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Market timing on the JSE using exchange rate fluctuations

ABSTRACT

Conventional market timing is the process of switching asset classes to meet expectations about economic or sector related forecasts. This paper extends existing research by examining the risk and return outcomes of a market timing approach in which portfolios of 'Rand-play' and 'Rand-hedge' shares are switched according to fluctuations in the exchange rate.

Three sets of exchange-rate sensitive portfolios are identified on the JSE. A market timing strategy of switching between these portfolios on a monthly basis is then examined for the 10 year period 1998 – 2008.

The results show that exceptional returns, in excess of 35% per annum above the benchmark can be obtained, dependant upon forecasting ability. To be certain of out-performing the benchmark, a forecasting accuracy of around 70% is required, but even with considerably lower ability it is possible to out-perform. These findings indicate that whilst similar levels of forecasting accuracy are required, bigger potential returns are possible for market timing strategies relating to currency fluctuations when compared to conventional asset switching strategies.

1. INTRODUCTION

Market timing is often defined as the process of shifting the weights in portfolio constituents in accordance with expected market conditions (see Jeffery 1984; Sy 1990; Sharpe 1975). For example, during bull phases of the market, market-timers will increase the weighting of equities versus cash, and vice-versa for bear phases. Many researchers (see De Chassart and Firer, 2004; Levis and Liodakis, 1999; Firer, Ward and Teeuwisse, 1987) have shown that, whilst the potential returns of such a strategy are attractive, the success of the investor is dependent upon forecasting ability. Generally speaking, high levels of prediction are necessary to out-perform a buy-and-hold strategy.

This paper investigates a market timing strategy on the JSE related to exchange rate fluctuations in the Rand. Various researchers (see Barr, Kantor and Holdsworth, 2007; Barr and Kantor, 2005) have identified shares which react positively or negatively to exchange rate fluctuations affecting the Rand. By increasing the weight of so-called 'Rand-hedge' shares when the Rand is expected to weaken or increasing the weight of 'Rand-play' shares when the currency is expected to strengthen, a market-timer can enhance her returns – subject to the accuracy of her currency predictions.

Using three independent sets of currency sensitive shares, this research examines the risk and return space on the JSE that would have been experienced by market-timers for different levels of predictive accuracy over the period October 1998 – October 2008.

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2. LITERATURE REVIEW

Investors employ numerous strategies to enhance their returns, one of which is the strategy of market timing (de Chassart and Firer, 2004). Traditional market timing is the process of switching between asset classes in anticipation of major turning points in the market. For example, Jeffrey (1984) examined the potential returns from a market timing strategy on the New York Stock Exchange for the period 1926 to 1982. He showed that perfect timing ability in switching between equities and cash would have produced a return of 10,8% above the S&P 500 return; but if all timing decisions were incorrect, the return would have dropped to 17,6% below that of the S&P 500. He concluded that the risks assumed by the market timer were not in proportion to the incremental rewards that could be gained.

Firer *et al*. (1987) repeated Jeffrey's study on the J.S.E. They found results that were consistent with those of Jeffrey, and concluded that, on average, for perfect timing it was possible to improve returns by 18%. However, a predictive accuracy of more than 85% was required to be certain of beating the returns obtainable by simply holding the asset. For an equal probability of loss or gain relative to the buy-and-hold strategy, a forecasting accuracy of 69% was needed.

Many studies (Chua, Woodward and To, 1987; Droms, 1989; Firer, Sandler and Ward, 1992) have shown that the more frequently a portfolio is reviewed, the higher are the potential rewards and the lower are the required levels of predictive accuracy. Studies in different stock markets all found that the returns that give the share market its high average returns are predisposed to occur infrequently over a small number of periods.

Conventional market timers run the risk of being out of equities at key moments (Jeffery 1984). This important issue is captured by the adage: "it is not market timing that counts, but time in the market that

counts". Accordingly, this study proposes to examine a pure equity market timing strategy, in which switches are made between two portfolios of equities, one positively correlated to the exchange rate, and the other negatively.

