
| Max # of consecutive bmark outperformance | 16 | 5 | 2 | 2 | 5 | 4 | 1 | |
| Maximum positive excess return | 17 | 18.27 | 5.88 | 9.83 | 8.00 | 4.04 | 2.26 | |
| Maximum negative excess return | 18 | -5.33 | -12.42 | -15.04 | -3.89 | -8.00 | -11.67 | |
| % periods positive returns to negative | 19 | 150.00 | 150.00 | 100.00 | 150.00 | 150.00 | 100.00 | |
| % periods of negative returns | 20 | 40.00 | 40.00 | 50.00 | 40.00 | 40.00 | 50.00 | 40.00 |
| Max # of consecutive negative periods | 21 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Max # of consecutive positive periods | 22 | 5 | 5 | 3 | 4 | 5 | 3 | 5 |
| Cumulative annual returns - (index=100 each year) | 23 | | | | | | | |
| <i>In sample</i> | | | | | | | | |
| 1993 | | 155.55 | 134.05 | 133.94 | 143.95 | 133.13 | 134.34 | 137.28 |
| 1994 | | 136.80 | 141.04 | 148.13 | 125.45 | 139.24 | 134.12 | 131.32 |
| 1995 | | 123.02 | 114.72 | 108.86 | 120.20 | 123.45 | 106.78 | 117.78 |
| <i>Out of sample</i> | | | | | | | | |
| 1996 | | 83.75 | 82.21 | 72.16 | 93.17 | 78.87 | 72.55 | 82.94 |
| 1997 | | 85.79 | 83.98 | 72.96 | 89.38 | 86.25 | 77.94 | 88.51 |
| 1998 | | 97.43 | 79.81 | 77.71 | 96.47 | 80.47 | 82.63 | 88.47 |
| Relative Performance - | 24 | | | | | | | |
| 1993 | | 3 | 2 | 1 | 3 | 1 | 2 | |
| 1994 | | 1 | 2 | 3 | 1 | 3 | 2 | |
| 1995 | | 3 | 2 | 1 | 2 | 3 | 1 | |
| 1996 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| 1997 | | 3 | 2 | 1 | 3 | 2 | 1 | |
| 1998 | | 3 | 2 | 1 | 3 | 1 | 2 | |
| Average Relative Performance - | | 2.67 | 2.00 | 1.33 | 2.50 | 2.00 | 1.50 | |
| Cumulative annual returns - | 25 | | | | | | | |
| Last two years | | 74.42 | 58.67 | 47.90 | 79.47 | 60.51 | 55.27 | 69.57 |
| Last five years | | 183.23 | 119.51 | 88.35 | 174.37 | 125.25 | 89.90 | 137.90 |
| Factor average | 26 | 2.48 | -0.40 | -3.35 | | | | -0.29 |
| Factor median | 27 | 2.50 | -0.50 | -3.00 | | | | 0.00 |
| Factor standard deviation | 28 | 1.08 | 0.75 | 1.37 | | | | 2.46 |

*All definitions are in Exhibit 2

EXHIBIT 11
Factor performance summary – South Africa

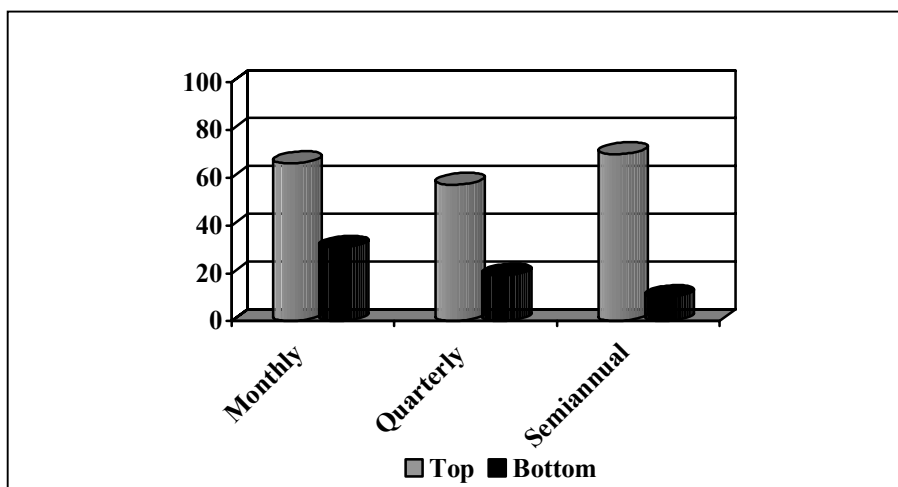
| | Sample Period | Number of observations | Average Annualised Return | | Return Spread | Annualised Excess Returns | | Std Deviation of Annualised Returns | | Std Deviation of Top/Bottom spread returns | % Periods Benchmark Outperformance | |
|--|---------------|------------------------|---------------------------|--------|---------------|---------------------------|--------|-------------------------------------|--------|--|------------------------------------|--------|
| | | | Top | Bottom | | Top | Bottom | Top | Bottom | | Top | Bottom |
| Scoring Model - Monthly observations | 1 /93 - 5 /98 | 65 | 18.69 | -5.58 | 24.27 | 8.64 | -15.63 | 26.50 | 26.28 | 14.45 | 66.15 | 30.77 |
| Scoring Model - Quarterly observations | 3 /93 - 3 /98 | 21 | 14.99 | -4.73 | 19.72 | 6.29 | -13.43 | 29.86 | 25.34 | 13.60 | 57.14 | 19.05 |
| Scoring Model - Semi annual observations | 6 /93 - 12/98 | 10 | 11.76 | -2.11 | 13.87 | 5.12 | -8.75 | 27.19 | 26.77 | 11.97 | 70.00 | 10.00 |

EXHIBIT 12
Performance of Scoring Screen over Different Holding Periods



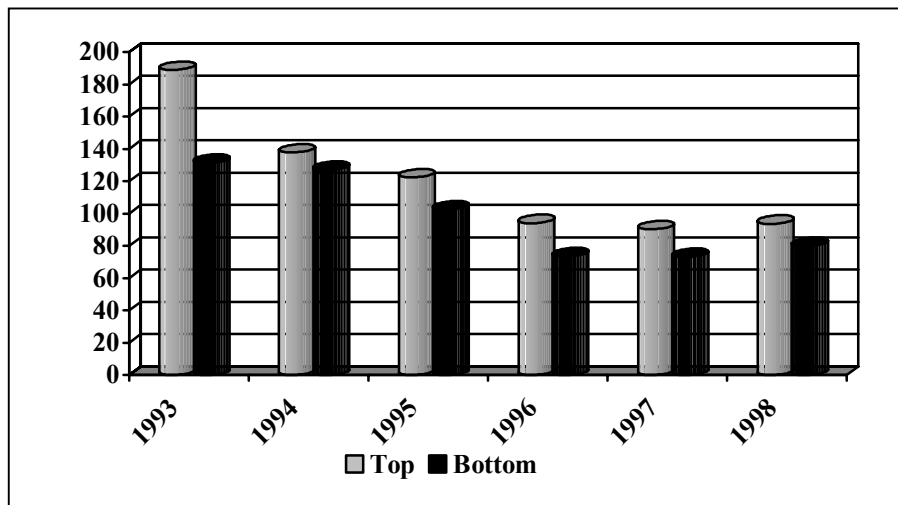
The percentage of periods whereby the benchmark return is exceeded is presented in Exhibit 13. The semi-annual holding period shows that the benchmark is exceeded in 70% of the observations. Importantly, the loser portfolio only exceeded the benchmark return in 10% of the periods.

EXHIBIT 13
Scoring Screen Percent of Periods Benchmark Outperformance



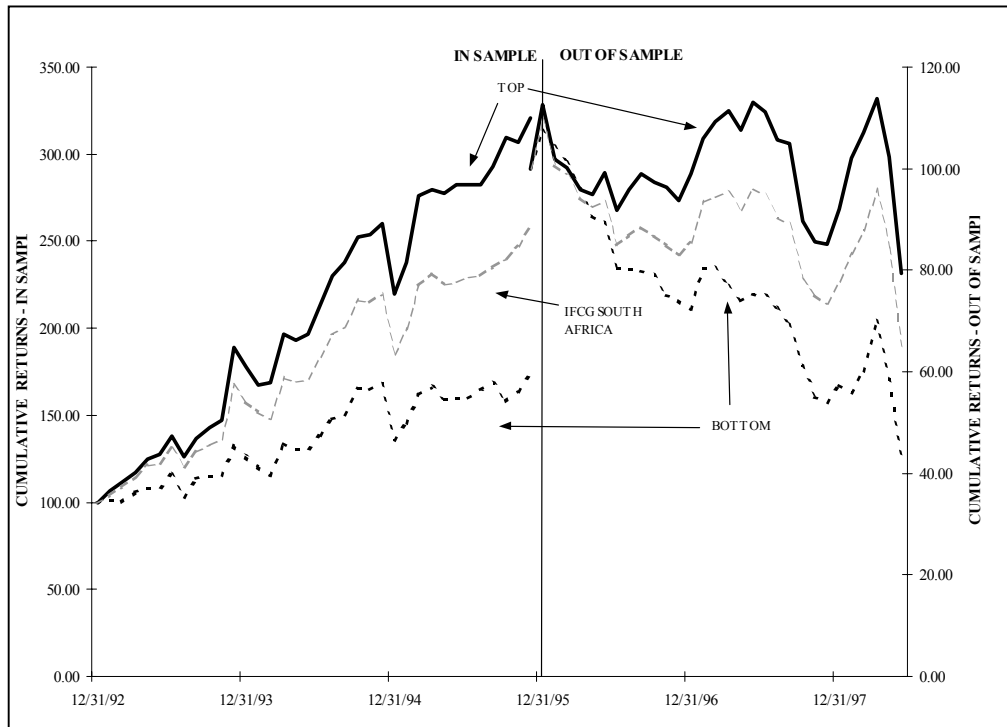
Consistency is also important. Exhibit 14 presents the year by year analysis of the scoring screen performance for the monthly rebalancing. In every year, the top portfolio outperforms the bottom portfolio.

EXHIBIT 14
Year by Year Scoring Screen Performance



Exhibits 15 displays the performance of the scoring screens. An investment of \$100 at the beginning of our in-sample period (December 1992) grows to approximately \$320 by December 1995. In this same period, the benchmark grew to \$260 and the bottom portfolio grew to only \$170. An investment of \$100 in December 1995 (the beginning of our out-of-sample period) falls to \$80 by March 1998 for the top portfolio compared to \$68 for the benchmark portfolio and \$44 for the bottom portfolio.

