

MSc Finance (Full Time)

2015-2016

FM406 Topics in Portfolio Management

The Search for Alpha in Emerging Markets



THE LONDON SCHOOL
OF ECONOMICS AND
POLITICAL SCIENCE ■

Candidate Number: 51025

Word Count: 6051

The copyright of this dissertation rests with the author and no quotation from it or information derived from it may be published without prior written consent of the author.

Index

Abstract	- 2 -
Introduction.....	- 2 -
Part 1: Literature Review	- 3 -
Part 2: Data, Methodology and Implementation.....	- 4 -
1. Data Sources	- 4 -
2. Risk Factors and Strategy Implementation	- 4 -
a. Single Factor – Capital Asset Pricing Model, Sharpe (1964), Lintner (1965)	- 5 -
b. 3 -Factor – Fama French (1993)	- 5 -
c. 4-Factor – Carhart (1995).....	- 6 -
3. Domestic Investor Model.....	- 7 -
a. Size Strategy:.....	- 7 -
b. Value Strategy.....	- 8 -
c. Momentum Strategy.....	- 8 -
d. Size+Value Strategy.....	- 9 -
e. Size+Momentum Strategy	- 9 -
4. Foreign Investor Model.....	- 9 -
Part 3: Empirical Analysis of Zero-Investment Strategies in Emerging Markets.....	- 11 -
1. Domestic Investor	- 11 -
2. Foreign Investor	- 13 -
a. UIP and Correlations	- 13 -
b. Abnormal Returns and Performance	- 14 -
3. 2007-08 Global Financial Crisis Period	- 16 -
a. UIP and Correlations	- 16 -
b. Abnormal Returns and Performance	- 17 -
Part 4: Implications	- 18 -
Part 5: Conclusion	- 20 -
Part 6: Limitations and Suggestions to Future Studies	- 21 -
References:	- 22 -

Abstract

This paper analyses the viability of zero-investment portfolio strategies (size, value, momentum and their variations) in 3 Emerging Markets (Brazil, China and India) from 2000 to 2013. Abnormal returns are measured with CAPM, Fama French 3-factor and Carhart 4-factor asset pricing models based on Prof. Stefano Marmi's publicly available database (Scuola Normale Superiore [SNS], 2012, Data Library). The portfolios are evaluated both from local and international investors' perspectives. In the same time period, uncovered interest rate parity (between USD and local currencies) does not hold and as a result excess USD returns of the portfolios are affected from the market inefficiency. Empirical results of the tested strategies in Emerging Markets indicate significant risk-adjusted abnormal returns in particular cases, especially in Brazil. Zero-investment portfolio returns in emerging markets during the 2007-08 global financial crisis may be valuable and provide diversification at the same time for international investors. Abnormal returns and diversification benefits of these strategies are supported with the favourable performance measures and low correlations especially in China. However, not all abnormal returns in emerging markets are statistically or economically significant. Low alpha returns in China and India can diminish by other market frictions such as international transaction fees and double taxation.

Introduction

The topic of zero-investment portfolio strategies is mostly analysed in the developed markets. Banz (1981) showed that small sized firms on NYSE on average returned more than the CAPM estimations. Porta, Lakonishok, Schleifer and Vishny (1997) used a full sample of NYSE, AMEX and Nasdaq firms and came to the conclusion that value and glamour stocks have an annual return difference of 25-30 percent in the first two to three years after portfolio formation. Jegadeesh and Titman (1993) found out that the strategy of buy past winners and sell past losers realized significant abnormal returns over the 1965 to 1989 period with compounded excess return of 12.01% per year on average. Lack of research in emerging market countries was a consequence of unavailability of data, late development of stock markets and low trade volume and size. However, with globalization, as Goetzmann, Li and Rouwenhorst (2005) argued, the diversification benefits of cross-border investing rely on high exposure to emerging markets. It was also found out by Didier, Hevia and Schmukler (2011) that even though the emerging markets were affected by the global financial crisis in 2008, on average they performed better and recovered faster. Therefore, there is valuable opportunity for international investors in the emerging markets to reduce their domestic market exposures. These portfolios enable the investors to achieve higher risk-return trade-offs with better diversification benefits. Correlations of these emerging markets with US remain relatively low during

crisis times. Zero-investment portfolio strategies are simpler to implement in comparison to the active investment strategies and even after adjusting for the respective risk factors, abnormal returns persist. The aim of this paper is to evaluate how traditional zero-investment portfolio strategies perform in emerging markets. In addition to that, it aims to see if these returns are robust to market inefficiencies such as failure of uncovered interest rate parity. The paper will test the hypothesis that zero-investment portfolio strategies in Emerging Markets empirically will result in higher alphas compared to the previous researches in developed countries.

This paper first reviews the literature related to the emerging market risk factors models and zero-investment portfolio strategies. Part 2 includes the data analysis and model methodology used in the paper. Part 3 shows the empirical abnormal return and performance results of size, value, momentum, size+value and size+momentum strategies under different risk factor models. Part 4 investigates the implications of the results and part 5 provides the conclusion. Finally, part 6 dwells on the limitations and further possible research areas.

Part 1: Literature Review

Following the findings that support significant abnormal returns of the zero-investment strategies in developed markets, the research area on emerging markets is still relatively unexplored. Iqbal, Brooks and Galagedera (2011) tested the Fama French 3-Factor model and looked for size and value risk premiums in emerging markets. Their findings show that as a result of the high volatility from institutional, political and macroeconomic conditions in emerging markets CAPM fails to model returns successfully. Their conclusion indicates strong size and value risk effects in Pakistan's stock market and by adding size and value factors in the Fama French framework improves the explanatory power of the model. Similarly, Almwalla and Karasneh (2011) found that multi-factor models perform better in emerging markets by empirically analysing Amman Stock exchange from 1999 to 2010.