Adler and Dumas (1984), in their seminal article, argue that exchange rate movements particularly impact on future cash flows of importers, exporters and multi-national companies with foreign operations. Consequently, the share prices of such companies are affected by exchange rate movements to the extent that a firm's competitive landscape may be significantly altered. Other researchers posit other factors as indicators of a firm's sensitivity to exchange rates; *viz* industry factors, size and competitiveness (see Allayannis and Ihrig, 2001; Allayannis and Ofek, 2001; Doukas, Hall and Lang, 2003; Bodnar, Dumas and Marston, 2002).

Adler and Dumas (1984), measure the degree, or exposure, of a firm to exchange rate movements in terms of the following regression equation:

$$R_j = \alpha_j + \delta j XR + \varepsilon_j \quad \ldots (1)$$

where:

α_j is the constant movement for firm *j*,

R_j is the stock return for firm *j*,

XR is the percentage change in an exchange rate variable, defined as the home currency price of foreign currency,

δj is the total elasticity of firm value to the exchange rate change and

ε_j the residual (see also Bodnar and Wong, 2003).

Macro economic factors are not accounted for in this initial model formulation and to adjust for macroeconomic changes that can be spuriously attributed to exchange rate exposure, researchers have adjusted the model. The addition of a firm's beta to Equation 1 helps to eliminate spurious macro economic changes. The exposure model therefore is rewritten as:

$$R_j = \alpha_j + \gamma_j XR + \beta_j R_m + \varepsilon_j \quad \ldots (2)$$

where:

γ_j is the exchange rate exposure elasticity of the firm and

β_j is the firm beta relating to the market portfolio

R_m is the return on the market portfolio

According to Bodnar and Wong (2003), the adjusted method developed by Adler and Dumas (1984) is the most commonly used method by researchers (see Chue and Cook, 2008; Barr, Kantor and Holdsworth, 2007; Dominguez and Tesar, 2001; Jorion, 1990).

Doidge, Griffin and Williamson (2006) note that mixed results are reported on the exchange rate exposure of firms in different developed countries. Jorion (1990), in a study on the impact of exchange rate exposure in US Multi-national companies (MNC), finds that only 5% of the sample of 287 MNC's showed contemporaneous exposure to exchange rates. Bodnar and Gentry (1993) report higher exchange rate exposure for US firms at 23%, whilst 21% of Canadian firms and 25% of Japanese firms report exposure to exchange rate fluctuations. In contrast, Bartram and Karolyi (2006) report weak empirical evidence in non-financial firms in the US, Canada and Japan.

Dominguez and Tesar (2006) in a study of eight non-US countries find that, in five countries, 20% of the firms exhibit exchange rate exposure and in four of these countries (*viz:* Germany, Japan, the Netherlands and the United Kingdom) the percentage is at 40%.

Koutmos and Martin (2003) establish that exchange rate exposure exists in firms from Germany (11%), Japan (33%), the UK (67%) and the US (44%).

In an emerging market setting Salifu, Osei and Adjasi (2007), in their review of exchange rate exposure of listed companies on the Ghana stock exchange, report a significant exposure to the US dollar (55% of firms) and UK pound sterling (35% of firms). Similarly, Kiymaz (2003) finds that 107 of the 109 companies listed on the Istanbul Stock Exchange are sensitive to exchange rate fluctuations. Dominguez and Tesar (2006) report that from the 199 Chilean firms reviewed, 86% of the firms exhibit exposure to the US dollar.

Barr and Kantor (2005) in a study on the JSE over the period 2001 – 2003 identify two classes of firms sensitive to exchange rate fluctuations, *viz* 'Rand-hedge' and 'Rand-play' shares.

Despite all the empirical studies conducted, researchers still report mixed results on the economic significance of exchange rate exposure and the impact on firm value (see, e.g. Chue and Cook, 2008; Dominguez and Tesar, 2001; Choi and Prasad, 1995; Jorion, 1990). Factors such as macroeconomic shocks, country of origin, spurious relationships between exchange rate changes, specific firm value changes, placement of a firm in an industry and emerging markets' exchange rate volatility are all themes that may have contributed towards the different reported results.