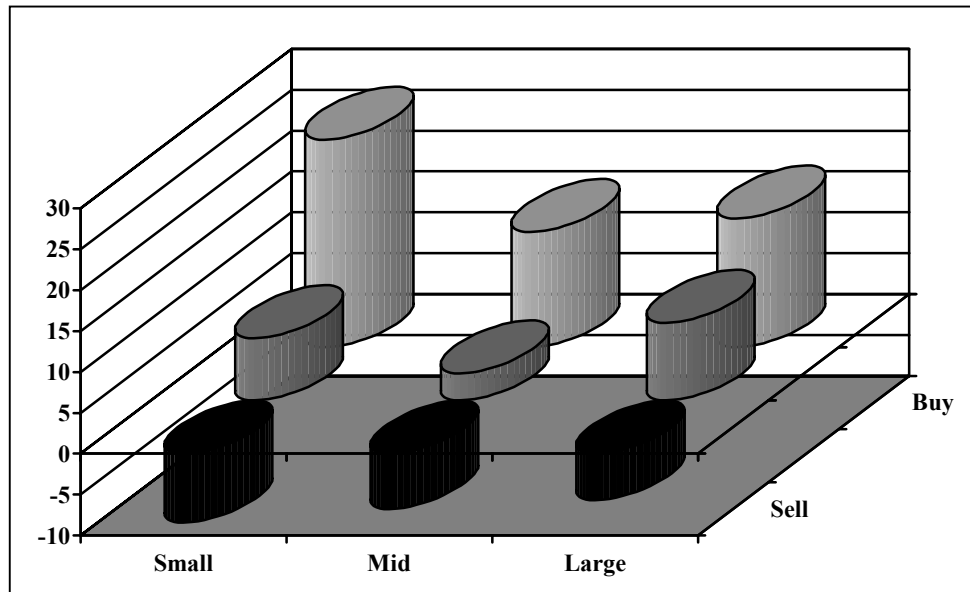
EXHIBIT 15
Value of US\$100 Investment in Scoring Screen Portfolios



A reasonable question to ask is whether we are just picking up some type of size effect. During the sample, small stocks outperformed large stocks. Exhibit 16 displays a bivariate analysis of the monthly-rebalanced scoring screen and market capitalization with data through March 1998. Across all size categories, the top fractile outperforms the bottom fractile. Not surprisingly, the best performing portfolio is the top fractile small stocks and the worst is the bottom fractile small stocks. If one knew in this in advance, the difference in the returns of these small stock portfolios averages 33% per year. The bivariate analysis of size provides evidence that the scoring screen is robust to the influence of size.

EXHIBIT 16

Analysis of Scoring Screen Performance by Market Capitalization



5. Conclusions

The financial markets in Africa are in the process of liberalizing and there are large potential benefits in terms of both diversification and return performance for both foreign and domestic investors. Unfortunately, little is known about African markets. Erb, Harvey and Viskanta (1999) is one of the few studies to examine the risk characteristics at the national level.

We present the first examination of equity characteristics at the firm level. Our research examines 28 firm-specific variables in South Africa and shows that these variables can identify equities that will both out-perform and under-perform the standard benchmark. Our research suggests that extra return can be generated, over and above an indexed portfolio benchmark, by using the information in these characteristics. Of particular importance are characteristics that are forward looking, such as earnings forecasts from IBES.

Our research is not without caveats. The country that we examine, South Africa, is not necessarily representative of other African countries. Further, we are handicapped by an extremely short sample of data to calibrate our models. Nevertheless, our goal is to establish a framework for the examination of firm specific characteristics in investment strategies. Our method produces impressive performance in South Africa. Future research will examine other countries.

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A Monetary Model of the South African Rand

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ABSTRACT

The behaviour of the South African rand is modeled using a monetary model of the exchange rate. The assumptions underlying the monetary approach are discussed in the context of the conditions prevailing in the South African economy. A cointegrating relationship involving the exchange rate, money stocks, industrial production and inflation rates is identified for the 1980M01-1998M11 period. In a later sub-period spanning 1988M01-1997M12, a sticky-price monetary model appears to fit the data better. The model also explains movements in the Rand during a sample encompassing the Russian financial crisis, as long as a dummy variable is included in the regression.

Introduction

In March 1995, South Africa unified its exchange rate system, marking yet another event in the country's integration into the global capital market. This ongoing process has important implications for the manner in which exchange rates are determined. As financial markets are liberalized, exchange rates become more sensitive to expectations regarding asset supplies and demands. This in turn places new constraints upon policymakers, and heightens the importance of understanding the parameters governing the relationships between monetary instruments and the value of the currency.

In this paper the behaviour of the South African rand is examined in the context of a monetary model of exchange rates. Using cointegration techniques, the long run relationship between exchange rates and money supplies, interest and inflation rates is identified and estimated. The results conform, broadly, to monetary models of the exchange rate, and are surprisingly robust to substantial changes in the economy, and uncertainty regarding the political landscape.

Evidence regarding the adjustment process is also presented. While prices do a large amount of adjustment during the entire sample, the burden of adjustment shifts toward exchange rates as well as interest rates during the last decade.

One is tempted to question the feasibility of estimating such structural models, given the well-known difficulties in predicting this asset price. The conventional wisdom concerning

the futility of structural exchange rate modeling was established by Meese and Rogoff (1983a,b). However, this view has been cast in doubt by several studies of G-7 currencies that provided robust evidence that macroeconomic fundamentals do affect nominal exchange rates.

This paper proceeds in the following manner. In Section 1, the monetary model of the exchange rate is presented. In Section 2, the econometric methodology is discussed. The empirical estimates and out-of-sample performance of the models are examined in Section 3. Some concluding remarks are included in Section 4.

THE MONETARY MODEL

The Standard Model

The asset-based approach to monetary model of the exchange rate can be represented as

$$s_t = \beta_0 + \beta_2(m_t - m_t^{SA}) + \beta_3(y_t - y_t^{SA}) + \beta_4(i_t - i_t^{SA}) + \beta_5(\pi_t - \pi_t^{SA}) \quad (1)$$

where s represents the value of the South African Rand (in US\$/rand), m_t is the (log) nominal money stock, p_t is the (log) price level, y_t is (log) income, i_t and π_t are the interest and expected inflation rates, respectively. A "SA" superscript denotes South African variables.

In the standard monetary model the coefficients have structural interpretations which may vary with the assumptions in effect. In monetary models, β_2 equals unity, while $\beta_3 < 0$, and represents the income elasticity of money demand. If prices are assumed to be flexible, then the interest rate and inflation differential are the same, and the condition $\beta_4 > 0$ holds. β_4 is equal to the absolute value of the interest semi-elasticity of money demand. On the other hand, if prices are sticky and there is secular inflation, then $\beta_4 < 0$ and the magnitude of this parameter is positively related to price stickiness; the more rapid price level adjustment is, the smaller this coefficient is, in absolute value terms. The coefficient on inflation is positive ($\beta_5 > 0$) and increases with the interest semi-elasticity of money demand and decreases with the degree of price stickiness. The flexible price version of the model is often associated with Frenkel (1976) and Bilson (1978), while the sticky-price versions are associated with Dornbusch (1976) and Frankel (1979).¹⁰

The negative findings of Meese and Rogoff (1983a,b) provide a pessimistic backdrop for any econometric project involving structural models of exchange rates, even for developed countries. However, work of MacDonald and Taylor (1994), Mark (1995) and Chinn and Meese (1995) suggest that there is some empirical content to at least the long run predictions of the monetary model, in its various incarnations.

¹⁰ The Frankel version allows for secular inflation. The money supply should have a unit coefficient assuming random walk driving processes.

1.2 Accounting for South African Conditions

There are four key issues that must be addressed when applying the monetary model the South African case: (i) purchasing power parity and the presence of nontradables; (ii) changes in the terms of trade; (iii) capital mobility and substitutability; and (iv) money demand stability.

Purchasing power parity and nontradables. The monetary approach is built upon some version of purchasing power parity (PPP),

$$s_t = p_t - p_t^{SA} \quad (2)$$

where p^{SA} a measure of the price level (such as a GDP deflator or the CPI) in South Africa, and p is the US or the Rest-of-World (RoW) price level. The relationship between the nominal exchange rate and relative prices (both series normalized to 0 in 1979M01) are depicted in Figures 1 and 2 (CPI deflated bilateral and trade weighted) and Figures 3 and 4 (PPI deflated bilateral and trade weighted). The PPP relationship does not appear to be grossly violated in these pictures.

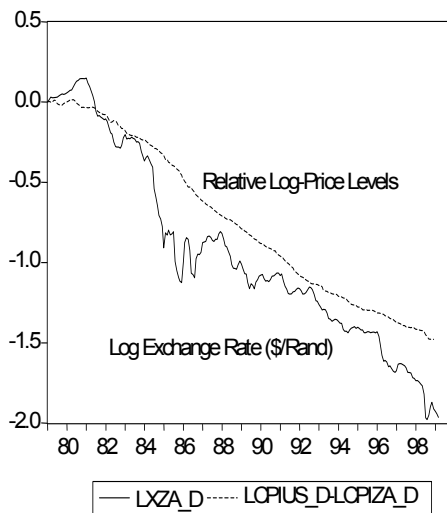


Figure 1
Bilateral exchange rate and CPIs
(rebased to 1979.01=0)

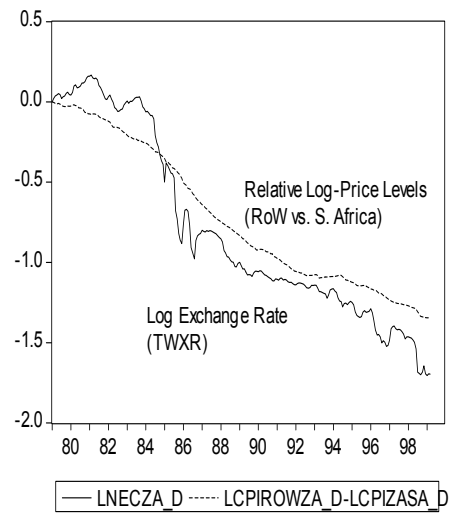


Figure 2
Trade weighted exchange rate
and CPIs (re-based to 1979.01=0)

