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Emerging and Frontier Africa's Currency Carry Trades: Any Value to Asset Allocation Decisions?

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Abstract

Carry trade, an investment strategy which takes advantage of the failure of uncovered interest parity condition (UIP), is well-documented in literature as profitable, though not in all markets. We evaluate the viability of emerging and frontier Africa's carry trades as an asset class and their significance for asset allocation decisions using Sharpe ratio contribution algorithm and a varying number of portfolio performance measures. We used monthly spot exchange rates and interbank interest rates covering the period January 2002 to December 2014. The results show that the emerging and frontier Africa's carry trades exhibit signs of improving the risk-adjusted performance of portfolios. We show that African carry trade's contribution to portfolio Sharpe ratio is

relatively higher than the S&P 500 index and some risky assets over the period 2002-2014, and to a large extent, satisfies the criteria of an asset class. Thus, fund managers may consider diversifying their portfolio with African carry trades.
JEL Classification: C32 F31 G11 G15

Keywords: *Currency Carry Trade, Sharpe Ratio Contribution, Asset Class, Asset Allocation*

1. Introduction

Carry trade, an investment strategy where investors borrow from low interest (funding) currencies and invest the funds in assets denominated in high interest (target) currencies, has dominated academic discussions in recent times. This trade should not be profitable if the UIP holds, however there appears to be a subtle consensus in the extant literature about its profitability, at least in developed and some emerging markets, in violation of the UIP condition (Ames et al., 2013; Brunnermeier et al., 2008; Burnside et al., 2010, 2006; Menkhoff et al., 2012a). As to whether the carry trade is fit to represent an asset class is of great interest to portfolio managers, hedge funds industry, and investors as they have been regularly searching for new asset classes that generate superior returns and at the same time diversify their portfolios (Galati and Melvin, 2004; Galati et al., 2007; Popova et al., 2007; Ferri, 2010; Marston, 2011). Over the last two decades, a variety of new instruments, such as the Deutsche Bank's G10 Carry Spot index, Collateralised Foreign Exchange Obligations (CFXOs), CSFB and Barclays Intelligent Carry Trade Indices, designed exclusively for the purpose of carry trading have emerged (Galati et al., 2007; Lynch, 2007). Thus, testing for the viability of carry trade especially for Africa's emerging and frontier markets, as an asset class and prudent investment will be of great value to investors. An asset class must at least meet one of two major criteria (Korhonen and Kunz, 2009); its risk-adjusted performance must match or outperform equity index; or it should be suitable to be used as an alternative asset. This paper tests the viability of carry trade as an asset class and also assesses its impact on risk-adjusted performance of existing portfolios, focusing on seven emerging and frontier African countries. According to S&P Dow Jones Index Country Classification 2017, Egypt and South Africa are classified as emerging markets whereas Botswana, Cote

d'Ivoire, Ghana, Kenya, Mauritius, Morocco, Namibia, Nigeria, Tunisia and Zambia are classified as frontier markets. These classifications are made on the basis of stock market developments and general macroeconomic environment. Secondly, the paper examines the correlations between African carry trade returns and the traditional stock returns to ascertain whether carry trade can be used as an alternative investment. Finally, the paper quantifies the contribution of African carry trades to portfolio Sharpe ratio when included in a portfolio.

2. Literature review

There is extensive literature in financial economics on the classification of asset classes. Mull and Soenen (1997) and Goetzmann and Ibbotson (1990) assessed the viability of real estate as an asset class using rudimentary, risk-adjusted performance measures and regression analysis. More recently, Inderst (2010) reviewed the potential of infrastructure for diversification and inflation protection in investor portfolios. Das, Kadapakkam and Tse (2013) and Korhonen and Kunz (2009) provide the most relevant works on the assessment of carry trade as a prudent investment and alternative asset class. Das, Kadapakkam and Tse (2013) studied the viability of carry trade as an asset class, using the risk-adjusted portfolio performance measures with realised daily carry trade (PowerShares DB G10 Currency Harvest) returns from Bloomberg from 1989 to 2011. They concluded that carry trade, when included in an existing portfolio, improves the performance of that portfolio and its risk-return profile. Korhonen and Kunz (2009), on the other hand, investigated whether carry trade in its simple form can be considered as a prudent investment or mere lottery. They used exchange and interest rate data from the G10[3] currency countries from 1993 to 2009 for carry trade and compares to the S&P 500, the FTSE 100, the NIKKEI 225 as well as the MSCI World. They concluded that carry trades outperform equity indices regardless of the risk-adjusted measure used for evaluation and thus represents a prudent investment. These studies ignored carry trades of Africa's emerging and frontier markets and thus raise the question as to whether those findings are applicable to the region. Additionally, Das, Kadapakkam and Tse (2013) looked at the impact carry trade has on the risk-adjusted performance of a portfolio, when it is included or when it

[3]Represents the most liquid and traded currencies of the world

replaces an asset in that portfolio. The extent to which the performance of the portfolio is attributable to the inclusion of (or substitution of asset with) carry trade, and the quantification of carry trade's impact on portfolios remains unanswered in the literature. This paper contributes to the literature in answering those questions.