Allayannis and Ofek (2001) note that in instances where research indicates that (some) firms are not

significantly affected by exchange rate movements, a plausible explanation may relate to currency hedging activities undertaken by firms.

The purpose of this study is to determine if a market timing strategy will outperform a buy-and-hold strategy of an appropriate index. The following null hypothesis was formulated: A strategy of market-timing, whereby a portfolio is switched between shares with positive exposure into shares with a negative exposure to exchange rate fluctuations, will not outperform the returns of buying and holding an appropriate index, at a 'reasonable level' of market timing ability.

3. METHODOLOGY

The first step in the methodology was to identify portfolios of 'Rand-play' and 'Rand-hedge' shares. Three approaches were used:

Firstly, the portfolios identified by Barr *et al.* (2007) were used (henceforth known as "BKH"). Companies in the JSE's ALSI40 index were grouped into: 'Rand-play' (15 constituents) and 'Rand-hedge' (11 constituents) – see Appendix 1.

Secondly, Investec Limited (Investec, 2008) identify the constituents of their so-called "Z-share Exchange Traded Funds", one of which is a 'Rand-play' ETF (comprising 8 companies), the other a 'Rand-hedge' ETF (comprising 7 companies). Although the constituent shares in each of these ETFs does change over time, those listed on 31 May 2008 were included in this study (henceforth known as the "Investec-z" shares) – see Appendix 1.

Thirdly, a replicating portfolio approach was used to identify those shares which experienced the highest level of sensitivity to exchange rate fluctuations after extracting other known effects on the JSE. Monthly returns were computed for all shares listed continuously on the JSE between 31 December 2001 and 31 May 2008. Following the methodology of Mutooni and Muller (2007), 12 equity style indices were constructed over the same period to isolate the size effect, the value/growth effect and the resources effect (all of which have been shown to exist on the JSE). In addition, the monthly returns of the nominal effective Rand exchange rate (NEER) were calculated. Each share was then 'regressed' against these 13 independent variables and the ten shares with the highest positive and negative weights against the NEER were identified (henceforth referred to as the "NEER" portfolio) – see Appendix 1.

Closing monthly share prices of the companies identified above were obtained from McGregorBFA, and monthly returns were calculated. Dividends were excluded.

For each of the strategies indicated above (i.e. BKH, Investec-z and NEER), a combined, equal weighted portfolio, containing the constituents of both the 'Rand-hedge' and the 'Rand-play' portfolios was constructed as a buy-and-hold benchmark. The benchmark portfolios were re-balanced monthly to form three appropriate benchmark indices. In the same manner, indices were created for each of the Rand-hedge and Rand-play portfolios.

The market-timer will choose the asset portfolio where the return is maximised for the holding period. Since perfect-timing is unlikely, the potential wealth at the end of the period will be determined by two factors: the accuracy of the predictions, and the particular periods missed. The diminished returns are calculated by a multiplier factor which is used to determine the best case scenarios and worst case scenarios (Firer *et al.*, 1987).

The following formula was used to determine the multiplier:

$$M = \frac{1 + R_l / 100}{1 + R_h / 100} \quad \ldots (3)$$

where:

M = multiplier;

R_l = lowest available return in a holding period;

R_h = highest available return in a holding period.

A multiplier (M) was calculated for every holding period and in turn was used to establish the best and worst case scenarios through the following formula:

$$W_n = W_{100\%} * M1 * \ldots * Mz \quad \ldots (4)$$

where:

W_n = ending wealth after n periods with (z/n)% forecasting precision;

$W_{100\%}$ = ending wealth after n periods with 100% forecasting precision;

M_z = multiplier with magnitude rank z;

Z = number of periods for which an incorrect forecast was made.

To establish the best case boundary, multipliers were ranked in ascending order. To establish the worst case boundary, multipliers were ranked in descending order. The annualised returns (R_{pa}) were plotted against the percentage forecasting accuracy to determine the upper and lower bounds of the risk return 'playing field' first identified by Jeffrey (1984).