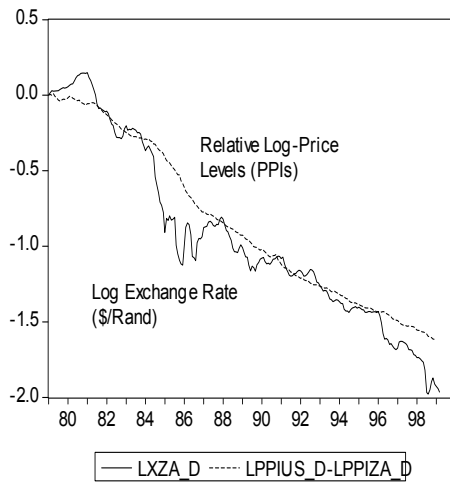


Figure 3
Bilateral exchange rate and PPIs
based to 1979.01=0)

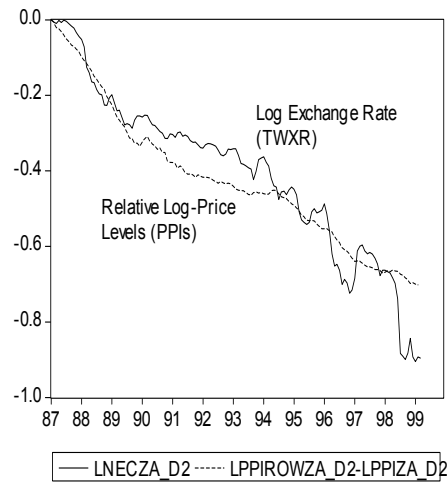


Figure 4
Trade weighted exchange rate (re-
PPIs (re-based to 1979.01=0)

Table 1 displays results from estimating the long run relationship in equation (2) using a dynamic ordinary least squares (DOLS) (Stock and Watson, 1993). Provided there is a cointegrating relationship, DOLS represents a simple and robust means by which to estimate the long run parameters.¹¹ In Column 1 are the estimates for the bilateral US-South African relation, using the CPI as the deflator. The long run parameters are not consistent with PPP; if the trade weighted exchange rate is used, the results equally poor; the point estimates are significantly different from the posited values of unity and negative unity (column 2).

Table 1
Tests for Purchasing Power Parity
Dynamic OLS Estimates

$$S_1 = Y_0 + Y_1 P_1 + Y_2 P_1^{SA} + \sum_{k=2}^2 \theta_k \Delta P_{t+k} + \sum_{k=2}^2 \Theta_k \Delta P_{t+k}^{SA} + U_t$$

¹¹ Appendix Table 1 provides detailed Johansen cointegration test results which supports the cointegration assumption for specifications corresponding to those reported in Table 1. The point estimates obtained using the Johansen procedure are often quite different than those obtained by DOLS. Stock and Watson (1993) present simulation evidence indicating that the Johansen estimates are often more dispersed than their DOLS counterparts.

| Var. | Pred | (1) | (2) | (3) | (4) | (5) |
|-------------------|------|----------------------|----------------------|----------------------|----------------------|---------------------|
| Currency Deflator | | \$ CPI | RoW CPI | \$ PPI | RoW PPI | RoW PPI |
| p | (1) | 0.223 (0.978) | 1.781*** (0.175) | 1.029*** (0.442) | 1.054*** (0.269) | 0.740 (0.413) |
| p^{SA} | (-1) | -0.838*** (0.284) | -1.501*** (0.070) | -1.074*** (0.076) | -1.168*** (0.135) | -1.002** (0.200) |
| P^{gold} | (+) | | | | | 0.173 (0.223) |
| Smpl | | 80.01 98.10 | 80.01 98.12 | 80.01 98.10 | 87.04 98.12 | 87.04 98.12 |
| N | | 226 | 228 | 226 | 141 | 141 |

Notes: Point estimates from Dynamic OLS regressions (robust standard errors in parentheses, calculated using average of 5 autocorrelations and Bartlett window). Begin and end denote the sample period. N denotes the number of observations. *(**)[***] indicates significance at the 10%(5%)[1%] marginal significance level for null of zero coefficient. Figures in ***bold face italics*** denote estimates significantly different at the 5% level from anticipated values. Detailed Johansen cointegration results are reported in Appendix Table 1.

In contrast, one could test the validity of PPP using a price index for highly tradable goods. The Producer Price Index (PPI) is used as a proxy for this variable (column 3). The results are better, confirming the findings of PPP obtained by Khan and Parikh (1998). They are almost as good using trade weighted exchange rates (column 4), suggesting that the key to detecting PPP is the use of a highly tradable price index. The results do not change if the PPI measure includes only home goods prices, instead of home and imported goods prices.¹²

Since PPP holds only for a sub-index of goods, it is reasonable to inquire how the model needs to be modified to account for this finding. A plausible approach is to assume

¹² PPP holds for the commercial Rand, rather than the financial. While cointegration is also found for this exchange rate, the point estimates are off by magnitudes of ten, with enormous standard errors. As noted in a number of writings, the financial Rand was behaved in a very volatile manner, with prices set in a very thin market. Hence, from here on out, all of the discussion will pertain to results using the commercial Rand.

that the presence of nontradable goods inhibits equalization of all prices in common currency terms. To see this, consider the aggregate price level as being defined by:

$$p_t = (1 - \alpha) p_t^T + \alpha p_t^N \quad (3)$$

$$s_t = p_t^T - p_t^{T,SA} \quad (4)$$

and PPP holds for traded goods,

then one obtains the usual expression for the exchange rate, except that it is augmented by a relative nontradables-tradables price term, $[(p^N - p^T) - (p^{N,SA} - p^{T,SA})] \equiv \omega$ with a coefficient of $-\alpha$.¹³

Terms of Trade Shocks. In the above treatment, the relative price of tradable goods denominated in common currency $q^T (= s - p^T + p^{T,SA})$ is constant in the long run. It is possible that, despite the results obtained in the previous section, this relative price variable is actually nonstationary,¹⁴ and cointegrated with other variables. For developing countries, a prime candidate for this effect is the changes in the terms of trade, or the price of gold, in the case of South Africa (Aron, Elbadawi and Khan, 1997). A visual inspection of the PPI-deflated real exchange rate and the price of gold displayed in Figure 5 is persuasive.

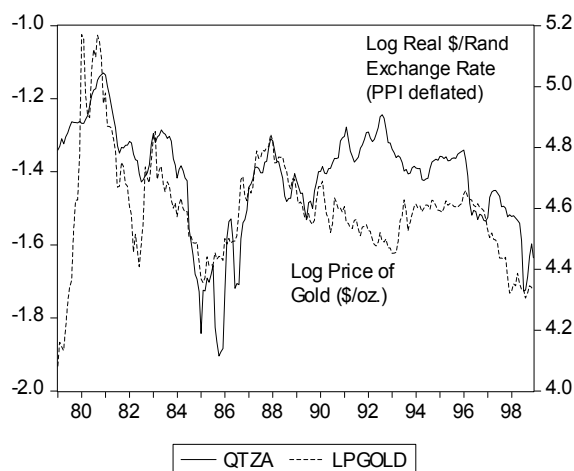


Figure 5: Real (PPI deflated) bilateral exchange rate and price of gold

One can test whether the PPP relationship is affected by this variable by augmenting the candidate cointegrating vector. Inclusion of the price of gold induces highly implausible

¹³. The complete derivation is contained in Chinn (1998). Systematic movements in the relative price of nontradables may be due to differential productivity growth, as suggested by Balassa (1964) and Samuelson (1964).

¹⁴. Engel (1996) makes the argument that series may incorrectly reject the unit root null when the error associated with the nonstationary component is small relative to the error associated with the stationary component.

estimates of the price coefficients when the CPI deflator is used. However, if one uses the trade weighted exchange rate and PPI deflators, then one obtains the results reported in column 5 of Table 1. This specification yields plausible estimates of the vector; moreover the long run elasticity of the exchange rate with respect to the price of gold is 0.34, remarkably close to the point estimates in Aron et al. However, the gold coefficient is not statistically significant at the conventional levels. Thus, it remains an open question whether the price of gold enters into the specification for the sample period examined. *If* increases in the price of gold do shift the real exchange rate, then one expects this variable to enter into (1) with a positive sign (an increase in gold appreciates the South African Rand, if s is expressed in \$/Rand).

Capital mobility and substitutability. Because the monetary approach is built on perfect capital mobility and substitutability, it is not clear that this model should hold well for South Africa. Frankel (1983) defines perfect capital mobility as the condition where covered interest parity holds, while perfect capital substitutability is the condition where bonds denominated in different currencies are viewed as perfect substitutes. Perfect substitutability implies the absence of an exchange risk premium.

To what extent is this first condition violated? Covered interest differentials will be zero if there are no capital controls or other regulatory impediments (extant or incipient) to international financial transactions. Verbal accounts clearly contradict this view, although it is not clear how effective these controls are. For the 1982M09-1987M03 period studied by Frankel and MacArthur (1988), the average covered interest differential was only about -1.52 percentage points, comparable in size and magnitude to that of New Zealand. Figure 6 depicts the covered interest differential, described as the forward discount minus the interest differential for the 1987Q1-1997Q4 period. The mean value is about -2 percentage points. However, since the central bank actively manages the forward rate with reference to the covered interest parity condition, it is difficult to interpret this result.¹⁵ An indirect measure might be obtained by inspecting the gap between the commercial rand and the black market rate (as reported by Pick's). According to Aron and Ayogu (1997, Figure 1) substantial divergences in the two rates exist until about 1985, so over the pre-1985 period capital controls might be considered binding.

¹⁵ The South African rate is proxied by the overnight interbank rate, so some measurement error is introduced in this calculation.

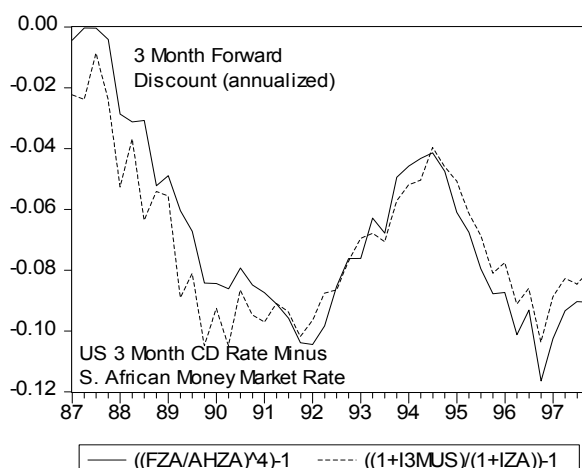


Figure 6: South African forward discount and interest differential

The second assumption is that of perfect capital substitutability. Confirming results of Aron and Ayogulo (1997), in this sample the 3 month forward rate is a biased predictor of the future spot rate (and significantly so).¹⁶ However, these results are no more perverse than those obtained for developed country currencies at this horizon, so as long as the implied exchange risk premium is stationary, the long run monetary model should still be identifiable.