A more geographically comprehensive research on emerging markets was conducted by Hanauer and Linhart (2015). They examined size, value and momentum patterns of the stock returns for 4 emerging market regions. Firstly, they used the global risk factors, but found out that global risk factors result in insignificant risk exposures and that the global models have high alphas and low R^2 s (explanatory powers). After re-performing their asset pricing model with local risk factors, they observed insignificant size premium, but significant value and momentum premiums across all portfolio groups for each region. Their results indicated value portfolio returns are much higher than the returns obtained in developed markets. Another conclusion was that 4-factor local factor models perform better for explaining returns of emerging market portfolio strategies, reducing the unexplained alpha returns.

Groot, Pang and Swinkels (2010) went one step further and checked the individual stock returns in 25 frontier emerging markets from 1997 to 2008. Their results showed that zero-investment strategies of value and momentum portfolios generate statistically significant excess returns of 1% per month, similar to results found in developed markets. As an additional benefit, they stated that frontier emerging countries provide diversification benefits to international investors through low correlations both with developed and developing markets.

In light of the findings of these researches, this paper implements the single factor CAPM and multi factor Fama French & Carhart asset pricing models for its analysis in Brazil, China and India from 2000 to 2013. Main difference from previous researches in this paper is that the evaluation of the size, value, momentum portfolio returns both from local and international investors' perspectives. Exchange rate fluctuations and deviations from uncovered interest rate parity are implemented through adjusting portfolio returns and risk free rates. Another addition is the size+value and size+momentum strategies. Combined strategies help to decrease idiosyncratic risk associated with following either of these strategies individually and benefit from possible negative or low correlation of returns. 2008 Global Financial Crisis sub-period (2007 to 2009) is investigated separately to test the performance of these strategies during crisis period.

Part 2: Data, Methodology and Implementation

1. Data Sources

The data used in this research is based on all stocks in Sao Paulo, Shanghai, Shenzhen and India Stock Exchanges. The market data and risk factors for emerging markets are from the public database of Prof. Stefano Marmi (2013) in collaboration with Flavia Poma constructed by using Factset. Schanghai, Shenzhen and India stock exchanges are founded in 1990, 1991 and 1992 respectively. Time-series sample data used in this paper starts from 2000 to minimise the noise created from the early development stages of these stock exchanges. The zero-investment portfolios on size, book-to-market and momentum are formed on the basis of the same database. The missing data points for risk factors and portfolios in the time-period are formed by following the identical methodology using Datastream. Exchange rate data is extracted from Datastream. Methodology used for risk factor and zero-investment portfolio construction is analysed in the next section.

2. Risk Factors and Strategy Implementation

To evaluate the risk adjusted expected portfolio returns and risk exposures, the portfolio return time series are regressed by using 3 different asset pricing models. For all three models implemented, local risk factors are adopted instead of global versions, based on Griffin's (2002) findings. Griffin

found that Fama and French risk factors are country specific and provide a more significant and robust explanation of stock returns than the global or regional factors.

a. Single Factor – Capital Asset Pricing Model, Sharpe (1964), Lintner (1965)

$$R_{it} - R_{free_t} = \alpha_i + \beta_i[MRP_t] + e_{it}$$

Where, R_{it} is the excess return on portfolio “i” at time “t”. These portfolios are size, value, momentum, size+value and size+momentum.

MRP_t is the excess return on the local market, which captures the market movements at time “t.” It is calculated by value-weighting returns on all stocks and subtracting the risk free rate.

Short term Treasury Bill rates of the local countries are used as risk free rate. Long-term bond rates are artificially too low because of the high demand and it is usually not feasible to find funding at those rates. Zero-investment strategies do not have long-term time horizon, so it is more suitable to match the time horizons by using treasury bills.

β_i is the portfolio “i”’s sensitivity to market movements, market risk exposure.

The same procedure is followed for Brazil, China and India. Under CAPM assumptions portfolio returns are only based on market risk exposure, which is the systematic risk β_i .

b. 3-Factor – Fama French (1993)

As Fama and French found out in 1992, market risk exposure (β_i) does not explain a significant amount of asset returns. Their results show that size and book-to-market risk exposures are also significant and help to explain more of the stock returns, thus in the second model, Fama and French’s methodology is adopted:

$$R_{it} - R_{free_t} = \alpha_i + \beta_i[MRP_t] + b_{SMB_i}[SMB_t] + b_{HML_i}[HML_t] + e_{it}$$

Fama and French constructs SMB (Small Minus Big) risk factor as the average return on the 3 small-cap portfolios minus the average on the 3 big-cap portfolios:

$$SMB = 1/3 (Small Value + Small Neutral + Small Growth) - 1/3 (Big Value + Big Neutral + Big Growth)$$

HML (High Minus Low) is the average return on the 2 value portfolios minus the average return on the 2 growth portfolios:

$$HML = 1/2 (Small Value + Big Value) - 1/2 (Small Growth + Big Growth)$$

One explanation for size and value premium is that small and value firms are riskier, so investors usually demand higher returns. It could be also behavioural and markets initially undervalue small and value stocks' prospects.

Time-series of risk factors in Brazil, China and India are constructed by Stefano Marmi (2013) following the identical methodology with Fama and French. This paper uses the data available in his publicly available database for Brazil, China and India from 2000 to 2013. As stated in his database "the portfolios for July of year "t" to June of "t+1" include all stocks for which we have market equity data for the last fiscal year and positive book equity data. Portfolios include stocks with average traded volume of 1000 shares and more for the last 5 days." (Marmi, 2013)

SMB and HML risk factors are constructed from the intersection of 2 portfolios (small and big), which are formed on market capitalisation and 3 portfolios (value, neutral and growth), which are formed based on book to market equity ratio. Size breakpoint for small and big portfolios is 50th percentile and value breakpoints for value and growth portfolios are 30th and 70th percentiles. Portfolios used to construct risk factors are value-weighted and constructed by Marmi (2013) following the Fama French (1993) methodology.

c. 4-Factor – Carhart (1995)