4. RESULTS

The summary statistics for each portfolio over the period October 1998 – October 2008 are presented in Table 1.

As can be seen from Table 1, the Investec-z Rand-hedge and the BKH Rand-hedge portfolios achieve the highest value over the period (R8,23 and R7,03 respectively), although the highest (modified) Sharpe ratios related to the benchmark portfolios (i.e. the combined hedge/play shares). The BKH Rand-play portfolio had the lowest Sharpe ratio (16,2%). The NEER Rand-play portfolio produces one of the highest Sharpe ratios (22%) with the lowest beta (0,42).

Figure 1 shows the performance of the portfolios over time:

From Figure 1 it is apparent that the Rand-hedge portfolios do particularly well over the 10 year review period; this is probably an artefact of the data start-up period. It is interesting to note that the Investec-z Rand-play portfolio does particularly well over the latter half of the data.

Figure 2 shows the value of a R1 investment in each of the portfolios, but after applying a perfect market timing strategy (max) and a completely incorrect market timing strategy (min).

Table 1: Summary statistics of portfolio monthly return data

	BKH			Investec-z			NEER			
	Hedge	Play	Bench mark	Hedge	Play	Bench mark	Hedge	Play	Bench mark	ALSI40
Mean	1,6%	1,0%	1,3%	1,8%	1,6%	1,7%	1,4%	0,9%	1,2%	1,3%
Median	1,0%	1,2%	1,2%	2,2%	1,5%	2,1%	1,2%	0,9%	1,6%	1,3%
Stdev	7,9%	6,1%	5,6%	7,7%	6,6%	6,1%	7,4%	4,3%	5,1%	5,5%
Max	26,4%	16,2%	15,4%	24,9%	19,0%	17,1%	22,3%	10,8%	10,4%	14,0%
Min	-17,8%	-17,2%	-15,9%	-22,1%	-17,3%	-18,2%	-18,5%	-13,3%	-14,0%	-14,0%
Value	7,03	3,31	2,12	8,23	6,98	7,61	5,17	3,10	4,13	4,68
CAGR	21,6%	12,7%	17,9%	23,5%	21,5%	22,6%	17,9%	12,0%	15,3%	16,7%
Sharpe	20,7%	16,2%	23,5%	22,8%	24,5%	27,7%	18,4%	22,0%	22,5%	24,2%
Beta	1,11	0,69	0,90	1,15	0,84	0,99	1,06	0,42	0,74	1,00