Money demand stability. An empirically stable counterpart to equation (1) requires, in part, the presence of stable money demand functions. This condition is unlikely to hold in an economy subject to monetization, increasing financial intermediation, or financial deregulation.

A recent study by Nell (1999) found that a stable relationship between either M1 or M2 and income and interest or inflation rates could not be identified for the entire 1965-1997 period; however, he did find that a stable relationship could be found for both of these money aggregates over the 1980-97 sub-sample.

In the monthly data set used in this paper, cointegration is easily detected between the real money stock (M1) and industrial production and the inflation rate. However, in contrast to the results obtained by Nell, it appears that over a later subsample of 1988-98 interest rates provide a better measure of the opportunity cost of holding money than do inflation rates. The subsequent investigation of the appropriate exchange rate specifications is conducted keeping these results in mind.

¹⁶ Using 3 month forward rates over the 1987M01-1998M12 period, one obtains a coefficient on the forward discount of -0.36 (0.72 is the robust standard error).

ECONOMETRIC METHODOLOGY

The series being analyzed -- nominal exchange rates, relative money supplies, incomes, and so forth -- are integrated of order one [$I(1)$], so that individually they do not tend to revert back to their means. However, this does not mean that the series taken together are unrelated. Rather they may (or may not) exhibit a long run relationship. The existence of a long run relationship in levels of $I(1)$ variables is termed cointegration. As discussed in Phillips and Loretan (1991), one can proceed along a number of avenues. The main choice is between single equation methods and multiple equation methods. In this study the latter is adopted because one is interested not only in how exchange rates adjust, but also how the *other* macroeconomic variables in the system adjust, especially since several accounts indicate that the South African monetary authorities actively managed the exchange rate by manipulating other policy instruments.

The current standard in testing for cointegration in time series is the full-system maximum likelihood estimation technique of Johansen (1988) and Johansen and Juselius (1990). Ignoring the tradable-nontradable price term, and the gold variable, this procedure involves estimating the system: where the carats (^) denote relative differences. For simplicity, equation (5) has been written assuming only one cointegrating vector, although in principle nothing prevents the existence of more.

$$\begin{aligned}
 \Delta s_t &= \gamma_{10} + \Phi_1 ECT_{t-1} + \sum_{i=1}^k \gamma_{1i} \Delta s_{t-i} + \sum_{i=1}^k \zeta_{1i} \Delta \hat{m}_{t-i} + \sum_{i=1}^k \nu_{1i} \Delta \hat{y}_{t-i} \\
 &\quad + \sum_{i=1}^k \xi_{1i} \Delta \hat{i}_{t-i} + \sum_{i=1}^k \mu_{1i} \Delta \hat{\pi}_{t-i} + \varepsilon_{1t} \\
 \Delta \hat{m}_t &= \gamma_{20} + \Phi_2 ECT_{t-1} + \sum_{i=1}^k \gamma_{2i} \Delta s_{t-i} + \sum_{i=1}^k \zeta_{2i} \Delta \hat{m}_{t-i} + \sum_{i=1}^k \nu_{2i} \Delta \hat{y}_{t-i} \\
 &\quad + \sum_{i=1}^k \xi_{2i} \Delta \hat{i}_{t-i} + \sum_{i=1}^k \mu_{2i} \Delta \hat{\pi}_{t-i} + \varepsilon_{2t} \\
 \Delta \hat{y}_t &= \gamma_{30} + \Phi_3 ECT_{t-1} + \sum_{i=1}^k \gamma_{3i} \Delta s_{t-i} + \sum_{i=1}^k \zeta_{3i} \Delta \hat{m}_{t-i} + \sum_{i=1}^k \nu_{3i} \Delta \hat{y}_{t-i} \\
 &\quad + \sum_{i=1}^k \xi_{3i} \Delta \hat{i}_{t-i} + \sum_{i=1}^k \mu_{3i} \Delta \hat{\pi}_{t-i} + \varepsilon_{3t} \\
 \Delta \hat{i}_t &= \gamma_{40} + \Phi_4 ECT_{t-1} + \sum_{i=1}^k \gamma_{4i} \Delta s_{t-i} + \sum_{i=1}^k \zeta_{4i} \Delta \hat{m}_{t-i} + \sum_{i=1}^k \nu_{4i} \Delta \hat{y}_{t-i} \\
 &\quad + \sum_{i=1}^k \xi_{4i} \Delta \hat{i}_{t-i} + \sum_{i=1}^k \mu_{4i} \Delta \hat{\pi}_{t-i} + \varepsilon_{4t} \\
 \Delta \hat{\pi}_t &= \gamma_{50} + \Phi_5 ECT_{t-1} + \sum_{i=1}^k \gamma_{5i} \Delta s_{t-i} + \sum_{i=1}^k \zeta_{5i} \Delta \hat{m}_{t-i} + \sum_{i=1}^k \nu_{5i} \Delta \hat{y}_{t-i} \quad (5) \\
 &\quad + \sum_{i=1}^k \xi_{5i} \Delta \hat{i}_{t-i} + \sum_{i=1}^k \mu_{5i} \Delta \hat{\pi}_{t-i} + \varepsilon_{5t}
 \end{aligned}$$

$$ECT \equiv [\beta_1 s + \beta_2 \hat{m} + \beta_3 \hat{y} + \beta_4 \hat{i} + \beta_5 \hat{\pi}]$$

The procedure yields a trace statistic on which a likelihood ratio (LR) test can be conducted for the null of r cointegrating vectors against the alternative of m cointegrating vectors. The asymptotic critical values for this test are reported in Osterwald-Lenum (1992). Cheung and Lai (1993), among others, have shown that finite sample critical values may be more appropriate given the relatively small samples which are generally under study. In this study, inference will be conducted using both sets of critical values.

The multi-equation approach just described also enables one to examine what variables adjust to restore equilibrium. The typical focus on a single equation, normalized on the exchange rate, may miss such adjustment mechanisms. An example of this phenomenon would obtain if money supplies are manipulated by the central bank to target a given nominal exchange rate. If this is the case, the exchange rate might not exhibit any response to the disequilibrium represented by the error correction term.

The lag length for the Johansen method is selected using the following procedure. VARs in levels are estimated, with lags extending up to 12. The optimal lag length k is chosen on the basis of the Akaike Information Criterion. This lag length is then used for the corresponding VECM used in the Johansen procedure. Hence, if the VAR lag order selected is 3, two lags of first differences are included in the VECM.

EMPIRICAL ANALYSIS

Data

$$\alpha[(p^N - p^T) - (p^{N,SA} - p^{T,SA})] \approx -\tilde{\omega} \equiv \log \left[\frac{(CPI^{US} / PPI^{US})}{(CPI^{SA} / PPI^{SA})} \right] \quad (6)$$

The analysis is conducted on quarterly data over the period 1980M01 to 1998M12, mostly drawn from the IMF's *International Financial Statistics* April 1999 CD-ROM. Exchange rates are end-of-period, in US\$/local currency unit. Money is either narrow money (*IFS* line 34) or broad money (*IFS* lines 34 plus 35). Income is proxied by industrial production (US) or manufacturing production (South Africa). Interest rates are interbank rates (*IFS* lines 60b). Inflation rates are calculated as the annualized first difference of the log-CPI.

Since we do not observe a pure measure of either p^N or p^T , these measures have to be proxied. If one assumes $\alpha = 0.5$ and one half of the CPI basket is nontradable, then: This means that the coefficient on the relative price variable should be approximately -1.

Empirical Results

The cointegration results are reported in Panel 1 of Table 2. In all cases, one can reject the no-cointegration null, and indeed can find multiple cointegrating vectors, even using the finite sample adjustment suggested by Cheung and Lai (1993). However, none of the other cointegrating vectors are readily interpretable so only one cointegrating vector is assumed present in the subsequent discussion.¹⁷

¹⁷. Omitting one of the error correction terms will reduce the efficiency of the estimates, but will not bias the results.

Table 2
The Monetary Model of Exchange Rates
Full Sample Johansen Cointegration Results

| Panel 2.1: Long Run Coefficients | | | | | |
|-----------------------------------|------|----------------------|----------------------|----------------------|----------------------|
| Coeff | Pred | (1) | (2) | (3) | (4) |
| LR | | 152.0 | 125.4 | 200.6 | 168.5 |
| c.v. | | 84.5[90.1] | 76.1[81.1] | 111.0[116.9] | 103.2[108.7] |
| CR's | | 2[2] | 2[2] | 3[3] | 2[2] |
| $m^{US}-m^{SA}$ | (1) | 0.544*** (0.215) | 0.538*** (0.234) | 0.413*** (0.203) | 0.408** (0.217) |
| $y^{US}-y^{SA}$ | (-) | -2.445*** (0.876) | -2.511*** (0.955) | -2.950*** (0.957) | -3.041*** (1.043) |
| $i^{US}-i^{SA}$ | (-) | -0.348 (1.195) | -0.381 (1.305) | -0.920 (1.226) | -0.975 (1.326) |
| $IF^{US}-IF^{SA}$ | (+) | 7.248*** (1.746) | 7.948*** (2.070) | 7.189*** (2.582) | 7.703** (2.967) |
| $\bar{\omega}$ | (-1) | | | -1.065 (1.453) | -0.960** (1.586) |
| Panel 2.2: Reversion coefficients | | | | | |
| Δs | (-) | -0.004 (0.008) | -0.001 (0.007) | 0.008 (0.007) | 0.008 (0.007) |
| $\Delta (m^{US}-m^{SA})$ | (+) | 0.004 (0.008) | 0.009 (0.007) | 0.007 (0.008) | 0.008 (0.007) |
| $\Delta (y^{US}-y^{SA})$ | (-) | 0.011* (0.006) | 0.009 (0.006) | 0.003 (0.006) | 0.003 (0.006) |
| $\Delta (i^{US}-i^{SA})$ | (±) | 0.005 (0.003) | 0.004 (0.003) | 0.004 (0.003) | 0.004 (0.003) |
| $\Delta (IF^{US}-IF^{SA})$ | (+) | 0.102*** (0.014) | 0.093*** (0.013) | 0.097*** (0.013) | 0.090*** (0.012) |
| $\Delta \bar{\omega}$ | (+) | | | 0.001 (0.001) | 0.001 (0.001) |
| Adj-R ² | | .20 | .21 | .17 | .19 |
| SER | | 0.032 | 0.032 | 0.033 | 0.032 |
| time trend | | no | in data | no | in data |
| k | | 3 | 3 | 2 | 2 |
| N | | 227 | 227 | 227 | 227 |
| Smpl | | 80.01 | 80.01 | 80.01 | 80.01 |

Notes: “Coeff” is the $\hat{\alpha}$ coefficient from equation (1). “Pred” indicates predicted sign. LR is the likelihood ratio test statistic for the null of zero cointegrating vector against the alternative of one. c.v. is the asymptotic critical value for the test of zero cointegrating vectors against the alternative of one [finite sample critical values in brackets]. CR’s is the number of cointegrating relations implied by the asymptotic critical values [finite sample critical values]. Coefficients are long run parameter estimates from the Johansen procedure described in the text. k is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period. All regressions include centered seasonal dummies. Panel 2 Reversion coefficients are the $\hat{\Phi}$ coefficients from equation (5). “Pred” is predicted sign. SER is the standard error of the regression. VECM Adj- R^2 and SER refer to the exchange rate error correction model.