3. Methodology

We implement the carry trade strategy by taking a long position in seven (selection based on availability of data) high-yielding, emerging and frontier African currencies, namely, the South African Rand (ZAR), Egyptian Pound (EGP), Moroccan Dirham (MAD), Nigerian Naira (NGN), Ghanaian Cedi (GHS), Botswana Pula (BWP), and Tunisian Dinar (TND), and a short position in four of the low-yielding currencies among the most traded currencies in the world, namely, the US Dollar (USD), Euro (EUR), Japanese Yen (JPY), and British Pound Sterling (GBP). The seven African currencies are paired with the four G10 currencies generating 28 currency pairs. Using Wang, Chung and Guo (2013) approach in equation 1, we estimate carry trade returns for all 28 currency pairs as follows:

$$Z_{t+1} = \ln\left(1 + (i_t^* - i_t)\right) - \Delta S_{t+1} \quad (1)$$

where i_t^* is the interest rate of target countries at time *t,* and i_t is the interest rate of the funding countries, the log return of the interest rate differential is $\ln\left(1 + (i_t^* - i_t)\right)$, and $\Delta S_{t+1} = S_{t+1} - S_t$. The risk-adjusted performances of these carry trade returns are compared with the stock market returns of the seven African countries estimated with equation 2 (Tsay, 2002, p.4).

$$R_t = [\ln(P_t) - \ln(P_{t-1})] \times 100 \quad (2)$$

where P_t and P_{t-1} are the current and the previous month's stock price respectively.

We also estimate the Spearman's correlation coefficients among the various carry trade returns (results available on request) and also with the stock returns of the seven African countries to assess their diversification properties. Since carry trade and stock returns do not follow normal

distribution, the choice of non-parametric Spearman's correlation is appropriate (Varadi and Bee, 2010).

Five portfolios are constructed out of these currency pairs. The first portfolio simultaneously takes a short position for all the four low-yielding currencies and a long position for all the seven high-yielding African currencies similar to the G10 carry index (Brunnermeier et al., 2008). The remaining four portfolios take a short position in the USD, JPY, EUR, and GBP in succession and a long position in the seven African currencies.

3.1 Performance measures

We employ four risk-adjusted performance measures: the Sharpe ratio, Adjusted Sharpe ratio (ASR), Value-at-risk (VaR) and Sortino ratio, as used by Das, Kadapakkam and Tse (2013).

Sharpe ratio is the average return of an asset or a portfolio, in excess of the risk-free rate, divided by its standard deviation (Cogneau and Hubner, 2009) as expressed in equation 3:

$$\mathrm{SR} = \frac{\mathrm{R_i} - \mathrm{R_f}}{\sigma_\mathrm{i}} \tag{3}$$

where R_i is the return of the portfolio i, R_f is the risk-free rate, and σ_i is the standard deviation of portfolio i. The drawback of this measure however is that it assumes normality, and currency carry trade returns are rarely normally distributed (Mistry and Shah, 2013). Thus, the adjusted Sharpe ratio (ASR) which accounts for skewness and kurtosis is employed to deal with the non-normality problem. The ASR, according to Pezier and White (2008) is defined in equation 4 as:

$$\mathrm{ASR} = \mathrm{Sharpe} \times \left[1 + \left(\frac{\mathrm{Skewness}}{6}\right)\mathrm{Sharpe} - \left\{\frac{\mathrm{Kurtosis}-3}{24}\right\} \times \mathrm{Sharpe}^2\right] \tag{4}$$

Value-at-risks (normal and historical) which measure the worst possible losses and Sortino ratios (see equation 5), a modification of the Sharpe ratio which seeks to differentiate harmful volatility from general volatility are also estimated. A large Sortino ratio indicates a low probability of a large loss.

$$Sortino\ ratio_p = \frac{R_p - MAR}{\sqrt{SV(R_p)}} \tag{5}$$

where R_p the expected return of the portfolio, MAR is the minimum acceptable return, and the SV is the semi-variance or variance of the negative asset or portfolio returns.

3.2 Sharpe contribution

We quantify the impact of the African carry trades on the conventional portfolios using Sharpe contribution algorithm proposed by Steiner (2011). Individual asset contributions to portfolio Sharpe ratio can be derived through the information ratio decomposition procedures (Steiner, 2011) specified in equation 6.

$$S_p = \sum_{i=1}^{n} \frac{w_i . \rho_{i,p} . \sigma_i}{\sigma_p} . \frac{1}{\rho_{i,p}} . \frac{r_i}{\sigma_i} \qquad (6)$$

where w_i is the weight of assets, $\rho_{i,p}$ is the correlation of assets with portfolio, σ_i is the standard deviation of assets, σ_p is portfolio standard deviation and r_i is excess return on assets.

3.3 Data

We collect monthly spot exchange rates for seven African currencies against four G10 currencies, totalling 28 currency pairs and interbank interest rates for the countries respectively. Data were collected for the period covering January 2002 to December 2014. The data were gleaned from Quantec EasyData and Bloomberg. Monthly carry trades returns were generated for all the 28 currency pairs using equation 1. As a benchmark for the equity markets, the paper selected the stock market indices of the seven African countries including JSE African All Share Index (JALSH) and others from the developed world such as MSCI World Index and S&P 500. The debt instruments used are the US 10-year bond and treasury bill rates for the USA, United Kingdom, Japan and the Euro area. The treasury bills rates are considered as the risk-free rates by investors.