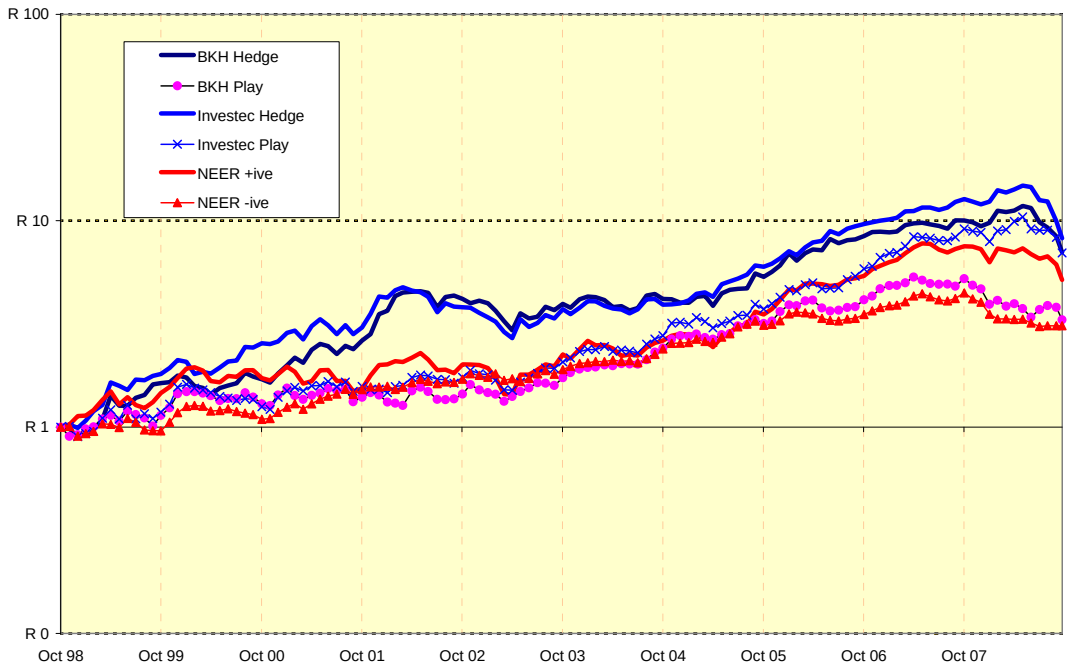

Figure 1: Portfolio performance over the period Oct 1998 – Oct 2008.

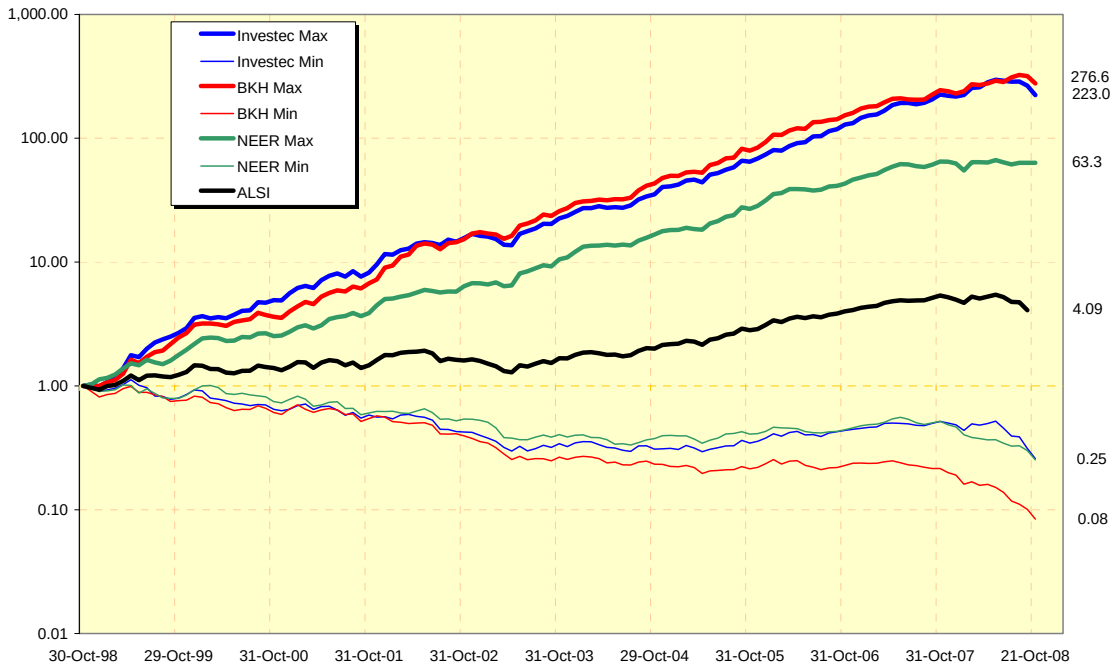

Figure 2: The value of correct versus incorrect timing across the portfolios

As can be seen, the Investec and BKH portfolios display similar results for perfectly correct market timers. A R1 investment given to either of these portfolios would have grown to approximately R250 over the 10 years. The downside on the BKH portfolio (resulting in a residual value of R0,08) is significantly worse than that of the Investec-z portfolio (R0,25). The NEER market timer would have achieved more modest returns; a maximum of R63 and a minimum of R0,25. By way of comparison, a R1 investment in a buy-and-hold the ALSI would have resulted in R4,09 over the review period (an annualised return of 15,1%).

Figure 3 shows the market timing risk/return analysis in the form of a 'football', as described by Jeffery (1984).