In column (1), the estimates are broadly in line with the monetary model. Increases in the money supply depreciate the currency, while higher income (proxied by industrial production) appreciates the currency. Aside from money, the most statistically significant coefficient is on inflation. A one percentage point increase in inflation weakens the currency by 7 percent, roughly in line with a semi-elasticity of money demand of 7. Notably, interest rates do not enter into the equation.

These results do not change appreciably if deterministic time trends are allowed in the data. The results are also insensitive to whether the relative price variable is included or not. Interestingly, the point estimate is close to what is expected, although the standard errors are so large that one cannot distinguish it from zero.

While the estimates do confirm the monetary model as a long run relationship, they do not speak to the manner in which the equilibrium is restored. Panel 2 of Table 2 presents the reversion coefficient estimates from the vector error correction models (i.e., the Φ ’s from equation 5). Interestingly, none of the coefficients are statistically significant, except for that on inflation. Over the entire sample period, it appears that inflation does the bulk of adjustment to exchange rate disequilibria.¹⁸

There are not many other studies to compare these results against. Odedokun (1997) reports some results for the trade weighted Rand over the 1986-92 period. Using OLS, he obtains a point estimate of 0.36 for relative money stocks, -2.90 for relative incomes, and a positive 0.464 for interest rates.¹⁹ With the exception of that on relative incomes, these estimates are in general agreement with the results discussed above.

¹⁸. This result stands in stark contrast to the results of applying a similar model to the East Asian economies. In those cases, money and interest rates – and sometimes exchange rates – respond to the disequilibria (Chinn, 1999).

¹⁹. Since a lagged real exchange rate is included in Odedokun’s specification, with an estimated coefficient of 0.685, the long run point estimates can be obtained by multiplying the short run

As mentioned earlier, the most appropriate model may be one that involves the relative price of nontradables. In columns 3 and 4, results are reported for a specification including a relative price variable. The point estimates do not change appreciably from those in the previous set of results. The relative nontradable-tradable price coefficient is approximately negative one as anticipated. However, the standard error for this parameter is such that one cannot reject the null hypothesis that the relative price variable is not important.

The price of gold was also included in the basic specification. Contrary to expectations, the coefficient on this variable was consistently in the wrong direction; that is, an increase in the price of gold lead to a depreciation of the Rand. Theoretically, this result can occur if the income effects are sufficiently strong that a terms of trade shift induces a real exchange rate depreciation (admittedly not the usual prior). Since the results of estimating the model with this additional variable do not differ substantially from those reported earlier, these results are not discussed further. (Specific results can be seen in Appendix Table 2).

Changes in the Regime

Aron, Elbadawi and Khan (1997) point out that there have been several exchange rate regimes over the past 20 years. To investigate the possibility that the set of fundamentals may be different over the most recent period, the regression sample is restricted to the 1988-1997 period.

There is an arbitrary break point, which happens to separate the sample into two roughly equal parts. The post-1988 sample also corresponds to period for which Khan and Parikh (1998) found that PPP held. Other candidate sub-samples certainly exist: the post-Apartheid era, or that period after the accession of Nelson Mandela to office. The former might be dated to November 1989, when de Klerk announces plans to eliminate the Separate Amenities Act, and the latter to May 1994. Attempts to implement the models over these samples yielded few findings of cointegration, so the subsequent discussion will address only the longer sub-sample.²⁰

In the restricted sub-sample the interest rate does become important in an economic -- although not statistical -- sense (column 1 of Table 3). This result holds up only when no deterministic trends are allowed in the data.

coefficients by approximately 3. In this case, the interest rate differential has to be interpreted as being equal to the inflation differential (by the Fisher equation) as in Frenkel (1976).

²⁰ There are at least two potential explanations for these negative findings. The first is that the shorter span of data reduces the power of the cointegration tests so much that the null cannot be rejected at conventional levels. The second is that there is no cointegration of these variables in the later period, due to political and economic uncertainties and structural shifts.

Table 3
The Monetary Model of Exchange Rates
Truncated Sample Johansen Cointegration Results

| Panel 3.1: Long Run Coefficients | | | | | | |
|-----------------------------------|-------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Coeff | Pre d | (1) | (2) | (3) | (4) | (5) |
| LR | | 85.7 | 62.4 | 42.3 | 66.2 | 49.6 |
| c.v. | | 84.5[95.1] | 60.2[66.2] | 54.5[60.0] | 60.2[67.5] | 54.5[61.2] |
| CR's | | 1[0] | 1[0] | 0[0] | 1[0] | 0[0] ^{adj} |
| s | (-1) | -1 | -1 | -1 | -1 | -1 |
| $m^{US}-m^{SA}$ | (1) | 1.004*** (0.458) | 0.729*** (0.276) | 0.608*** (0.136) | 0.592** (0.127) | 0.570*** (0.121) |
| $y^{US}-y^{SA}$ | (-) | 0.057 (1.318) | -0.494 (1.020) | -0.061 (0.614) | 0.085 (0.608) | 0.000 (0.576) |
| $i^{US}-i^{SA}$ | (-) | -6.938 (5.204) | -2.838 (2.344) | -3.362*** (1.400) | -3.476*** (1.389) | -3.215*** (1.283) |
| $II^{US}-II^{SA}$ | (+) | 4.595 (3.626) | | | | |
| Panel 3.2: Reversion coefficients | | | | | | |
| Δs | (-) | -0.021*** (0.008) | -0.030*** (0.009) | -0.066*** (0.019) | -0.087*** (0.021) | -0.087*** (0.021) |
| $\Delta(m^{US}-m^{SA})$ | (+) | -0.040*** (0.015) | -0.062*** (0.017) | 0.018 (0.036) | -0.012 (0.035) | 0.000 (0.034) |
| $\Delta(y^{US}-y^{SA})$ | (-) | -0.003 (0.011) | 0.013 (0.014) | -0.051* (0.028) | -0.041* (0.026) | -0.046* (0.026) |
| $\Delta(i^{US}-i^{SA})$ | (±) | -0.005 (0.004) | 0.001 (0.005) | -0.020** (0.010) | -0.024*** (0.010) | -0.024** (0.010) |
| $\Delta(II^{US}-II^{SA})$ | (+) | 0.061*** (0.021) | | | | |
| Adj-R ² | | .0 | .22 | .26 | .34 | .35 |
| SER | | 0.017 | 0.017 | 0.017 | 0.019 | 0.019 |
| time trend | | no | no | in data | no | in data |
| k | | 3 | 3 | 3 | 4 | 4 |
| N | | 120 | 120 | 120 | 131 | 131 |
| Smpl | | 88.01 97.12 | 88.01 97.12 | 88.01 97.12 | 88.01 98.11 | 88.01 98.11 |

Notes: "Coeff" is the $\hat{\alpha}$ coefficient from equation (1). "Pred" indicates predicted sign. LR is the likelihood ratio test statistic for the null of zero cointegrating vector against the alternative of one. c.v. is the asymptotic critical value for the test of zero cointegrating vectors against the alternative of one [finite sample critical values in brackets]. CR's is the number of cointegrating relations implied by the asymptotic critical values [finite sample critical values]. Coefficients are long run parameter estimates from the Johansen procedure described in the text. Panel 2 Reversion coefficients are the $\hat{\alpha}$ coefficients from equation (5). k is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period. All regressions include centered seasonal dummies. VECM Adj-R² and SER refer to the exchange rate error correction model.

^{a/} Significant at the 5% MSL.

During the latter part of the sample, South African inflation fell relative to interest rates. This suggests that the Dornbusch (1976) model -- which sets $\beta_5 = 0$ and $\beta_4 < 0$ -- might become more relevant in this later sample. Omitting inflation also avoids multicollinearity. Doing so yields the results in columns 2 and 3; plausible estimates between 0.68 to 0.73 are obtained for relative money stocks. While the interest rate coefficient is not statistically significant when no time trends are assumed to be in the data, it is significant in column 3. Unfortunately, in this truncated sample, it is not possible to reject the no cointegration null hypothesis.

In this later period, the short run dynamics differ substantially from that in the entire sample. In particular, the exchange rate now moves in response to disequilibria, as represented by the error correction term. Interest rates also respond in column 3. This means that if the nominal exchange rate exceeds (is weaker than) the long run equilibrium rate justified by the fundamentals, two things happen. First, the exchange rate "reverts", or gets stronger. Second, interest rates rise. Unfortunately, one cannot tell whether this represents the monetary authorities' response to a depreciated currency, or not.

So far, the discussion has addressed the behaviour of the Rand up to 1997; investigation of the last year of data has been deferred due to the difficulties in tracking exchange rates during the period of widespread turmoil in currency markets associated with the Russian and Brazilian crises. Still it is of interest to see if the monetary model identified in this paper survives such.

In columns (4) and (5), results extending the sample to 1998M11 are reported. A crisis dummy accounting for the effects of the Russian default is included as a deterministic regressor. The dummy takes on a value of 1 for the period 1998M07-09. Interest rates now enter with statistical significance, and a negative sign (although one can only reject the no cointegration null in column 5 at the 5% MSL). This is consistent with the sticky price model alluded to earlier.

The model's static fit is very good (see Figure 7); since it is an in-sample forecast, this is not very surprising. Conducting a dynamic forecast yields a less accurate fit, but the model still performs relatively well, in the sense that it does not go completely off track as is often the case.