Carhart (1995) evaluates 27 size, book to market and momentum portfolios for the Fama French time period by adding momentum risk factor. Results showed that 4-factor model significantly reduces the average pricing errors compared to CAPM and 3-factor Fama French model. Carhart's 4 factor model is:

$$R_{it} - R_{free_t} = \alpha_i + \beta_i[MRP_t] + b_{SMB_i}[SMB_t] + b_{HML_i}[HML_t] + b_{WML_i}[WML_t] + e_{it}$$

This paper adopts the methodology used in the database (Marmi, 2013) and adds WML risk factor which is the average return on 2-winner portfolios minus the average returns on 2-loser portfolios:

$$WML = 1/2 (Small\ High + Big\ High) - 1/2 (Small\ Low + Big\ Low).$$

The construction process follows Carhart's (1995) methodology and results are available for emerging markets in Marmi's (2013) database. To create WML factor, 6 value-weighted portfolios are created from the intersection of 2 size and 3 past performance portfolios. The monthly winner and loser portfolios are formed at the end of month "t-1" by ranking based on cumulative returns of the top 30% for winners and bottom 30% for losers from "t-12" to "t-2".

3. Domestic Investor Model

Under domestic investor model, returns are stated in local currencies. Exchange rate fluctuations do not affect investment decisions. The 3 different asset pricing models described above are used to explain the time-series return variations of the five zero-investment portfolio strategies by being adjusted to risk exposures from 2000 to 2013.

a. Size Strategy:

To test the higher returns of the small cap stocks, zero-investment portfolio is created through buying equally-weighted smallest 50% market cap stocks and short selling equally-weighted biggest 50% market cap stocks. All zero-investment strategies in this paper are based on equally weighted portfolios to avoid size-bias towards bigger stocks. Ranking is done at the end of June and portfolios are rebalanced once a year. Table 1 provides descriptive statistics on zero-investment size portfolio returns from 2000 to 2013. In Brazil, size returns are negatively skewed and the mean of the size strategy is 0.253% per month while the median is -0.0367%. Tails are relatively thinner than the other strategies. It appears that the monthly average return from size strategy is too low to be economically significant for the given time period in Brazil. In China, mean is again twice larger than median. Distribution is skewed to right, with a low range. In India, mean and median returns are similar. Skewness of the distribution is close to zero and tails are thinner than other strategies. 1.1% average monthly return seems economically significant with a lower standard deviation than other strategies. In general, size strategy offers lower returns, but at the same time lower standard deviation.

Table 1:

Brazil - Zero Investment Portfolios (Returns in BRL)							
Size		Value		Momentum		SmallValue-BigGrowth	
Mean	0.2532	Mean	1.7768	Mean	0.9727	Mean	2.0627
Standard Error	0.3253	Standard Error	0.3884	Standard Error	0.4469	Standard Error	0.4335
Median	-0.0367	Median	1.5250	Median	1.6250	Median	0.8900
Standard Deviation	4.0236	Standard Deviation	4.8042	Standard Deviation	5.5282	Standard Deviation	5.3615
Sample Variance	16.1890	Sample Variance	23.0805	Sample Variance	30.5613	Sample Variance	28.7461
Kurtosis	3.2920	Kurtosis	8.7621	Kurtosis	4.6585	Kurtosis	1.4841
Skewness	-0.2972	Skewness	1.4027	Skewness	-1.0403	Skewness	0.8297
Range	31.3567	Range	44.9450	Range	42.7250	Range	34.8100
Minimum	-19.2867	Minimum	-13.8550	Minimum	-28.6150	Minimum	-14.1300
Maximum	12.0700	Maximum	31.0900	Maximum	14.1100	Maximum	20.6800
China - Zero Investment Portfolios (Returns in YUA)							
Size		Value		Momentum		SmallValue-BigGrowth	
Mean	0.6456	Mean	0.6097	Mean	0.1419	Mean	1.4241
Standard Error	0.2422	Standard Error	0.2727	Standard Error	0.3728	Standard Error	0.4446
Median	0.3967	Median	0.4200	Median	0.0500	Median	0.7000
Standard Deviation	2.9953	Standard Deviation	3.3727	Standard Deviation	4.6109	Standard Deviation	5.4999
Kurtosis	2.8546	Kurtosis	16.7933	Kurtosis	6.7502	Kurtosis	24.7272
Skewness	0.8374	Skewness	2.6899	Skewness	1.4613	Skewness	3.6315
Range	20.5967	Range	32.3150	Range	35.0800	Range	55.9700
Minimum	-6.3067	Minimum	-7.6400	Minimum	-11.4750	Minimum	-11.6800
Maximum	14.2900	Maximum	24.6750	Maximum	23.6050	Maximum	44.2900
India - Zero Investment Portfolios (Returns in RUP)							
Size		Value		Momentum		SmallValue-BigGrowth	
Mean	1.1034	Mean	1.3154	Mean	0.7352	Mean	2.3880
Standard Error	0.3449	Standard Error	0.4445	Standard Error	0.5043	Standard Error	0.6295
Median	1.0067	Median	0.5050	Median	1.7600	Median	1.0900
Standard Deviation	4.2665	Standard Deviation	5.4985	Standard Deviation	6.2373	Standard Deviation	7.7861
Kurtosis	1.6153	Kurtosis	19.3936	Kurtosis	7.5003	Kurtosis	9.6439
Skewness	0.3748	Skewness	3.1802	Skewness	-1.9819	Skewness	2.1437
Range	29.0400	Range	51.1750	Range	47.8950	Range	63.1600
Minimum	-12.9033	Minimum	-9.4550	Minimum	-33.9950	Minimum	-13.1200
Maximum	16.1367	Maximum	41.7200	Maximum	13.9000	Maximum	50.0400

b. Value Strategy

Value strategy is implemented by following Porta, Lakonishok, Shleifer and Vishny's (1997) methodology. However, instead of using top and bottom 10% of stocks ranked by book value/market value, this paper adopts 30% and 70% percentile breakpoints for data availability reasons. Vishny (1997) also finds positive alphas up to 30% of top value stocks from 1971 to 1992 in NYSE. The strategy adopts equally weighted portfolios. It buys top 30% value stocks and short sells bottom 30% BE/ME stocks. Ranking is done at the end of June and portfolios are rebalanced once a year. Table 1 includes information on descriptive statistics. Value portfolios for all countries have mean returns higher than median returns and they are positively skewed to the left. Tails are fatter relative to other strategies. Brazil and India has average monthly returns higher than 1%.