As discussed above, a buy-and-hold strategy of the JSE ALSI index would have yielded an average annual return of 15,1%, with no market timing risk. However, as can be seen from Figure 3, significantly better returns can be achieved through market timing, provided the timer is reasonably accurate in predicting exchange rate fluctuations. If we ignore the NEER results which were the least successful of the three portfolios, it is apparent that to be certain of out-performing the buy-and-hold the index return, a market timer would need to predict currency changes with an accuracy in excess of 70% (point "A"). This is perhaps an unreasonably harsh estimate, in that the market timer is equally likely to miss good periods and bad periods, in which case an accuracy level of around 35% is required (point "B") on the Investec-z portfolio. Further detail is provided in Table 2.

Table 2 highlights the risk and reward structure for market timing on exchange rate fluctuations. In this instance, the required forecasting accuracies are determined against the benchmark portfolio; which is a buy-and-hold portfolio comprising the equally weighted constituents of the Rand-hedge and Rand-play shares in each strategy.

Investors who are able to achieve high levels of accuracy are likely to achieve returns that exceed the benchmark by up to 50%. This result is significantly higher than other researchers. Ahmed, Lockwood and Nanda (2002) reported returns in excess of 37%, Levis and Liodakis (1999) reported an excess of 17,4% whilst Firer *et al.* (1987) reported excess returns of 18% - once again, these related to conventional timing.

As illustrated earlier, high levels of predictive accuracy (above 75%) are necessary to be certain of out-performing. However, to have an equal chance of out-performing, accuracy levels of around 50% are required, and this drops as low as 40% for the Investec-z portfolio. These findings concur with those of Ahmed *et al.* (2002), Levis and Liodakis (1999), Firer *et al.* (1987) and Jeffrey (1984) who reported similar levels of accuracy required to exceed benchmarks, although it must be noted that these studies related to conventional market timing, and not to fluctuating exchange rates.