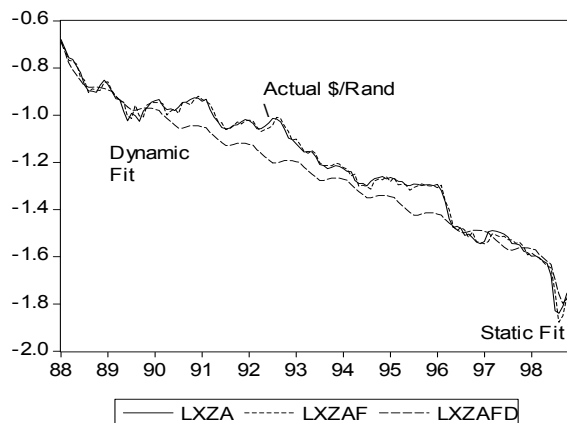


Figure 7: Bilateral exchange rate and static and dynamic forecasts from Table 2 column 5

Conclusions

A monetary model of the exchange rate appears to fit the South African experience over the past two decades. However, it is easy to overstress the results. A flexible price monetary model fits the entire sample, but does not seem completely appropriate for the more recent period since 1988. With the decline in inflation rates, a sticky price monetary model -- wherein high interest rates strengthen a currency -- becomes more applicable.

The short run dynamics do not appear to be particularly well explained. The proportion of short run exchange rate variance explained seldom exceeds 30%, even in-sample. Thus, there will be a large amount of uncertainty attendant with use of this specification for forecasting purposes. Whether any other structural model could do better remains an open question.

Data Appendix

The data are primarily drawn from IMF, *International Financial Statistics*, April 1999 CD-ROM. Some other data is drawn from the Economic Data Sharing System (EDSS) at the IMF.

- Bilateral exchange rate (commercial), *IFS* line ah, in US\$/national currency unit, end of period. Bilateral exchange rate (financial) from EDSS.
- Multilateral exchange rate (nominal and real CPI deflated) from IMF Information Notices System, June 1999 version. Uses 1990 trade weights. Rest-of-World CPI

calculated by dividing the nominal by real indices, and multiplying by the South African CPI (seasonally adjusted), from EDSS.

- Multilateral exchange rate (real PPI deflated) from JP Morgan, June 1999 version. Uses 1990 trade weights for the 1987-1999 sample period. [Http://www.jpmorgan.com](http://www.jpmorgan.com). Rest-of-World PPI calculated by dividing the IMF nominal index by the JP Morgan real index, and multiplying by the South African PPI.
- Narrow money, *IFS* line 34, in national currency units. Broad money is narrow money plus quasi-money *IFS* line 35, in national currency units. US M1 and M2, national definitions, seasonally adjusted, retrieved from St. Louis FRED system, June 1999.
- US income is industrial production, seasonally adjusted, *IFS* line 66*eyc*. South African income is manufacturing production, seasonally adjusted.
- Interest rates are short term, interbank interest rates, *IFS* line 60b, in decimal form.
- Consumer price index, *IFS* line 64, 1990 = 100.
- Producer price index, *IFS* line 63, 1990 = 100. South African PPI (ex. Imports) price index from EDSS.
- Inflation is the first difference of $\log(\text{CPI})$, annualized.
- Relative price variable:

$$\tilde{\omega} \equiv \log(PPI^{US} / CPI^{US}) - \log(PPI^{SA} / CPI^{SA})$$

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Appendix Table 1
 Tests for Purchasing Power Parity
 Johansen Cointegration Results

| Var. | Pred | (1) | (2) | (3) | (4) | (5) |
|------------|------|---------------------|-------------------|----------------------|----------------------|---------------------|
| Currency | | \$ | RoW | \$ | RoW | RoW |
| Deflator | | CPI | CPI | PPI | PPI | PPI |
| LR | | 96.7 | 61.3 | 73.5 | 46.0 | 69.2 |
| c.v. | | 35.7[37.1] | 35.7[36.6] | 35.7[37.1] | 35.7[36.6] | 54.5[57.6] |
| CR's | | 3[3] | 1[1] | 3[3] | 1[1] | 1[1] |
| p | (1) | 14.655 (4.490) | 0.500 (0.655) | 4.066*** (0.961) | 1.493*** (0.536) | 0.974 (0.685) |
| p^{SA} | (-1) | 4.827*** (1.257) | -1.145 (0.228) | -1.473*** (0.150) | -1.527*** (0.254) | -1.261** (0.335) |
| p^{gold} | | | | | | 0.340 (0.358) |
| time trend | | in data | in data | in data | in data | in data |
| k | | 3 | 2 | 3 | 2 | 2 |
| N | | 228 | 228 | 228 | 142 | 142 |
| Smpl | | 80.01 98.10 | 80.01 98.10 | 80.01 98.10 | 87.04 98.12 | 87.04 98.12 |

Notes: "Coeff" is the coefficient from equation (2). "Pred" indicates predicted sign. LR is the likelihood ratio test statistic for the null of zero cointegrating vector against the alternative of one. c.v. is the asymptotic critical value for the test of zero cointegrating vectors against the alternative of one [finite sample critical values in brackets]. CR's is the number of cointegrating relations implied by the asymptotic critical values [finite sample critical values]. Coefficients are long run parameter estimates from the Johansen procedure described in the text. k is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period.

Appendix Table 2
The Monetary Model of Exchange Rates Including Gold Prices
Johansen Cointegration results

| Panel A2.1 | | | | | | |
|-------------------------------------|------|----------------------|----------------------|----------------------|----------------------|-----|
| Coeff | Pred | (1) | (2) | (3) | (4) | (5) |
| LR | | 211.6 | 184.1 | 129.5 | 108.1 | |
| c.v. | | 102.1[110.2] | 94.2[101.7] | 111.0[127.7] | 103.8[119.4] | |
| CR's | | 3[3] | 3[3] | 3[1] | 1[0] | |
| $m^{US}-m^{SA}$ | (1) | 0.878*** (0.208) | 0.912*** (0.224) | 0.866*** (0.2001) | 0.850*** (0.196) | |
| $y^{US}-y^{SA}$ | (-) | -1.591** (0.753) | -1.481 (0.802) | -0.731 (0.708) | -0.685 (0.702) | |
| $i^{US}-i^{SA}$ | (-) | 1.002 (1.008) | 0.799 (1.074) | -0.945 (1.418) | -1.367*** (1.437) | |
| $\delta^{US}-\delta^{SA}$ | (+) | 5.490*** (1.116) | 6.345*** (1.330) | 1.951* (1.027) | 2.371*** (1.132) | |
| p^{gold} | (+) | -1.730*** (0.459) | -1.686*** (1.330) | -1.782*** (0.759) | -1.789*** (0.756) | |
| Panel A2.2: Reversion coefficients | | | | | | |
| $\ddot{A}s$ | (-) | -0.006 (0.008) | -0.001 (0.008) | -0.039*** (0.011) | -0.033*** (0.012) | |
| $\ddot{A}(m^{US}-m^{SA})$ | (+) | -0.025*** (0.009) | -0.010 (0.008) | -0.072*** (0.021) | -0.041* (0.022) | |
| $\ddot{A}(y^{US}-y^{SA})$ | (-) | 0.008 (0.007) | 0.007 (0.006) | -0.029* (0.017) | -0.053*** (0.017) | |
| $\ddot{A}(i^{US}-i^{SA})$ | (±) | 0.007 (0.004) | 0.007 (0.006) | -0.010* (0.006) | -0.014*** (0.006) | |
| $\ddot{A}(\delta^{US}-\delta^{SA})$ | (+) | 0.093*** (0.015) | 0.095*** (0.014) | 0.057* (0.032) | 0.062* (0.035) | |
| $\ddot{A}p^{gold}$ | (+) | -0.049*** (0.012) | -0.044*** (0.011) | -0.049*** (0.017) | -0.052*** (0.019) | |
| Adj-R ² | | .12 | .12 | .29 | .34 | |
| SER | | 0.032 | 0.032 | 0.016 | 0.019 | |
| time | | no | in data | no | indata | |
| k | | 3 | 3 | 3 | 3 | |
| N | | 227 | 227 | 120 | 120 | |
| Smpl | | 80.01 98.11 | 80.01 98.11 | 88.01 97.12 | 88.01 97.12 | |

Notes: "Coeff" is the $\hat{\alpha}$ coefficient from equation (1). "Pred" indicates predicted sign. LR is the likelihood ratio test statistic for the null of zero cointegrating vector against the alternative of one. c.v. is the asymptotic critical value for the test of zero cointegrating vectors against the alternative of one [finite sample critical values in brackets]. CR's is the number of cointegrating relations implied by the asymptotic critical values [finite sample critical values]. Coefficients are long run parameter estimates from the Johansen procedure described in the text. Panel 2 Reversion coefficients are the $\hat{\alpha}$ coefficients from equation (5). k is the number of lags in the VAR specification of the system. N is the effective number of observations included in the regression. Smpl is the sample period. All regressions include centered seasonal dummies.

Proposals Regarding Restrictions on Capital Flows

Jeffrey Frankel

A variety of measures to slow down international capital flows are in place somewhere in the world, and some additional measures have been proposed by academic observers. The debate over the desirability of such measures has been sterile however. It generally consists of arguments for and against the virtues of free and unfettered capital markets. On the one hand, proponents of introducing “sand in the wheels” of international financial markets point to evidence of inefficiencies, anomalies, bubbles, speculative attacks and crashes. On the other hand, opponents (which, at least until recently, has included the heavy majority of academic economists) argue that any measures to weed out alleged destabilizing short-term capital flows would inevitably also inhibit desirable long-term capital flows. Neither group bothers much to distinguish among the details of the various possible measures. (appendix 1, shows how a number of important details differ across three such proposals: Chile’s deposit requirement on inflows, the Eichengreen-Wyplosz deposit requirement proposal, and the Tobin tax proposal.) In the wake of the East Asia crisis, a more careful consideration may be warranted.

Review of arguments on efficiency of financial markets

Financial integration between an emerging-market country and the rest of the world has many advantages. First, for a successfully developing country, the rate of return to domestic capital is sufficiently high that investment can be financed more cheaply by borrowing from abroad than out of domestic saving alone. Second, investors in richer countries can earn a higher rate of return on their saving by investing in the emerging market than they could domestically. Third, everyone benefits from the opportunity to diversify away risks and smooth disturbances.

Fourth, letting foreign financial institutions into the country improves the efficiency of domestic financial markets. Over-regulated and potentially inefficient domestic institutions are subject to the harsh discipline of competition and the demonstration effect of having examples to emulate. At the same time, the governments face the discipline of the international capital markets in the event they make policy mistakes (e.g., in their domestic regulatory duties).

There are some indications, however, that financial markets do not always work quite as perfectly as the happy view of the economic theorist suggests. Most salient are such recurrent disruptions as the 1982 international debt crisis, 1992-93 crisis in the European Exchange Rate Mechanism, 1994-95 Mexican peso crisis, and 1997-98 Asian financial crisis. It is difficult to argue that investors have punished countries when and only when the governments are following bad policies. First, large inflows often give way suddenly to large outflows, with little news appearing in between that might explain the change in sentiment. Second, contagion sometimes spreads to countries where fundamentals appear strong. Third, the recessions that have hit emerging market countries in such crises have

been of such magnitude that it is difficult to argue that the system is working well.