4. Results

Table 1 presents the basic statistical description of carry trade and African stock returns. Except for the EUR/TND and GBP/TND

currency pairs which have negative historical returns, all the other currency pairs show positive returns. Standard deviations of carry trades are generally lower than that of the stock markets. However, the returns of the stock markets are generally higher than that of carry trades. This is consistent with the principle that the higher the risk the higher the rate of return (Bodie, Kane and Marcus, 2004, p.9). The skewness and kurtosis of the returns largely conform to the position in the literature that carry trades usually exhibit large excess kurtosis and negative skewness (Burnside et al., 2010). The returns are predominantly negatively skewed though GBPGHS, GBPMAD, GBPNGN, GBPTND and EURGHS are positively skewed. The African stock markets data are largely negatively skewed, consistent with stock returns behaviour in the literature (Alagidede, 2008). In 15 out of the 28 currency pairs, carry trade exhibit large excess kurtosis, which is an indication of abrupt crash risk or the peso effect[4] (Burnside et al., 2010).

As indicated in Table 1, the Sharpe ratio of USD/NGN (0.2006) for carry trade outperforms all stock markets in Africa. Tunisia, Egypt and Botswana stock markets however produced some impressive Sharpe ratios of 0.1597, 0.1555 and 0.1250 respectively. The profitable carry trades appear to be dominating their stock market counterparts on risk-adjusted basis. All the risk-adjusted measures point to the fact that some carry trades dominate stock market performance over the period studied. The adjusted Sharpe ratio, however, shows the stock markets of Tunisia, Egypt and Botswana outperform almost all the carry trades. This can be explained by the fact carry trade exhibit fatness in their tails and are more negatively skewed than their stock market counterparts. Sortino ratio from Table 1 shows that the stock market of Tunisia outperforms all the carry trades. This is followed by the USDNGN carry trade which has the next highest Sortino ratio (0.2583). Other high-performing currency pairs are the JPYNGN, JPYBWP, USDGHS, JPYGHS and GBPNGN.

The returns of the African carry trades are largely negatively correlated (results available on request) with themselves and also with the stock returns, meaning they can be combined to make a good portfolio. Figure 1 shows there is a risk-return trade-off of carry trades which

[4] The peso effect is a term in the international finance lexicon which originates from the Mexican peso currency crisis which was sparked by the sudden devaluation of the Mexican peso against the US dollar in December 1994 which resulted in widespread financial crisis ignited by capital flight. Thus currency crash risk is usually referred to as the peso effect.

indicates higher returns attract higher risk and vice versa. This behaviour is consistent with the behaviour of risky asset classes (Reilly and Brown, 2003) of all kinds which is an indication that African carry trades may be classified as an asset class.

4.1 Equally-weighted carry trade portfolios

We construct an equally-weighted portfolio of carry trade and use as proxy for Africa's carry trade index and compare with other stock market indices. The Johannesburg Stock Exchange Africa All Share Index (JALSH) is used as proxy for the African Stock Index. This is justified because the JALSH commands almost 80% capitalisation of all African stock markets put together (Alagidede, 2008). The Morgan Stanley International All World Stock Index (MSCI) and the S&P 500. Further, the paper adopts the US 10-year bond as a proxy for the international bond index.

It is evident from Table 2 that except for the 10-year bond, the African carry trade portfolios largely outperform the stock market indices. Apart from the EUR CT and GBP CT, the risk-adjusted performances for the remaining carry trade portfolios are surprisingly beating the S&P 500, MSCI and the JALSH. This can be explained by the general attractiveness of the large interest rate differential associated with the target and the funding currencies. Also, African carry trades volatility appears to be lower, relative to that of the stock markets in Africa. The Sortino ratio, which penalises only the downside risk of the portfolios, appears to agree with the Sharpe ratio in all cases except one. The JALSH over the period outperformed carry trade portfolio funded by the EUR. It would therefore be appropriate to conclude that the African carry trade funded by the EUR is prone to downside risk as compared to the stock returns, since returns per unit of downside risk are lower than that of JALSH. These results are consistent with the findings of earlier studies (Brunnermeier et al., 2008; Das et al., 2013; Korhonen and Kunz, 2009). Table 3 shows the correlation matrix which reveals a mix of low positive and negative correlations between carry trade portfolios and other asset classes. Thus portfolio formulation with these assets would be justified.

4.2 Impact of African carry trade on portfolio performance

This section is in two parts. The first part looks at carry trade as an alternative to the stock market index, specifically the S&P 500. In the second part, we complement the performance of an existing portfolio by adding the African carry trade to it.

4.2.1 Carry trade as substitute for equity index

In Table 4, the representative portfolio generates returns of 0.45% with a Sharpe and Sortino ratios of 0.051 and 0.097 respectively. We present carry trades as a substitute for S&P 500 in succession. By replacing the S&P 500 with the African carry trade (CT PORT), the portfolio's monthly return increases from 0.45% to 0.49%, with relatively lower portfolio volatility. Sharpe and Sortino ratios increase to 0.064 and 0.202 respectively. The returns again increase by replacing S&P 500 with USD CT (0.50%), JPY CT (0.53%), EUR CT (0.47%) and GBP CT (0.49). The risk-adjusted performance improved for each of these substitutions. This could partly be explained by the relatively low standard deviation associated with African carry trade returns.