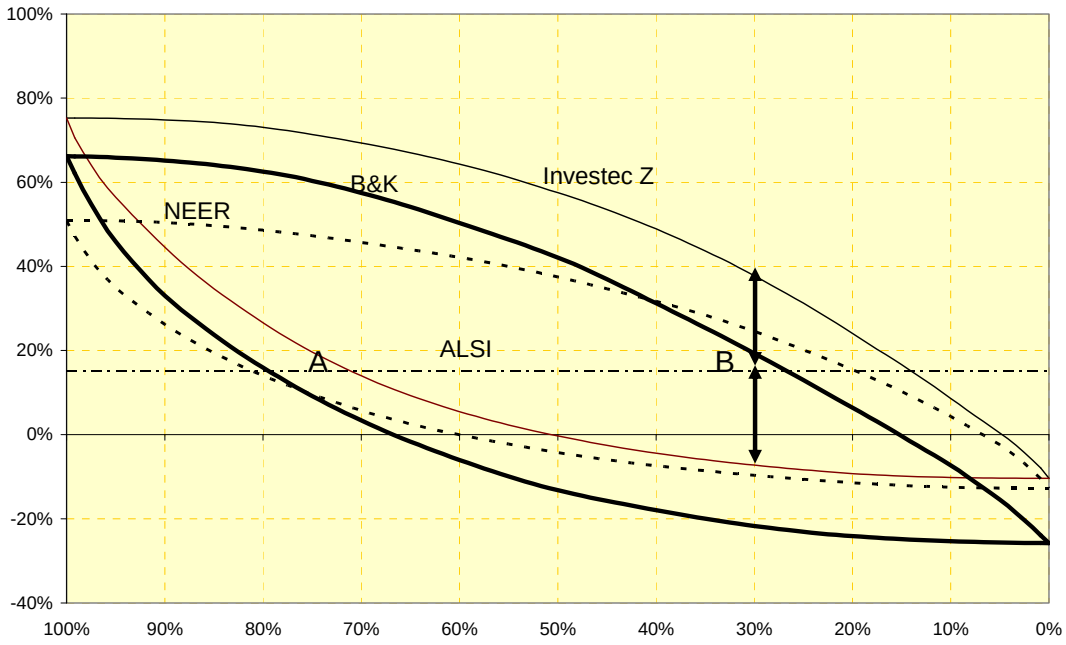

Figure 3: The risk/return 'football' for all three market timing strategies

Table 2: Returns and forecasting accuracy levels required

	Annualised returns achieved:		
Accuracy	**BKH**	**Investec-z**	**NEER**
100%	66,2%	75,3%	50,9%
0%	-25,8%	-10,4%	-12,7%
	Forecast accuracy required:		
Strategy	**BKH**	**Investec-z**	**NEER**
Certainty of beating benchmark return	80,8%	76,7%	80,8%
Equal chance of beating benchmark return	54,2%	40,0%	46,7%
Portfolio Benchmark Return	17,9%	22,6%	15,3%

To further assess the risk of market timing, researchers have applied other measures. Firer *et al.* (1987) calculated the percentage number of switches required to achieve the maximum return against the total number of periods in which the investment was held. Jeffery (1984) defined a 'compression ratio', by establishing the number of periods in which the most significant returns are generated (and which can therefore not be missed) expressed as a percentage of the number of holding periods. Portfolios with low compression ratios are more risky as these represent fewer, more significant periods, that 'cannot be missed'. See Table 3 below.

Table 3: Compression ratios

Compression Ratio		
BKH	**Investec-z**	**NEER**
15,7%	21,5%	18,2%

Table 3 indicates that, for the Investec-z market timing strategy for example, around 22% of the periods comprise those months where the importance of being in a particular portfolio is most critical. If the investor misses these specific months, she cannot beat a buy-and-hold strategy even if she correctly times the remaining 78%. From Table 3 it can be seen that the Investec-z strategy is therefore less risky than the others.

A further consideration is that of transaction costs incurred when portfolios are switched. Transaction costs vary with the value of the transaction, and with the type of instrument used. For small deals transaction costs could be as higher than 2%, whereas for large transactions, or through the use of derivatives, transaction costs would be less than 0,5%. For purposes of this study, transaction costs were established conservatively at 0,98% (Standard Bank, 2008). An optimal timing strategy, with a monthly review period, requires approximately 55 (45%) switches to achieve maximum returns. Although the actual cost of the transaction is fixed, the timing of the transaction determines the impact on the overall return. In the case of the BKH portfolio, for instance, the inclusion of transaction costs at 0,98% reduces the return on investment from 75% to almost 64%. Although this is a significant reduction, the performance still remains in excess of 35% from the benchmark.

The impact of transaction costs is obviously related to the frequency of the review period. Given this consideration, the findings for this study are in line with those of Jeffrey (1984), who reports (using quarterly review periods) that transaction costs will reduce the ending portfolio value by approximately 13%. Firer *et al.* (1987) set transaction cost at 1,38% and report a reduction in potential average annual return of only 5% whilst the required forecasting accuracy increases by 6%. Levis and Liodakis (1999) report that transaction costs of 1% result in a 5% drop in returns.

5. CONCLUSIONS

The research highlights the potential risks and returns relating to a market timing approach in which portfolios of equities are switched according to fluctuations in the exchange rate over the period October 1998 to October 2008. The analysis suggests that a market timing strategy may generate returns of up to 35% in excess of traditional buy and hold strategies for accurate market timers.

Shares with a positive rand exchange rate exposure contribute more frequently to maximum returns than shares with negative exchange rate exposure. This is consistent with the performance of the Rand over the past six years, in which the Rand was (mostly) stable against major foreign currencies.

The feasibility of a market timing strategy is dependent upon prediction ability. To be certain of out-performance, a market timer must be able to forecast currency fluctuations correctly 75% of the time. However, the level of predictive accuracy can drop to around 40% to equal a buy and hold strategy, if one assumes an equal chance of missing good verses bad periods. These findings reject the null hypothesis that market timing, based on exchange rate movements, will not outperform the returns of buying and holding an appropriate index, at a 'reasonable level' of market timing ability.