c. Momentum Strategy

Momentum strategy relies on Jagadeesh and Titman's (1993) finding that recent past winners outperform recent past losers and constructing a zero-investment portfolio based on this fact. In this case stocks are ranked on the basis of cumulative returns from "t-12" to "t-2" months. Results of Jagadeesh and Titman show us that equal weighted portfolio of 30% of the stocks with the highest past returns tend to have positive alpha and the exact opposite for the 30% of the stocks with the lowest past returns. Rebalancing is done monthly to not miss any new information incorporated in the markets. Table 1 has information on descriptive statistics of momentum strategy portfolios. Momentum

average monthly returns are much lower than other strategies, which lowers the economic significance. Returns are fat tailed and skewed to the right in Brazil and India.

d. Size+Value Strategy

Based on Fisher, Shah and Titman's (2015) idea of combining value and momentum strategies to benefit from reduced transaction costs and lower correlations, this paper analysis size, value and momentum combinations. Table 2 shows the correlations between size, value and momentum strategies in all three countries. Lower or negative correlations of "size/value" and "size/momentum" indicates there are diversification benefits. Given the available dataset of Marmi (2013), this paper investigates size+value and size+momentum combinations. "Size+Value" is constructed by buying equally weighted intersection of small and value stocks and short selling the intersection of big and growth stocks. Stocks are rebalanced yearly at the end of June. Table 1 has the descriptive statistics for "small+value" portfolio. Average returns are all higher than 1% per month and tails are thin except in China. Distribution is skewed towards right in all countries. Median returns are lower than mean returns.

Table 2:

Brazil				China				India			
	Size	Value	Moment.		Size	Value	Moment.		Size	Value	Moment.
Size	1.00			Size	1.00			Size	1.00		
Value	-0.35	1.00		Value	0.22	1.00		Value	0.18	1.00	
Momentum	0.10	0.17	1.00	Momentum	0.12	0.42	1.00	Momentum	0.23	-0.25	1.00

e. Size+Momentum Strategy

Last zero-investment strategy tested in this paper is combining size and momentum. The zero-investment is constructed by buying the intersection of small and winner stocks and short selling big and loser stocks. Rebalancing is done monthly based on the past cumulative returns and at the end of June market capitalisations. Table 1 has descriptive statistics for "size+momentum" strategy. In Brazil and India this strategy has the highest average monthly returns. However, standard deviation of returns is high.

4. Foreign Investor Model

One of the main purposes of this paper is to evaluate the viability of investing in emerging markets with zero-investment portfolio strategies. For simplification, the model assumes that international investor resides in US, faced with US risk free rate and cares about USD based returns. To understand if an adjustment to our asset pricing models is needed or not, first uncovered interest rate parity is tested. Froot and Thaler's (1990) methodology is used to test if the linear relation between interest rate differentials and exchange rates hold between US and emerging markets.

$$\frac{S_T}{S_t} - 1 = \alpha + \beta * (R_t^{Domestic} - R_t^{Foreign}) + \varepsilon_T$$

Under no arbitrage and efficient markets hypothesis, interest rate differential between countries should be offset by the exchange rate movements. S_T is the realised exchange rate at “t+1”. S_t is the spot rate. If UIP holds, regressions should yield α of 0 and β of 1. Froot and Thaler finds out that in the short term UIP does not hold and it even behaves in the opposite direction, amplifying the effects. Results of UIP test in emerging markets from 2000 to 2013 can be found in part 3. Therefore, to analyse effective returns of the zero-investment portfolios for international investors, market inefficiency of UIP failure needs to be incorporated in asset pricing models.

First, local currency returns (R_{it}) are multiplied with exchange rates to obtain time series of USD returns. Secondly, ($Rfree_t^{domestic}$) is replaced with USD risk free rates to find excess returns relative to US investment opportunities faced by the international investor. Adjusted 4-factor Carhart Model is as below:

$$\begin{aligned} R_{it} * \left(\frac{S_{t+1}}{S_t}\right) - Rfree_t^{USD} \\ = \hat{\alpha}_i + \hat{\beta}_i \left[R_{market_i} * \left(\frac{S_{t+1}}{S_t}\right) - Rfree_t^{USD} \right] + \widehat{b_{SMB_i}}([SMB_t] * \left(\frac{S_{t+1}}{S_t}\right)) \\ + \widehat{b_{HML_i}}([HML_t] * \left(\frac{S_{t+1}}{S_t}\right)) + \widehat{b_{WML_i}}([WML_t] * \left(\frac{S_{t+1}}{S_t}\right)) + \hat{e}_{it} \end{aligned}$$

CAPM and Fama French models are modified using the same methodology. Adjusted $\hat{\alpha}_i$ now represents the abnormal returns denominated in USD and incorporates the exchange rate risk. The aim is incorporating the exchange rate fluctuations to the portfolio time-series price variations, while keeping the local market risk exposure characteristics, which explains some part of the returns.

Zero-investment portfolios of size, value, momentum, “size+value” and “size+momentum” are also adjusted by exchange rates to denominate USD returns. Table 3 has information on descriptive statistics of the 5 portfolios.

Local currencies in Brazil and India depreciated on average from 2000 to 2013, so USD monthly return means are lower than local returns for all portfolios. In China the appreciation of local currency increased the average returns. In general, exchange rate fluctuations increased the volatility of returns for all portfolios. All portfolio strategy’s return distributions except “size” in Brazil have thinner tails. Except “size+momentum” in Brazil, “size” and “size+momentum” in India; all other portfolio distributions get more skewed to the right.