This note will proceed on four premises: (i) modern financial markets do not work perfectly, as the recurrence of crises attests, but (ii) we are better off with them than without them, so that (iii) as countries industrialize, open markets should be the goal (eventually, if not right away), and (iv) the interesting question in the meantime is *whether or not there exists some possible tinkering with the freedom of capital movement that might potentially reduce the frequency or severity of the crises that occur.*

Five possible aims of controls

What would be the precise aim of capital controls, or other lesser “sand-in-the-wheels” measures? There are five possibilities:

- to discourage **capital outflows** in the event of a balance of payments crisis.
- to discourage **capital inflows in the aggregate**, before a crisis.
- to modify the **composition of capital inflows**, in particular to discourage short-term banking inflows, especially those denominated in foreign currency, relative to other inflows.
- to create some friction for **all foreign exchange transactions**, with the aim of reducing volatility.
- to decouple **domestic interest rates** from foreign, with the aim of restoring some monetary independence.

We consider each of these categories in turn.

(1) Discouraging **capital outflows**.

Controls on capital outflows have been very common, especially among smaller and less developed countries. Even the United States, in the 1960s, imposed an interest equalization tax, and a “voluntary” foreign credit restraint program that put ceilings on banks’ foreign lending. France and Italy maintained such controls up until the late 1980s. Conditional on a speculative attack occurring, controls on capital outflow can help slow down or minimize the loss of reserves or the required increase in interest rates. Controls are generally leaky, however. (There is the problem of “leads and lags” in payments for imports and exports, for example.) Needless to say, controls on outflows can also weaken the discipline that international financial markets place on the quality of macroeconomic policy.

How are controls on outflows relevant for ex ante efforts to make crises less likely, as opposed to ex post crisis management? For a country experiencing potentially excessive

capital inflows, liberalization of controls on outflow may offer a way of reducing net national indebtedness. On the other hand, international investors sometimes respond to such liberalization by accelerating the capital inflows. The explanation is that liberalization boosts investors' confidence -- particularly their confidence that they will be able to take their money back out of the country in the future if they wish.²¹ This logic could be inverted to suggest that if a country wants to discourage volatile capital inflows, it could do so by retaining controls on outflows, thereby deliberately depressing investor confidence. This suggestion may sound facetious, until one considers that China weathered the 1997 Asian crisis well, in part, because it had sufficiently low capital account convertibility that it had avoided running up large debts.

(2) Discouraging **capital inflows**

The usual motivation for controls on inflows is to prevent overvaluation and over indebtedness. Traditionally, high levels of capital inflow and cumulative indebtedness (expressed as a share of GDP or exports), often in conjunction with a currency overvalued in real terms, have been considered key indicators of the risk of financial crises. Mexico and Thailand had large net capital inflows in 1994 and 1996, respectively, in advance of their crises. It is probably easier to keep capital out than to keep it in. Some countries appear to have had some success discouraging inflow (particularly temporary inflows), so as to limit real appreciation and aggregate debt, and subsequently to have withstood contagion from others' crises.²²

The historical record, however, suggests that aggregate borrowing is a poor predictor of crises. More important is the mode of financing -- see below -- and the uses to which the funds are put.

Furthermore, limiting aggregate debt is the same as limiting the extent to which both foreign investors and the domestic economy can benefit from the above-mentioned benefits of capital inflows. An economy which is growing rapidly and has sound economic policies, good financial regulation, and high marginal product of capital should in principle be able to sustain quite a large debt ratio, to the benefit of both debtor and creditors.

Controls may have a role to play as a temporary measure when a country faces a large upsurge of inflows. They might help a government "play for time" until it can determine whether the funds are going to useful investments, which will generate the foreign exchange earnings needed in the future to service the debt, or whether they are instead going, for example, to consumption. After several years, policy-makers may have a better

²¹ Bartolini and Drazen (1997) and Laban and Laraine (1994).

²² Reinhart and Smith (1998) explain the controls on inflows adopted in the 1990s [up to 1996] by Indonesia, Malaysia, Philippines, Thailand, Brazil, Chile, and Colombia, and discuss the issues. They conclude that controls on inflows are more likely to be effective than controls on outflows.

idea whether their country is the next tiger, justifying the inflows, or merely the subject of a speculative bubble. [Figures on growth in output and productivity in developing countries are typically available only with a lag as long as two years.] While Chile's removal of some of its inflow controls in 1998 have been described by some as evidence against their utility, it could instead be interpreted as an appropriate recognition by Chile that the controls should be maintained only in the phase of the cycle when inflows are potentially excessive.

The efficacy of controls on inflows is likely to be greater than controls on outflows, in part because it is easier to "scare capital off" than to "keep it in against its will." Enforceability remains a serious limitation however, the more so as time goes by. Also, controls that were intended to be temporary may turn out to be kept too long. In that case, the argument that controlled countries cut themselves off from an advantageous means of financing their development remains a serious limitation.²³

(3) Modifying the *composition of capital inflows*

Statistical evidence suggests that the composition of inflow is a significant leading indicator of the probability of currency crashes occurring. The higher the reliance on foreign direct investment, the lower the probability of crisis. The higher the reliance on foreign-currency borrowing that is short-term or intermediated through banks, the higher the probability of crisis.²⁴ The theory is that bank flows in particular are more vulnerable to moral hazard problems than are other sorts of modes of finance, and that a mismatch of short-term bank liabilities with longer-term bank assets (e.g., real estate) leaves a country vulnerable. FDI is thought to be relatively more stable than banking inflows.²⁵ Flows of longer-term securities have the advantage that the price of a stock or bond adjusts automatically in the event of adverse developments ("risk-sharing"), with fewer sticky issues of bankers' negotiating over terms of rollovers or restructuring.

This conclusion lends support to proposals for controls that would seek to change the composition of capital inflows, rather than the total magnitude. Taxes or restrictions on short-term inflows might shift the composition toward longer maturities.

²³ A theoretical calculation of Reinhart and Smith (1998) gives the result that, although a country can benefit from a temporary control on inflows in response to a temporary shock, if the government mistakenly retains the control after the shock disappears (for a roughly equal period of time), then the net effect becomes detrimental.

²⁴ For econometric evidence, see Frankel and Rose (1996). Among many commentators expressing concerns about the stability of short-term, foreign-denominated, bank borrowing is Greenspan (1998, p. 8).

²⁵ As pointed out by Claessens, Dooley and Warner (1995), FDI can be a source of volatility in the balance of payments. (For example, firms in time of crises can transfer funds from subsidiary to parent, even while controls prevent other investors from getting their money out of the country.) Nevertheless, statistical results suggest that countries that host FDI are less likely to have currency crises.

Chile imposed its famous implicit tax on inflows in 1991. Initially it was a non-interest bearing deposit requirement equal to 20% of the investment, to be maintained at the central bank for a period that varied from 90 days to one year depending on the maturity of the loan. In 1992, the reserve requirement was raised to 30% of the foreign loan, and the period required to be held at the central bank was fixed to one year no matter the maturity of the loan. In addition, there is a longstanding requirement that all FDI stay in the country for at least one year.²⁶ A common interpretation of Chile's experience is that the controls have succeeded in changing the composition of the capital inflow, in the direction of longer-term maturities, while having little effect on the total magnitude.²⁷ Colombia's controls are evaluated similarly.²⁸

One possibility is the idea of placing some penalty on banks' short-term borrowing from abroad in foreign currency, perhaps in the form of requiring a non-interest-earning deposit with the central bank. This formulation combines aspects of other proposals, including the Chilean feature of taxing inflows of maturity less than one year, with the Eichengreen-Wyplosz proposal of aiming the restriction specifically at banks.²⁹ The penalty could take the form of higher reserve requirements on banks' foreign borrowing than are placed on other bank borrowing (Argentina-style). As such, it need not be inconsistent with the pursuit of properly timed liberalization of the overall capital account. Rather it would fall well within the kind of enhanced prudential banking regulation that the United States and the IMF have for some time urged on developing countries, and for which the need has become increasingly obvious in the wake of the East Asian crisis.³⁰

Moreover, reserve requirements that penalize bank borrowing can be viewed from a third angle, in addition to their interpretation as capital controls or prudential banking

²⁶ The source is Velasco and Cabezas (1997, 19-20). For more on Chile's controls, see Edwards (1998) and Gosin and French-Davis (1996).

²⁷ References, in addition to *ibid*, include Eichengreen (1998), Valdes-Prieto and Soto (1996), and Chucamaro, Laban, and Larrain (1996), who use regression analysis to confirm a relationship between the observed decline in the share of short-term capital inflows into Chile and the deposit scheme.

²⁸ Colombia adopted non-remunerated reserve requirements on firms' liabilities in foreign currency in 1993. Cardenas and Barrera (1997).

²⁹ Eichengreen, Tobin and Wyplosz (1995). On the other hand, it has been argued that if such restrictions are applied to banks alone, financial markets will find ways around them (Garber, 1995, 1997).

³⁰ E.g., Frankel (1995, p.188). Fischer (1997) argues that the IMF's plans for generalized capital account convertibility are not inconsistent with restrictions on financial institutions of this sort. Cooper (1998, p.8), however, argues that an inconsistency does arise because convertibility without harmonization would lead to " 'unfair competition,' i.e., to competitive pressures on those countries that choose prudential regulations more rigorous than those prevailing in serious competitors."

regulations: sterilization of reserve inflows so as to prevent increases in the money supply and real appreciation of the currency. This form of sterilization does not have the disadvantage of inducing a problematic “quasi fiscal deficit.” (This is the deficit that results when the central bank has sterilized reserve inflows by issuing high-interest-rate domestic obligations in exchange for low-interest-rate US Treasury bills.) Penalty reserve requirements on foreign borrowing substitute low- or zero-interest-rate central bank liabilities for foreign assets, rather than high-interest-rate liabilities.

(4) **Friction for all foreign exchange transactions**

The fourth idea is the much-discussed (though little-analyzed) Tobin tax, the proposal for a small uniform tax on all buying and selling of foreign exchange, with no attempt to ascertain the purpose of the transactions.³¹ It is an overstatement to claim, as many do, that there is no possible reason to believe that a Tobin tax would discourage short-term destabilizing speculation without harming desirable longer-term movements or trade in goods and services. A small Tobin tax would automatically dampen short-term capital movements (such as the majority of transactions that take place in well-developed foreign exchange markets, which are typically unwound within hours), more than it would discourage long-term movements or trade in goods and services. There exists at least some reason to suspect that the former are more likely to represent destabilizing speculation than the latter.