The excess returns found in this study are significantly higher than returns presented in previous studies, whilst the risks are similar. Furthermore, other researchers have found that shorter review periods can enhance out-performance (see Chua *et al.* 1987; Droms, 1989; Firer *et al.* 1992), and transaction costs can be reduced through derivatives (see Waksman *et al*., 1997). These factors may improve the possible benefits arising from timing exchange rate fluctuations.

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Appendix 1: Composition of the three exchange-rate sensitive portfolios

Portfolio	JSE Ticker	Name	ERE : NEER
NEER Positive Exchange Rate Exposure ("ERE")	RAH	Real Africa Holdings Limited	100%
	APA	Apexhi Properties Limited	100%
	CRM	Ceramic Industries Limited	83%
	ADR	Adcorp Holdings Limited	56%
	DEL	Delta Electrical Industries Limited	55%
	CSB	Cashbuild Limited	46%
	OCE	Oceana Group Limited	45%
	NED	Nedbank Group Limited	39%
	TBS	Tiger Brands Limited	38%
	MDC	Medi Clinic Corporation Limited	33%
NEER Negative ERE	DDT	Dimension Data Holdings PLC	-59%
	DTC	Datatec Limited	-59%
	CAT	Caxton CTP Publishers and Printes	-64%
	PSG	PSG Group Limited	-64%
	NHM	Northam Platinum Limited	-83%
	HAR	Harmony Gold Mining Company Limited	-91%
	MRF	Merafe Resources Limited	-98%
	SNT	Santam Limited	-131%
	FBR	Famous Brands Limited	-136%
	AVI	AVI Limited	-165%

Portfolio	JSE Ticker	Name
Investec Rand-play	ARI	African Rainbow Minerals Limited
	TBS	Tiger Brands Limited
	ACL	ArcelorMittal SA Limited
	AEG	Aveng Limited
	BAW	Barloworld Limited
	MTN	MTN Group Limited
	SLM	Sanlam Limited
	SHP	Shoprite Holdings Limited
Investec Rand-hedge	SOL	SASOL Limited
	AGL	Anglo American PLC
	RCH	Richemont Securities AG
	AMS	Anglo Platinum Limited
	BIL	BHP Billiton PLC
	IMP	Impala Platinum Holdings Limited
	LBT	Liberty International PLC

Portfolio	JSE Ticker	Name
BKH Rand-Play	FSR	First Rand Bank
	IPL	Imperial Holdings Ltd
	LGL	Liberty Group Ltd
	MTN	MTN Group Ltd
	NPK	Nampak Business Support
	NPN	Naspers Limited
	NED	Nedcor Ltd
	NTC	Network Healthcare Services
	PIK	Pick n Pay
	RMH	RMB Holdings
	SBK	Standard Bank Group
	ASA	ABSA Bank
	SLM	Sanlam Limited
	TBS	Tiger Brands Limited

Portfolio	JSE Ticker	Name
BKH Rand-Hedge	WHL	Woolworths Holdings Ltd
	SOL	Sasol Ltd
	AGL	Anglo American Plc
	ANG	Anglo Gold Limited
	AMS	Anglo American Platinum Corp
	ACL	ArcelorMittal SA Limited
	BIL	BHP Billiton Plc
	GFI	Gold Fields Limited
	HAR	Harmony Gold Mining
	IMP	Impala Platinum Holdings
	LBT	Liberty International Plc
	SAP	Sappi Limited
	KMB	Kumba Resources Limited

The following companies commenced trading after 1 October 1998:

- Liberty International PLC listed during June 1999
- Apexhi Properties Limited listed during September 2001

During August 2008, Richemont Securities AG de-listed on the JSE but was been included in the sample selection until de-listing.

The following company underwent a name change:

- Mittal SA became ArcelorMittal SA Limited

Exclusions from individual portfolios

Based on the criteria for selection, Kumba Resources Limited was omitted from the selection since Kumba Resources Limited divested into Exxaro Resources Limited and Kumba Mining. The nature of the company changed materially and therefore has been excluded from the analysis. The BKH Rand Hedge portfolio therefore consists of only 11 companies.