Table 3:

Brazil - Zero Investment Portfolios (Returns in USD)									
Size		Value		Momentum		SmallValue-BigGrowth		SmallWinner-BigLoser	
Mean	-0.0104	Mean	1.5407	Mean	0.6478	Mean	1.7827	Mean	2.1755
Median	0.5948	Median	1.3047	Median	1.2440	Median	0.9721	Median	1.2476
Std. Dev.	6.2516	Std. Dev.	7.1694	Std. Dev.	6.5505	Std. Dev.	7.1446	Std. Dev.	8.7296
Kurtosis	3.3558	Kurtosis	3.6938	Kurtosis	2.2840	Kurtosis	2.0117	Kurtosis	5.8952
Skewness	-0.9713	Skewness	-0.7924	Skewness	-0.8863	Skewness	0.1596	Skewness	0.9238
Range	43.4495	Range	50.9389	Range	42.8080	Range	47.0810	Range	76.2206
Minimum	-25.8710	Minimum	-30.5428	Minimum	-24.4801	Minimum	-23.8557	Minimum	-31.3513
Maximum	17.5785	Maximum	20.3961	Maximum	18.3279	Maximum	23.2254	Maximum	44.8693
China - Zero Investment Portfolios (Returns in USD)									
Size		Value		Momentum		SmallValue-BigGrowth		SmallWinner-BigLoser	
Mean	0.8328	Mean	0.7965	Mean	0.3280	Mean	1.6118	Mean	1.2592
Median	0.5960	Median	0.5538	Median	0.3194	Median	0.8771	Median	0.4087
Std. Dev.	3.0126	Std. Dev.	3.3783	Std. Dev.	4.6206	Std. Dev.	5.4978	Std. Dev.	8.5192
Kurtosis	2.5755	Kurtosis	16.2165	Kurtosis	6.4725	Kurtosis	24.3195	Kurtosis	65.8814
Skewness	0.8365	Skewness	2.6212	Skewness	1.3902	Skewness	3.6119	Skewness	6.8122
Range	20.0627	Range	32.1632	Range	35.0922	Range	55.5947	Range	100.4825
Minimum	-5.7644	Minimum	-7.4792	Minimum	-11.4782	Minimum	-11.2942	Minimum	-14.2090
Maximum	14.2983	Maximum	24.6840	Maximum	23.6140	Maximum	44.3005	Maximum	86.2735
India - Zero Investment Portfolios (Returns in USD)									
Size		Value		Momentum		SmallValue-BigGrowth		SmallWinner-BigLoser	
Mean	0.9239	Mean	1.1769	Mean	0.5487	Mean	2.2192	Mean	2.0779
Median	0.4119	Median	0.3339	Median	1.1092	Median	1.1944	Median	2.3160
Std. Dev.	4.1959	Std. Dev.	6.1674	Std. Dev.	6.1428	Std. Dev.	7.9185	Std. Dev.	8.4937
Kurtosis	1.0660	Kurtosis	12.5186	Kurtosis	5.0471	Kurtosis	9.4772	Kurtosis	6.4435
Skewness	0.7019	Skewness	2.3865	Skewness	-1.4688	Skewness	2.1604	Skewness	-0.2780
Range	24.5722	Range	52.1576	Range	45.3969	Range	63.3831	Range	81.3917
Minimum	-7.8199	Minimum	-10.0034	Minimum	-30.1426	Minimum	-12.8834	Minimum	-39.6626
Maximum	16.7522	Maximum	42.1542	Maximum	15.2543	Maximum	50.4997	Maximum	41.7291

Part 3: Empirical Analysis of Zero-Investment Strategies in Emerging Markets

1. Domestic Investor

Time series variation in zero-investment portfolios' returns are explained by 3 different asset pricing models for each country from 2000 to 2013. Alpha returns are the amount, which is not explained by the risk factors present in the respective models, called abnormal return. Betas are the portfolio exposures for each of the risk factors and represents how these portfolios move with these risks.

Alpha returns and risk factor exposures of each zero-investment portfolio strategies in Brazil from 2000 to 2013 can be seen in Table 4.

Table 4:

Brazil	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	0.3184 (1.0247)	-0.1996 (-4.0049)	0.0553 (0.2137)	-0.0213 (-0.4538)	0.5251 (8.3608)	-0.0013 (-0.0237)	-0.0274 (-0.1075)	0.0090 (0.1907)	0.5489 (8.8596)	-0.0113 (-0.2165)	0.0818 (2.8279)
Value	1.7894 (4.5913)	-0.0384 (-0.6141)	1.5064 (4.4806)	-0.0291 (-0.4773)	-0.1146 (-1.4049)	0.4784 (6.9029)	1.4389 (4.2808)	-0.0044 (-0.0701)	-0.0952 (-1.1639)	0.4702 (6.8155)	0.0668 (1.7500)
Momentum	1.0383 (2.3741)	-0.2006 (-2.8595)	1.3679 (3.1823)	-0.3553 (-4.5567)	-0.4021 (-3.8549)	-0.1790 (-2.0203)	0.9663 (2.9706)	-0.2081 (-3.4576)	-0.2866 (-3.6204)	-0.2278 (-3.4127)	0.3973 (10.7550)
"Size+Value"	2.1337 (5.0643)	-0.2171 (-3.2129)	1.5496 (4.1069)	-0.0038 (-0.0551)	0.4864 (5.3118)	0.4770 (6.1329)	1.3887 (3.8227)	0.0552 (0.8207)	0.5327 (6.0257)	0.4575 (6.1349)	0.1591 (3.8561)
"Size+Momnt."	2.6932 (4.1015)	-0.4241 (-4.0265)	2.6166 (3.8638)	-0.3993 (-3.2509)	0.0518 (0.3151)	0.0710 (0.5085)	2.1141 (3.6340)	-0.2152 (-1.9992)	0.1964 (1.3872)	0.0099 (0.0828)	0.4970 (7.5235)

Under CAPM in Brazil, except size portfolio all other 4 portfolios have economically and statistically significant abnormal returns at the 95% confidence interval. “Size+Momentum” portfolio has the highest average monthly abnormal return of 2.69%. Another significant information is the negative market beta of -0.42. The implication is that portfolio returns move in the opposite direction of market ups and downs, technically acting like a hedging strategy against market risk. All other portfolio market betas are either non-significant or negative. This is an expected result because longing and shorting should cancel out the market risk.