4.2.2 Carry trade as complementary asset class

In Table 5, we repeat the representative portfolio, but this time, we add our African carry trade portfolios in succession. Comparing the portfolio *with* and *without* carry trade reveals that, generally, the portfolios with carry trade components perform better. This can be attributed to the fact that the African carry trade largely correlates negatively with the financial markets of the developed world. This finding is true for all the African carry trades except the EUR CT. In addition, the risk associated with carry trade appears to be relatively lower when compared with other risky assets. Hence, there exist significant diversification benefits whenever the African carry trade is combined with other risky assets. Investors seeking to improve the risk-adjusted performance of their investment and to reduce their portfolio risks could benefit from the inclusion of carry trade in their portfolio. Table 5 also shows that the inclusion of African carry trade significantly reduces the volatility of the portfolio, perhaps due to the fact that the carry trade portfolios themselves have lower volatility compared to the stock market. Furthermore, Table 5 reveals

that the VaR (5%) for the portfolio reduces significantly when the carry trade is included in the representative portfolio.

4.3 Sharpe ratio contribution

This section presents individual asset's contribution towards portfolio's Sharpe ratio. Table 6 presents the contribution when carry trade is used as a substitute, and Table 7 when carry trade is added to the representative portfolio.

In Table 6, the representative portfolio has a Sharpe ratio of 0.0557 with JALSH contributing 0.0346, followed by bond (0.0112), and the remaining shared amongst the MSCI (0.0099), and the S&P 500 (0.0000). Substituting the S&P 500 with CT PORT, USD CT, JPY CT, EUR CT and GBP CT brings remarkable improvement in the portfolio's Sharpe ratio. All the existing risky assets in the representative portfolio moved up more than twice their initial contribution to the portfolio Sharpe ratio. The contributions of the African carry trades in absolute terms are 0.0143, 0.0291, 0.0366, -0.0127 and 0.0040 for CT PORT, USD CT, JPY CT, EUR CT and GBP CT respectively, which are in most cases (except for EUR CT) more than five times the performance of the S&P 500 in a similar portfolio. Furthermore, it can be observed that the inclusion of carry trade in the portfolio contributed more than just their absolute numbers since their inclusion triggered some tremendous jumps in the contributions of all the assets in the portfolio.

Adding CT PORT to the portfolio in Table 7 seems to marginally improve the portfolio Sharpe ratio. The Sharpe ratio increases from 0.0557 to 0.0656 with the CT PORT's contribution of 0.0103 more than twice the value of the S&P 500 contribution. The trend is similar across all the other four carry trade portfolios. In fact, in the case of the CT PORT, USD CT and the JPY CT, it appears that the inclusion of carry trade actually reduces the contributions of the existing individual assets in their respective portfolios compared to the representative portfolio. This can be attributed to the high volatility as well the low contribution of the S&P 500 to the portfolio. On the other hand, including the EUR CT and the GBP CT in their respective portfolios not only marginally improved the Sharpe ratio of the portfolio but also increased the individual contributions of the various assets in the portfolio.

It is thus evident that the impact of carry trade on portfolio Sharpe ratio is more pronounced when it replaces the S&P 500 than it

complements the representative portfolio. This is because, the S&P 500 has almost perfect positive correlation with the representative portfolio and the five other portfolios constructed thereof and so may not present much diversification value to these portfolios. The carry trades, on the other hand, negatively correlate with the underlying portfolios and so offer significant amount of diversification benefits to the portfolio.

5. Conclusion

After examining 28 currency pairs, we found that the risk-adjusted performances of African carry trades largely outperform the stock markets indices and in some cases match the stock market performance. Almost all the currency pairs examined in this study show some profitability tendencies, and most importantly display diversification properties. We concluded that substituting the stock index in a conventional portfolio of risky assets with African carry trade influences the portfolio to perform better than adding the carry trade to the conventional portfolio. We also argue that carry trade makes a significant contribution to the portfolio's Sharpe ratio when included that portfolio. The paper concludes that the African carry trade may represent a viable asset class for investors to consider in their asset allocation decisions.

References

Ackermann, F., Pohl, W. and Schmedders, K. (2012) 'On the risk and return of the carry trade', Swiss Finance Institute Research Paper Series, , pp. 1–19.

Alagidede, P. (2008) 'African Stock Market Integration : Implications for Portfolio Diversification and International Risk Sharing', Proceedings of the African Economic Conference 2008, (April)

Ames, M., Bagnarosa, G. and Peters, G.W. (2013) 'Reinvestigating the Uncovered Interest Rate Parity Puzzle via Analysis of Multivariate Tail Dependence in Currency Carry Trades', SSRN Electronic Journal

Andreas Steiner, C. (2011) 'Sharpe Ratio Contribution and Attribution Analysis', Research Note, Andreas Steiner Consulting GmbH, (May), pp. 1–8.

Bodie, Z., Kane, A. and Marcus, A.J. (2004) Essentials of Investments.5th Edition.

Brunnermeier, M., Nagel, S. and Pedersen, L. (2008) Carry Trades and Currency Crashes., NBER Working Paper. Working Paper No. 14473.

Burnside, C., Eichenbaum, M., Kleshchelski, I. and Rebelo, S. (2010) 'Do Peso Problems Explain the Returns to The Carry Trade?', The Review of Financial Studies, 24(3), pp. 853–891.

Burnside, C., Eichenbaum, M., Kleshchelski, I. and Robelo, S. (2006) The Returns to Currency Speculation., NBER Working Paper Series. Working Paper No. 12489.

Cogneau, P. and Hubner, G. (2009) 'The (more than) 100 Ways to measure Portfolio Performance. Part 1: Standardized Risk-Adjusted Measures', Journal of Performance Measurement, 14, pp. 56–69.