But in any case, the entire debate applies properly to the currencies of major industrialized countries with floating exchange rates. The proposal is not very relevant to the desire to minimize balance of payments crises among countries that peg or stabilize their exchange rates. It is hard to see how a Tobin tax of a fraction of a percent would discourage speculators who are hoping to earn overnight returns of 30 or 40 percent by speculating against the French franc in 1993 or the new Taiwan dollar in 1997. Another manifestation of the difference is the geographical scope of the proposed restriction. The Tobin tax, as proponents and detractors alike agree, would have to be extended to all financial centers worldwide. In the context of proposals to minimize the danger of payments crisis in a given country, the capital controls contemplated pertain only to transactions between that country and the rest of the world.

(5) **Decoupling interest rates**

The fifth and final possible motivation for controls, on all capital account transactions, does apply to countries with fixed exchange rates. That would be the motivation to decouple domestic interest rates from foreign interest rates in order to retain some independence for monetary policy. Reisen (1993a,b) argued pre-crisis that Southeast

³¹ The original proposal came from Tobin (1979). Frankel (1996) reviews the issues. Problems with enforceability of a Tobin tax are explained by Garber (1996) and Kenen (1996).

Asian countries had succeeded in doing something that Latin American and European countries could not: achievement of the “Impossible Trinity” of fixed exchange rates, open capital markets, and monetary independence at the same time.

The goal of policy independence is not directly relevant to the goal of minimizing financial crises. But the hypothesis, more specifically, was that in the face of large capital inflows the Southeast Asians were able to sterilize the increase in reserves, so as to avoid real appreciations of their currencies. A reasonable interpretation is that they in fact were able to attain (only) a modest amount of policy independence through modestly incomplete liberalization of capital markets.³² And one could argue that the ill-fated real appreciations of 1996-97 in the end showed that, in Asia as elsewhere, the sterilization strategy is not sustainable indefinitely.

Sequence of liberalization

Even if one stipulates the superiority of a system with no government-imposed distortions, there is an important question of the optimal order of liberalization, since most countries begin with many distortions. Should capital controls be removed before or after domestic financial regulations? Before or after trade barriers are liberalized? Before or after a budget deficit is eliminated, or monetary stabilization is complete? There is a general principle that removing one barrier can sometimes make things worse, rather than better, if other barriers remain in place -- an application of the “Theory of the Second Best.”

In the context of financial liberalization, the argument is usually that if capital controls are not still in place at a time when other problems are being addressed, misleading market signals may attract an excessive capital inflow and current account deficit, leaving the country over indebted and vulnerable. When the unfinished business is monetary disinflation or an outstanding budget deficit, the market signals include high real interest rates and a currency overvalued in real terms, both of which result in capital inflows and current account deficits. If the unfinished business is domestic financial liberalization -- an end to “financial repression” that keeps rates of return to savers artificially low and allocates funds to investment inefficiently -- the shortfall in domestic saving can likewise lead to a large capital inflow. If the unfinished business is removal of import barriers, the period of adjustment of the economy once again can lead to a large current account deficit (especially if consumers increase import purchases out of fear that the reforms may be reversed in the future) and capital inflow.

The conventional wisdom is thus that opening of the financial markets should come last, after these other issues are resolved. (The question of the optimal order of liberalization was first extensively considered in the context of liberalization programs in the “Southern

³² Frankel (1994). A mainstream viewpoint would be that countries should liberalize as they develop; and that if an industrializing country is large enough to satisfy the criteria for an independent optimum currency area, then it should achieve its policy independence by means of exchange rate flexibility, not capital controls.

Cone” of South America in the late 1970s, and more recently in the context of the transition economies.³³)

Indonesia is an example of a country that is said to have reversed the conventional wisdom, pursuing international financial liberalization more rapidly than domestic financial (and other) liberalization.³⁴ There is a possible justification for this reverse sequencing that some have proposed for Japan and other Asian countries. In an environment where banks, brokers, and the rest of the financial sector are highly protected, regulated, and dependent on longstanding customer relationships, they may lack experience at competing in terms of the fees they charge for their services or at adapting to new ways of doing business. Like any vested interest group, they may be able to oppose liberalization politically. In such an environment, if international liberalization comes first, the “demonstration effect” of seeing foreign financial companies operating in their markets may teach them new ways of doing business. In any case, the political opposition may become irrelevant, as banks are forced to offer competitively high interest rates to their depositors, and brokers are forced to charge competitively low fees to their clients, to avoid losing business to the foreign newcomers. This argument notwithstanding, however, the financial crises recently experienced by Japan (1990-97) and Indonesia (1997) might be interpreted as supporting the conventional wisdom that international liberalization should be saved for last.

One should add a note: domestic liberalization and macroeconomic stabilization do not complete the list of pre-requisites to full opening of the capital account. Recent events have reminded us that another pre-requisite is a well-developed domestic financial market, including adequate mechanisms for prudential banking regulation. This pre-requisite is no less important because it cannot be described as removal of a government-imposed distortion. Prudential banking regulation might be described as an appropriate government remedy to market failure -- the danger of bank runs and the consequent need for a safety net, the fact that the payments mechanism is implicated when banks are at risk, and the political necessity of bailing out individual depositors.

The highway analogy

A popular analogy is used to illustrate the proper role of the moral hazard problem in the context of efficient capital markets, and can be extended to illustrate the proper sequencing of financial liberalization as well. The analogy, reportedly due to Robert Merton originally, is that today’s financial markets are like superhighways. They get you where you want to go fast. By this is meant that they are useful: they help countries finance investment and therefore growth. But accidents occur, and they tend to be bigger than they used to be when people were not able to drive so fast. The lesson is not that

³³ Edwards (1984, 1985) and McKinnon (1991).

³⁴ Cole and Slade (1992) and Sabirin (1993) for Indonesia; Frankel (1984) for Japan.

superhighways are bad. But drivers need to drive carefully, society needs speed limits, and cars need air bags.

The moral hazard problem is, of course, that IMF/G7 “bailout” programs to reduce the impact of a crisis reduce the incentive of borrowers and lenders to be more careful in the future. The bailout programs are represented in the analogy by the seat belts and air bags, which cushion the driver in the event of an accident. It is a standard principle of economics that actions in one area can generate partly offsetting reactions in another. That is not in itself a reason not to take action. In our highway example, there is research demonstrating that drivers react to seat belts and airbags by driving faster and less safely than they used to. But that is not a reason to dispense with air bags. If it were, that logic would say that to discourage dangerous driving, we should put a spike in the steering wheel (as Michael Mussa of the IMF says).

The capital controls are represented by speed bumps or posted speed limits, which are necessary when coming into a town, even if not on an open highway. Drivers sometimes have the illusion that in the event of a sudden obstacle, they can respond quickly enough to avoid a crash. (They cannot have such illusions when it comes to air travel, which may account for the fact that people typically have an irrationally greater fear of air travel than car travel. The analogy is that perhaps bankers have greater illusions of control than do equity investors.) In part because crashes involve others, the public has an interest in keeping speeds safe.

A country with a primitive domestic financial system should not necessarily be opened up to the full force of international capital flows before the appropriate domestic market reforms and prudential financial regulations have been put into place. If the planned route for a superhighway draws near to a primitive village, it is not a good idea to design an off-ramp that dumps high-speed traffic into the center of town before its streets are paved, intersections are regulated, and pedestrians learn the dangers of walking in the street. But neither is it practical or desirable to try to insulate the village from the modern world indefinitely. Emerging-market countries should proceed *both* with domestic reforms and opening to the outside world, in the proper balance and sequence.

Conclusion

The East Asia crisis has further weakened support for the proposition that financial markets work flawlessly. Accordingly, more attention is falling on proposals that some developing countries should introduce some sort of international capital controls, or at least should slow down the speed with which they remove existing controls. Measures that apply a tax penalty to capital flows (or an implicit tax, such as the deposit requirements) are to be preferred on efficiency grounds to controls that amount to outright ceilings or prohibitions. Of these proposals, perhaps the strongest case can be made in favor of Chile-style penalties on short-term capital inflows, prudential restrictions on banks’ borrowing in foreign currency, or the intersection of these two measures. These

policies might do no more than change the composition of capital inflows for a while -- away from banks' short-term borrowing in foreign currency. But such an effect might nonetheless be useful, particularly when a country is experiencing a large inflow and is unsure whether the funds are being put to good use. Statistical evidence suggests that the probability of a future currency crisis goes up when capital inflows take the form of short-term bank borrowing, and goes down when they take the form of foreign direct investment.

Worryingly, however, one observes a frequent failure to target intervention this narrowly. It is important that experts distinguish among different types of capital controls (with regard to short-term vs. long-term, inflow vs. outflow, bank loans vs. securities transactions, and temporary vs. permanent) and among the different circumstances that countries find themselves in, and that they think more carefully about the pros and cons of each specific case. Countries have all too often used controls to shield their economic policies from the discipline of international markets. There is a risk that blessing one particular targeted kind of capital control would have the effect of encouraging the indiscriminate use of controls. Since financial market integration, on the whole, does more good than harm; this is a danger that should be taken into account as part of the analysis of any proposal.

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APPENDIX 1

Three proposals for “sand in the wheels” capital controls, and how they differ

| | Chile's deposit requirement on inflows | Eicher green-Wyplisz deposit requirement proposal | Tobin tax proposal |
|--|---|--|--|
| 1. Motive | Prevent over-indebtedness | Protect balance of payments | Reduce volatility in exchange rate (and raise revenue) |
| 2. Tax applied to: | Capital inflows | Capital outflows (and inflows) | All foreign exchange transactions, including trade |
| 3. Paid immediately by: | Foreign investors | Banks | All traders (mostly banks) |
| 4. Paid immediately to: | Central bank (foreign currency earnings) | Central bank (seignorage only) | Tax authority (domestic revenue) |
| 5. Relationship of tax amount to interest rate | Rises with foreign interest rate | Rises with domestic interest rate | Invariant to interest rate |
| 6. Relationship to maturity | Fixed amount (falling with maturity in % p.a. terms) when maturity < 1 year | Falls with maturity? But does not apply to intra-day trading | Fixed amount. In % p.a. terms, falls continuously with maturity. |
| 7. Where imposed | One country (facing inflows) | One country (facing outflows) | Must be world-wide |
| 8. Probable level of tax rate | Moderate (30 % times interest rate) | High (to discourage speculative attacks) | Low (to avoid distortions and substitution) |