When the same regressions are repeated with Fama French Model, some of the abnormal returns stated with CAPM get explained by exposures to the size and value risk factors. However pure momentum and “size+momentum” strategies’ alpha returns are persistent under FF Model too. Size, value and “size+value” portfolios have insignificant market exposures at 95% confidence interval with t-stats lower than 1.96. It implies that zero-investment portfolio strategies neutralize the market risk exposure. With Carhart Model, momentum risk factor is added. This addition reduces the high implied abnormal returns of momentum strategies under Fama French Model. Momentum and “size+momentum” portfolios have 0.4 and 0.5 WML risk factor exposures with very high t-stats. Even after 4 factors explaining returns; value, “size+value” and “size+momentum” strategies have on average out-performed the expected returns predicted by the asset pricing model more than 1% per month. These abnormal returns are both economically and statistically significant.

Alpha returns and risk factor exposures of each zero-investment portfolio strategies in China from 2000 to 2013 can be seen in Table 5.

Table 5:

China	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	0.6208 (2.5640)	0.0373 (1.3739)	0.1771 (1.7460)	-0.0224 (-1.9662)	0.6594 (27.1132)	0.1243 (4.0605)	0.1849 (1.8508)	-0.0183 (-1.6135)	0.6554 (27.3105)	0.0981 (3.0591)	0.0504 (2.4003)
Value	0.5726 (2.1105)	0.0558 (1.8329)	0.1056 (1.0208)	0.0205 (1.7669)	0.0609 (2.4557)	0.9519 (30.4755)	0.1231 (1.3084)	0.0297 (2.7802)	0.0520 (2.3015)	0.8932 (29.5875)	0.1127 (5.7007)
Momentum	0.1585 (0.4230)	-0.0249 (-0.5933)	-0.0606 (-0.1658)	-0.0417 (-1.0162)	0.0342 (0.3897)	0.4393 (3.9798)	0.0797 (0.8393)	0.0320 (2.9627)	-0.0376 (-1.6484)	-0.0329 (-1.0776)	0.9065 (45.4111)
"Size+Value"	1.3476 (3.0663)	0.1151 (2.3326)	0.3604 (1.8860)	0.0119 (0.5541)	0.7848 (17.1286)	1.1615 (20.1383)	0.3923 (2.2527)	0.0286 (1.4475)	0.7685 (18.3719)	1.0544 (18.8679)	0.2057 (5.6236)
"Size+Momnt."	1.0306 (1.4894)	0.0629 (0.8103)	-0.0101 (-0.0178)	-0.0508 (-0.7990)	0.9418 (6.9358)	1.0759 (6.2940)	0.1728 (0.5210)	0.0452 (1.1999)	0.8483 (10.6513)	0.4610 (4.3325)	1.1805 (16.9477)

With all 3 models, individual size, value and momentum strategies fail to achieve abnormal returns higher than 1% per month in China. As a matter of fact, these strategies can only create significant abnormal returns when risk adjustment is done by CAPM. However, explanatory power of CAPM regressions are lower than 0.1 adjusted R-square. When 4-factor Carhart model is used, only “size+value” portfolio has a statistically significant abnormal return of 0.4% per month. It is very low

to be economically significant. Market inefficiencies such as transaction costs would probably diminish the arbitrage opportunity. In general, China does not seem like a viable market for a domestic investor to invest in with zero-investment portfolio strategies to achieve alpha returns. The returns are not significantly above the predicted returns based on the exposed risks factors.

Alpha returns and risk factor exposures of each zero-investment portfolio strategies in India from 2000 to 2013 can be seen in Table 6.

Table 6:

India	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	1.2001 (3.5341)	-0.1057 (-2.7439)	0.7057 (3.9162)	-0.0904 (-4.4264)	0.7135 (20.2558)	-0.0125 (-0.4057)	0.5146 (2.9675)	-0.0438 (-2.0364)	0.7155 (21.7079)	-0.0004 (-0.0139)	0.1289 (4.7110)
Value	1.1956 (2.7267)	0.1310 (2.6334)	0.2394 (1.2374)	0.0247 (1.1264)	0.1620 (4.2845)	0.8260 (24.8708)	0.2127 (1.0665)	0.0312 (1.2612)	0.1623 (4.2819)	0.8277 (24.7676)	0.0180 (0.5725)
Momentum	1.0216 (2.2382)	-0.3130 (-6.0457)	1.1760 (2.5277)	-0.2947 (-5.5920)	-0.0161 (-0.1769)	-0.1405 (-1.7588)	-0.0055 (-0.0227)	-0.0068 (-0.2279)	-0.0036 (-0.0787)	-0.0654 (-1.6182)	0.7972 (20.9521)
"Size+Value"	2.3677 (3.7299)	0.0223 (0.3093)	0.8872 (2.8958)	-0.0627 (-1.8073)	0.9636 (16.0894)	0.7813 (14.8551)	0.6733 (2.1923)	-0.0106 (-0.2784)	0.9659 (16.5460)	0.7949 (15.4463)	0.1443 (2.9777)
"Size+Momnt."	2.6009 (3.8834)	-0.3435 (-4.5219)	1.7150 (2.9227)	-0.3795 (-5.7091)	0.7102 (6.1916)	0.3742 (3.7154)	0.3961 (1.0165)	-0.0581 (-1.2023)	0.7241 (9.7760)	0.4581 (7.0149)	0.8899 (14.4691)

In India, with CAPM assumptions, domestic investors are able to earn significant abnormal returns above 1% per month with all strategies. As expected market risk exposures are neutralised and close to zero or insignificant. When controlled for size and value risk premiums with Fama French Model, abnormal returns for size and value strategies fall below 1% per month. By using Carhart 4-factor model to explain portfolio returns, only size and "size+value" strategies have persistent abnormal returns. However, these returns are close to 0.5% per month and economically insignificant to achieve an arbitrage opportunity.