Das, S., Kadapakkam, P.R. and Tse, Y. (2013) 'Is carry-trade a viable alternative asset class?', Journal of International Financial Markets, Institutions and Money, 24(1) Elsevier B.V., pp. 247–257.

Ferri, R.A. (2010) All About Asset Allocation. 2nd edn. McGraw-Hill Companies.

Galati, G., Heath, A. and Mcguire, P. (2007) 'Evidence of carry trade activity', BIS Quarterly Review, 3(September), pp. 27–41.

Galati, G. and Melvin, M. (2004) 'Why has FX trading surged? Explaining the 2004', BIS Quarterly Review, (December), pp. 67–74.

Goetzmann, W.N. and Ibbotson, R.G. (1990) 'The Performane of Real Estate as an Asset Class', Journal of Applied Corporate Finance, 3(1), pp. 65–76.

Inderst, G. (2010) 'Infrastructure as an asset class', EIB Papers, 15(1), pp. 70–105.

Korhonen, J. and Kunz, D. (2009) 'Currency Carry Trades – Prudent Investments or Just a Lottery?', Lund University, School of Economics and Management, Masters Thesis

Marston, R.C. (2011) Portfolio Design: A Modern Approach to Asset Allocation. John Wiley & Sons, Inc., Hoboken, New Jersey.

Menkhoff, L., Sarno, L., Schmeling, M. and Schrimpf, A. (2012) 'Currency Momentum Strategies', Journal of Financial Economics, 106(3), pp. 660–684.

Mistry, J. and Shah, J. (2013) 'Dealing with the limitations of the sharpe ratio for portfolio evaluation', Journal of Commerce & Accounting Research, 2(3)

Mull, S.R. and Soenen, L.A. (1997) 'U.S. REITs as an asset class in international investment portfolio', Financial Analysts Journal, 53(2), pp. 55–61.

Pezier, J. and White, A. (2008) 'The Relative Merits of Alternative Investments in Passive Portfolios', The Journal of Alternative Investments, 10(4), pp. 37–49.

Reilly, F. and Brown, K. (2003) Investment Analysis and Portfolio Management. 7th edn. U.S South-Western/Thomson Learning.

Steiner, A. (2011) 'Sharpe Ratio Contribution and Attribution Analysis', Social Science Research Network, (May), pp. 1–8.

Tsay, R.S. (2002) Analysis of Financial Time Series. John Wiley & Sons, Inc.

Varadi, D. and Bee, H. (2010) Using Non-Parametric Statistics to Improve Portfolio Optimisation., CSSA

Wang, Y.J., Chung, H. and Guo, J.H. (2013) 'A value-at-risk analysis of carry trades using skew-GARCH Models', Studies in Nonlinear Dynamics and Econometrics, 17(4), pp. 439–459.

Tables

Table 1: Performance of Carry Trade and Stock Monthly Returns

Asset	Average	Std Dev.	Kurtosis	Skewness	Sortino	Rf Rate	Sharpe	ASR	VaR(norm)	VaR(hist)
USD/BWP	0.0033	0.0342	0.5663	-0.2935	0.0986	0.0012	0.0631	0.0628	-0.0529	-0.0531
USD/EGP	0.0031	0.0160	69.5573	-6.8792	0.1464	0.0012	0.1197	-0.0159	-0.0232	-0.0127
USD/GHS	0.0034	0.0214	5.0386	-0.0410	0.1636	0.0012	0.1057	0.0999	-0.0318	-0.0389
USD/MAD	0.0024	0.0192	0.7512	-0.1795	0.1079	0.0012	0.0644	0.0641	-0.0292	-0.0303
USD/NGN	0.0050	0.0192	19.4738	-3.4056	0.2583	0.0012	0.2006	0.0216	-0.0265	-0.0243
USD/ZAR	0.0045	0.0383	3.1966	-0.6787	0.1294	0.0012	0.0862	0.0834	-0.0585	-0.0585
USD/TND	0.0007	0.0181	0.4436	-0.2339	-0.0229	0.0012	-0.0264	-0.0264	-0.0290	-0.0304
GBP/BWP	0.0044	0.0358	3.3653	-0.2046	0.1395	0.0021	0.0622	0.0613	-0.0546	-0.0519
GBP/EGP	0.0019	0.0265	8.3166	-0.9385	0.0482	0.0021	-0.0079	-0.0079	-0.0417	-0.0401
GBP/GHS	0.0026	0.0298	1.7296	0.4817	0.0823	0.0021	0.0149	0.0149	-0.0465	-0.0486
GBP/MAD	0.0014	0.0154	4.2096	1.2300	0.0405	0.0021	-0.0496	-0.0486	-0.0240	-0.0194
GBP/NGN	0.0040	0.0296	1.6965	0.2383	0.1559	0.0021	0.0622	0.0619	-0.0448	-0.0478
GBP/ZAR	0.0036	0.0354	0.9041	-0.4671	0.1028	0.0021	0.0404	0.0402	-0.0547	-0.0581
GBP/TND	-0.0002	0.0159	1.3931	0.4105	-0.1071	0.0021	-0.1493	-0.1435	-0.0263	-0.0243
EUR/BWP	0.0044	0.0363	12.0201	-1.3564	0.1313	0.0032	0.0340	0.0333	-0.0553	-0.0464
EUR/EGP	0.0016	0.0289	8.3992	-1.4699	0.0264	0.0032	-0.0553	-0.0547	-0.0459	-0.0427
EUR/GHS	0.0016	0.0301	2.0361	0.5775	0.0323	0.0032	-0.0514	-0.0509	-0.0478	-0.0468
EUR/MAD	0.0006	0.0048	-0.1136	-0.0257	-0.1073	0.0032	-0.5369	-0.5750	-0.0073	-0.0084
EUR/NGN	0.0031	0.0354	11.6408	-1.6522	0.0798	0.0032	-0.0013	-0.0013	-0.0550	-0.0519
EUR/ZAR	0.0030	0.0344	0.7205	-0.4810	0.0793	0.0032	-0.0064	-0.0064	-0.0535	-0.0606
EUR/TND	-0.0011	0.0089	0.9463	0.3436	-0.2879	0.0032	-0.4800	-0.3760	-0.0158	-0.0159
JPY/BWP	0.0059	0.0416	2.7713	-0.6651	0.1712	0.0001	0.1381	0.1290	-0.0625	-0.0654
JPY/EGP	0.0039	0.0273	6.4588	-1.2449	0.1456	0.0001	0.1371	0.1169	-0.0410	-0.0383
JPY/GHS	0.0043	0.0318	1.4426	0.2496	0.1614	0.0001	0.1319	0.1296	-0.0479	-0.0507
JPY/MAD	0.0033	0.0252	4.7903	-0.8240	0.1280	0.0001	0.1256	0.1142	-0.0381	-0.0360
JPY/NGN	0.0059	0.0339	4.8933	-0.8390	0.2136	0.0001	0.1700	0.1425	-0.0499	-0.0437
JPY/ZAR	0.0052	0.0441	6.1242	-1.3670	0.1292	0.0001	0.1160	0.1036	-0.0674	-0.0694
JPY/TND	0.0016	0.0240	4.1620	-0.8453	0.0319	0.0001	0.0602	0.0588	-0.0380	-0.0319
Tunisia-SR	0.0073	0.0382	1.3735	0.3040	0.2815	0.0012	0.1597	0.1559	-0.0556	-0.0491
Botswana-SR	0.0074	0.0502	1.6419	-0.5428	0.1838	0.0012	0.1250	0.1206	-0.0751	-0.0908
Egypt-SR	0.0153	0.0907	1.2556	-0.5060	0.2341	0.0012	0.1555	0.1492	-0.1339	-0.1432
Ghana-SR	0.0060	0.0673	1.8303	-0.0193	0.1104	0.0012	0.0720	0.0713	-0.1046	-0.1044
Morocco-SR	0.0024	0.0672	1.1479	0.0865	0.0305	0.0012	0.0185	0.0185	-0.1081	-0.0925
Nigeria-SR	0.0047	0.0891	2.8433	-0.3202	0.0579	0.0012	0.0391	0.0389	-0.1419	-0.1155
South Africa-SR	0.0102	0.0801	2.1185	-0.4530	0.1643	0.0012	0.1128	0.1090	-0.1215	-0.1348

Note: Table 3.1 presents the performance measures of currency carry trade returns of seven African currencies (Tunisian Dinar, Botswana Pula, Egyptian Pound, Ghanaian Cedi, Moroccan Dirham, Nigerian Naira and South African Rand) financed by borrowing the four currencies from the developed world, namely, the United States Dollar (USD), Euro (EUR), Great British Pound (GBP) and Japanese Yen (JPY) from January 2002 to November 2014. ASR denotes Adjusted Sharpe Ratio, which is the Sharpe ratio adjusted for skewness and kurtosis. The SR attached to Tunisia, Botswana, Egypt, Ghana, Morocco, Nigeria and South Africa denotes monthly stock returns for their respective all share indices. The US Treasury bill rate is used as a proxy for risk-free (Rf Rate) for the estimation of Sharpe ratios.

Table 2: Descriptive Statistics and Risk-Adjusted Performance of Currency Carry Trade Portfolios

	Average Return	SD	Kurtosis	Skewness	Sortino	Sharpe	ASR	VaR(norm)	VaR(hist)
S&P 500	0.0012	0.2329	1.8311	1.5029	0.0014	0.0000	0.0000	-0.3819	-0.2233
MSCI	0.0037	0.0474	3.2043	-1.1180	0.0759	0.0544	0.0534	-0.0742	-0.0919
JALSH	0.0102	0.0801	2.0860	-0.4516	0.1643	0.1128	0.1090	-0.1215	-0.1348
BOND	0.0029	0.0008	-1.0036	-0.3068	-	2.0789	11.9984	0.0015	0.0014
CT PORT	0.0027	0.0091	0.6398	-0.4868	0.2801	0.1668	0.1622	-0.0123	-0.0147
USD CT	0.0032	0.0123	1.5224	-0.6648	0.2689	0.1654	0.1560	-0.0170	-0.0186
JPY CT	0.0043	0.0219	2.6712	-0.7394	0.2175	0.1899	0.1680	-0.0318	-0.0357
EUR CT	0.0019	0.0147	0.5096	-0.1331	0.0883	- 0.0877	- 0.0876	-0.0223	-0.0250
GBP CT	0.0025	0.0149	1.1795	0.2160	0.1643	0.0272	0.0273	-0.0219	-0.0201

Note: Table 2 shows the four moments of returns (from February 2002-December 2014) for the selected asset classes and the currencies carry trade portfolios generated by the researcher. CT PORT is the African carry trade portfolio comprising shorting all the four funding currencies simultaneously and longing all the target currencies as well. The USD CT, JPY CT, EUR CT and the GBP CT are the African currency carry trades financed by the USD, JPY, EUR and GBP respectively. The value-at-risk is calculated at the 95% confidence level for the normal distribution and the historical VaR.