2. Foreign Investor

a. UIP and Correlations

Uncovered interest rate parity has a very critical role for investors investing in international markets. Failure of UIP is a market inefficiency and it can drastically change effective returns of foreign investors. UIP is tested in Brazil, China and India versus US from 2000 to 2013. Table 7 has data on UIP tests.

Table 7:

	Brazil	China	India
α	-(0.3314) (-0.2302)	-(0.1953) (-5.7183)	-(0.7691) (2.5335)
β	(0.5613) (0.4057)	(0.1015) (0.4876)	-(1.9640) (2.5807)

Under UIP, α should be 0 and β should be 1 for all countries. In Brazil, both alpha and beta is not significantly different than 0 at 95% confidence interval. This means that when there is an interest rate differential between US and Brazil treasuries, exchange rate movement on average does not compensate for it, thus creating an arbitrage opportunity.

In China, alpha is significantly negative, but close to zero. However, beta is insignificant. This implies that yuan is appreciating against US dollar without any relation with respect to interest rate differential.

Failure of UIP is even more evident in India. Both alpha and beta is negative and significant. It implies that on average when the risk free rate in India was higher, Indian Rupee appreciated. This amplifies the USD returns of zero-investment portfolios, benefiting the foreign investor.

Investors also care about diversification to decrease their market risks. Even though zero-investment strategies target to earn returns above risk exposures and it's expected to have neutralised market betas, possible negative or low correlations can provide diversification benefits too. Market return correlations between US and emerging markets tested in this paper is available in Table 8. China has the lowest correlation with US Market, offering more diversification benefits for foreign investor, exposed to US market. It could be because of being a closed and isolated economy for too long. This could be valuable for global financial crisis time period investments too.

Table 8:	
	<i>US Mkt-RF</i>
US Mkt-RF	1.0000
Brazil Mkt-Rf	0.6527
China Mkt-Rf	0.2529
India Mkt-Rf	0.5851

b. Abnormal Returns and Performance

Based on the research done by Froot and Thaler(1990) and the empirical test done in this paper in Brazil, China and India from 2000 to 2013, UIP fails to hold in the short-term. The market inefficiency of exchange rate movements not in line with interest rate differentials affect foreign investors' USD returns in emerging markets. Therefore, this paper adjusts the asset pricing models to capture exchange rate movements and US Market risk free rate. Calculating abnormal returns with this methodology yields effective USD returns, which can be earned by foreign investors.

Table 8:

Brazil(USD)	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	-0.4606 (-1.1047)	0.3526 (8.7097)	-0.2868 (-1.1272)	0.1198 (3.7913)	0.6528 (14.8293)	0.1031 (2.5400)	-0.3053 (-1.2325)	0.1140 (3.6977)	0.6569 (15.3248)	0.0669 (1.6214)	0.0880 (3.0453)
Value	0.9758 (2.1501)	0.4425 (10.0401)	1.0383 (3.2366)	0.1573 (3.9483)	0.0310 (0.5581)	0.6103 (11.9286)	1.0244 (3.2154)	0.1529 (3.8582)	0.0341 (0.6186)	0.5830 (10.9922)	0.0663 (1.7827)
Momentum	0.2596 (0.5512)	0.3041 (6.6492)	0.2893 (0.6307)	0.1936 (3.3973)	0.0402 (0.5061)	0.2188 (2.9911)	0.2018 (0.5685)	0.1659 (3.7571)	0.0598 (0.9743)	0.0476 (0.8063)	0.4162 (10.0534)
"Size+Value"	1.3456 (2.6453)	0.3424 (6.9311)	1.4955 (4.0354)	0.0126 (0.2739)	0.4322 (6.7407)	0.4562 (7.7186)	1.4674 (4.0776)	0.0037 (0.0834)	0.4385 (7.0414)	0.4013 (6.6977)	0.1335 (3.1792)
"Size+Momnt."	1.9428 (2.7871)	0.1823 (2.6931)	2.0360 (3.0638)	-0.0308 (-0.3727)	0.2613 (2.2725)	0.3060 (2.8874)	1.9339 (3.3778)	-0.0630 (-0.8852)	0.2842 (2.8688)	0.1063 (1.1152)	0.4856 (7.2710)

Table 8 presents the results of portfolio returns for Brazil denominated in USD adjusted by risk exposures. When controlled only for market exposure in CAPM, abnormal returns decreased substantially compared to the domestic investor case. In this situation exchange rate movements are against the foreign investor and decreasing the value of investing in Brazil. Another observation is that, when adjusted with exchange rate movements, portfolios have higher and positive market exposures. Compared to negative co-movement in the domestic case, this increases systemic risk faced by the zero-investment strategies. In all models, momentum strategy has insignificant abnormal returns with t-stat lower than 1.96 at 5% significance level. The results show that even though size and momentum strategies separately have insignificant abnormal returns, when combined together it has 1.93% average monthly abnormal return in Carhart model. Value and "size+value" strategies also yield more than 1% and significant abnormal returns when controlled for risk exposures in all models. It should be also noted that value strategies benefited from exchange rate adjustments with higher abnormal returns than domestic version.