Table 3: Correlation Matrix of Conventional Asset Classes with Carry Trade Portfolios

	S&P 500	MSCI	JALSH	CT PORT	BOND	USCT	JPCT	EUCT	GBCT
S&P 500	1.000								
MSCI	0.074	1.000							
JALSH	0.039	0.276	1.000						
CT PORT	0.076	0.387	0.123	1.000					
BOND	-0.036	-0.007	0.098	0.008	1.000				
US CT	0.070	0.574	0.290	0.601	0.174	1.000			
JP CT	0.062	0.495	0.204	0.839	-0.021	0.498	1.000		
EU CT	0.010	-0.238	-0.117	0.497	-0.052	-0.143	0.119	1.000	
GB CT	-0.060	-0.123	-0.315	0.457	-0.051	0.078	0.086	0.503	1.000

Note: The Table shows the correlations between the returns of the selected asset classes and the currencies carry trade portfolios generated by the researcher. CT PORT is the African carry trade portfolio comprising shorting all the four funding currencies simultaneously and longing all the target currencies as well. The US CT, JP CT, EU CT and the GB CT are the African currency carry trade financed the USD, JPY, EUR and GBP respectively. The data collected from February 2002 to December 2014.

Table 4: Portfolio Perfomance with African Carry Trade Alternative to Stocks

		African Currency Carry Trade as an Alternative to Stocks				
Assets in the Portfolio	**Representative Portfolio**	**CT PORT**	**USD CT**	**JPY CT**	**EUR CT**	**GBP CT**
JSE Africa All Share Index	25%	25%	25%	25%	25%	25%
MSCI World Index	25%	25%	25%	25%	25%	25%
US 10 Year Bond	25%	25%	25%	25%	25%	25%
S & P 500	25%					
CT PORT		25%				
USD CT			25%			
JPY CT				25%		
EUR CT					25%	
GBP CT						25%
Average Return	0.45%	0.49%	0.50%	0.53%	0.47%	0.49%
Standard Deviation	6.52%	2.67%	2.76%	2.85%	2.55%	2.51%
Kurtosis	1.736	4.697	4.555	5.950	3.772	3.713
Skewness	1.026	-1.096	-1.041	-1.341	-0.906	-0.969
Sortino Ratio	0.097	0.202	0.204	0.205	0.202	0.216
Sharpe Ratio	0.051	0.064	0.140	0.181	0.059	0.108
Adjusted Share Ratio	0.051	0.062	0.124	0.139	0.058	0.102
VaR(normal)	-0.103	-0.039	-0.040	-0.042	-0.037	-0.036
VaR(historical)	-0.083	-0.049	-0.050	-0.045	-0.045	-0.045

Note: Table 4 shows a four asset portfolio representative portfolio with the various carry trade portfolios replacing the S&P 500 index in different scenarios. CT PORT is the African carry trade portfolio comprising shorting all the four funding currencies simultaneously and longing all the target currencies as well. The US CT, JP CT, EU CT and the GB CT are the African currency carry trade financed the USD, JPY, EUR and GBP respectively. The data collected from February 2002 to December 2014.

Table 5: Impact of African Carry Trade in a Dummy Portfolio

	African Currency Carry Trade Included in a Dummy Portfolio					
Assets in the Portfolio	**Representative Portfolio**	**CT PORT**	**USD CT**	**JPY CT**	**EUR CT**	**GBP CT**
JSE Africa All Share Index	25%	20.00%	20.00 %	20.00 %	20.00 %	20.00 %
MSCI World Index	25%	20.00%	20.00 %	20.00 %	20.00 %	20.00 %
US 10 Year Bond	25%	20.00%	20.00 %	20.00 %	20.00 %	20.00 %
S & P 500	25%	20.00%	20.00 %	20.00 %	20.00 %	20.00 %
CT PORT		20.00%				
USD CT			20.00 %			
JPY CT				20.00 %		
EUR CT					20.00 %	
GBP CT						20.00 %
Average Return	0.45%	0.41%	0.42%	0.45%	0.40%	0.49%
Standard Deviation	6.52%	5.25%	5.29%	5.33%	5.21%	2.51%
Kurtosis	1.736	1.736	1.748	1.828	1.706	3.713
Skewness	1.026	0.995	0.969	0.898	1.073	-0.969
Sortino Ratio	0.097	0.108	0.110	0.116	0.105	0.216
Sharpe Ratio	0.051	0.076	0.080	0.081	0.015	0.108
Adjusted Share Ratio	0.051	0.077	0.081	0.082	0.015	0.102
VaR(normal)	-0.103	-0.082	-0.083	-0.083	-0.082	-0.036
VaR(historical)	-0.083	-0.066	-0.067	-0.067	-0.064	-0.045

Note: Table 5 shows a four asset portfolio representative portfolio which is augmented to five asset portfolio with the various carry trade portfolios. CT PORT is the African carry trade portfolio comprising shorting all the four funding currencies simultaneously and longing all the target currencies as well. The US CT, JP CT, EU CT and the GB CT are the African currency carry trade financed the USD, JPY, EUR and GBP respectively. The data collected from February 2002 to December 2014.

Table 6: Impact of African Currency Carry Trade on Portfolio Perfomance

	Contribution of African Currency Carry Trade to Portfolio Sharpe Ratio					
Assets in the Portfolio	**Representative Portfolio**	**CT PORT**	**USD CT**	**JPY CT**	**EUR CT**	**GBP CT**
JSE Africa All Share Index	25%	25%	25%	25%	25%	25%
MSCI World Index	25%	25%	25%	25%	25%	25%
US 10 Year Bond	25%	25%	25%	25%	25%	25%
S & P 500	25%					
CT PORT		25%				
USD CT			25%			
JPY CT				25%		
EUR CT					25%	
GBP CT						25%
Asset in the Portfolio	**Asset Contribution to Sharpe Ratio**					
JSE Africa All Share Index	0.0346	0.0847	0.0819	0.0792	0.0887	0.0900
MSCI World Index	0.0099	0.0242	0.0234	0.0226	0.0253	0.0257
US 10 Year Bond	0.0112	0.0164	0.0265	0.0153	0.0172	0.0174
S & P 500	0.0000					
CT PORT		0.0143				
USD CT			0.0291			
JPY CT				0.0366		
EUR CT					-0.0127	
GBP CT						0.0040
Portfolio Sharpe Ratio	**0.0557**	**0.1396**	**0.1608**	**0.1537**	**0.1185**	**0.1372**

Note: Table 6 shows the decomposition of Sharpe ratios for the various portfolios when the S&P 500 is replaced by the currency carry trade portfolios funded by the USD, JPY, EUR and GBP to determine the real impact of currency carry trade on the risk-adjusted performance of portfolio. The African Carry Trade (CT PORT) is a portfolio that takes a short position in four different currencies (USD, JPY, EUR and GBP) and takes a long position on seven African currencies (BWP, NGN, GHS, EGP, TND, MAD and ZAR). Data collected from February 2002-December 2014.

Table 7: Impact of African Carry Trade as a Complement to Existing Portfolio

	African Currency Carry Trade Included in a Dummy Portfolio					
Assets in the Portfolio	**Representative Portfolio**	**CT PORT**	**USD CT**	**JPY CT**	**EUR CT**	**GBP CT**
JSE Africa All Share Index	25%	20.00%	20.00%	20.00%	20.00%	20.00%
MSCI World Index	25%	20.00%	20.00%	20.00%	20.00%	20.00%
US 10 Year Bond	25%	20.00%	20.00%	20.00%	20.00%	20.00%
S & P 500	25%	20.00%	20.00%	20.00%	20.00%	20.00%
CT PORT		20.00%				
USD CT			20.00%			
JPY CT				20.00%		
EUR CT					20.00%	
GBP CT						20.00%
Asset in the Portfolio	**Asset Contribution to Sharpe Ratio**					
JSE Africa All Share Index	0.0346	0.0344	0.0342	0.0339	0.0347	0.0349
MSCI World Index	0.0099	0.0098	0.0098	0.0097	0.0099	0.0100
US 10 Year Bond	0.0112	0.0111	0.0110	0.0110	0.0112	0.0113
S & P 500	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CT PORT		0.0103				
USD CT			0.0121			
JPY CT				0.0161		
EUR CT					0.0073	
GBP CT						0.0098
Portfolio Sharpe Ratio	**0.0557**	**0.0656**	**0.0671**	**0.0707**	**0.0631**	**0.0660**

Note: Table 7 shows the decomposition of Sharpe ratios for the various portfolios when the existing four assets portfolio is augmented to five assets by the currency carry trade portfolios funded by USD, JPY, EUR and GBP to determine the real impact of currency carry trade on the risk-adjusted performance of portfolio. The African Carry Trade (CT PORT) is a portfolio that takes a short position in four different currencies (USD, JPY, EUR and GBP) and takes a long position on seven African currencies (BWP, NGN, GHS, EGP, TND, MAD and ZAR). Data collected from February 2002-December 2014.

Figures

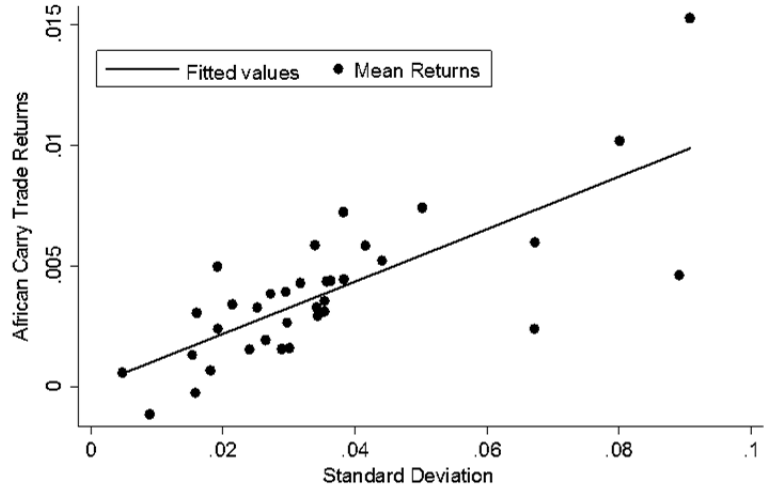

Figure 1: Currency Returns and Standard Deviation