Table 9:

China (USD)	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	0.8020 (3.2830)	0.0347 (1.2615)	0.2213 (2.1332)	-0.0234 (-2.0419)	0.6604 (27.1383)	0.1267 (4.1418)	0.2243 (2.1971)	-0.0192 (-1.6829)	0.6565 (27.3454)	0.1002 (3.1286)	0.0508 (2.4116)
Value	0.7497 (2.7489)	0.0529 (1.7240)	0.1026 (0.9712)	0.0202 (1.7256)	0.0592 (2.3868)	0.9485 (30.4446)	0.1093 (1.1368)	0.0294 (2.7335)	0.0505 (2.2322)	0.8902 (29.4955)	0.1120 (5.6428)
Momentum	0.3526 (0.9373)	-0.0277 (-0.6553)	0.0481 (0.1292)	-0.0434 (-1.0517)	0.0332 (0.3797)	0.4398 (4.0041)	0.1026 (1.0588)	0.0316 (2.9122)	-0.0371 (-1.6281)	-0.0319 (-1.0510)	0.9064 (45.3512)
"Size+Value"	1.5138 (3.4330)	0.1106 (2.2299)	0.1968 (0.9919)	0.0129 (0.5897)	0.7773 (16.6977)	1.1469 (19.6062)	0.2090 (1.1491)	0.0297 (1.4610)	0.7615 (17.8051)	1.0411 (18.2432)	0.2032 (5.4150)
"Size+Momnt."	1.2082 (1.7429)	0.0576 (0.7387)	-0.1662 (-0.2873)	-0.0499 (-0.7799)	0.9296 (6.8497)	1.0554 (6.1878)	-0.0955 (-0.2794)	0.0474 (1.2389)	0.8384 (10.4266)	0.4425 (4.1243)	1.1774 (16.6881)

Table 9 presents regression results for strategies implemented in China. Compared to local currency results CAPM abnormal returns increased more than 10%, but again only "size+value" portfolio has economically significant monthly alpha return of 1.54%. As a matter of fact, when we control for other risk factors, all the abnormal returns get explained by risk exposures, leaving foreign investors with no viable and significant arbitrage option. If the foreign investors only care about

market risk, “size+value” is the only zero-investment strategy in China, which yields significant and higher than 1% monthly abnormal return.

Table 10:

India (USD)	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	0.8854 (2.5901)	0.0316 (0.9370)	0.5889 (3.2301)	-0.0454 (-2.3011)	0.7175 (19.4366)	0.0175 (0.5769)	0.4414 (2.6140)	-0.0172 (-0.9147)	0.7147 (21.1688)	0.0138 (0.4996)	0.1403 (5.4927)
Value	0.8627 (1.8886)	0.2579 (5.7232)	0.2471 (1.2892)	0.0214 (1.0317)	0.1474 (3.7979)	0.8185 (25.7257)	0.2413 (1.2390)	0.0225 (1.0402)	0.1473 (3.7823)	0.8183 (25.6305)	0.0055 (0.1870)
Momentum	0.7206 (1.4759)	-0.1410 (-2.9280)	0.7286 (1.4706)	-0.1370 (-2.5532)	0.0143 (0.1430)	-0.0202 (-0.2457)	-0.1308 (-0.5519)	0.0277 (1.0511)	-0.0020 (-0.0415)	-0.0414 (-1.0648)	0.8178 (22.8144)
"Size+Value"	2.0458 (3.2154)	0.1423 (2.2673)	1.1901 (3.7113)	-0.1450 (-4.1747)	0.9305 (14.3302)	0.7146 (13.4234)	1.1282 (3.4787)	-0.1331 (-3.6919)	0.9293 (14.3316)	0.7131 (13.4108)	0.0589 (1.2001)
"Size+Momnt."	2.3049 (3.4058)	-0.1863 (-2.7906)	1.7696 (3.0412)	-0.3598 (-5.7110)	0.6902 (5.8585)	0.3841 (3.9760)	0.9427 (2.3072)	-0.2014 (-4.4341)	0.6745 (8.2571)	0.3637 (5.4295)	0.7868 (12.7274)

Table 10 presents regression results for strategies implemented in India. When exchange rate is incorporated; value and momentum abnormal returns become insignificant. The most notable difference is the abnormal return increase in “size+value” and “size+momentum” portfolios. Under all risk adjustment model assumptions, these 2 portfolios’ abnormal returns persist. In the Carhart Model with all risk adjustments, “size+value” and “size+momentum” strategies have on average close to 1% monthly abnormal returns. Foreign investor fails to earn both economically and statistically significant alpha return in the individual portfolio strategies (size, value, momentum) under all 3 models. In CAPM, combined portfolio strategies yield more than 2% monthly abnormal returns significant at %5 significance level.

3. 2007-08 Global Financial Crisis Period

a. UIP and Correlations

Another aim of this paper is to empirically test the performance of investing in emerging markets with zero-investment portfolios during a global crisis. UIP is re-tested for sub-period of 2007 to 2009. Table 11 shows the results of UIP regressions. During a global crisis, exchange rate volatilities peak and as apparent in table 11, UIP relation becomes even weaker. This is in line with Froot and Thaler’s (1990) hypothesis that UIP fails drastically in short-term time periods.

Table 11:

	Brazil	China	India
α	-0.7691 (-1.9640)	-8.1287 (-2.5280)	-0.3724 (0.9057)
β	2.53355 (2.5807)	10.4653 (2.5395)	-4.7294 (1.4891)

Table 12 shows the market correlations between US and emerging countries during 2008 global financial crisis. As hypothesized and proved by Ribeiro and Veronesi (2002) co-movement of

international stock markets increase during bad times. Even with increased correlations, China still provides the best diversification benefits.

Table 12:	
	US Mkt-RF
US Mkt-RF	1.0000
Brazil Mkt-Rf	0.6515
China Mkt-Rf	0.3719
India Mkt-Rf	0.7598

b. Abnormal Returns and Performance

Given that UIP fails even more during global crisis period, risk adjusted USD performance of zero-investment portfolios in emerging markets is critical for international investors. Therefore, this paper re-analyses the sub-period of 2007 to 2009 with adjusted asset pricing models to control the risk factors.

Table 13, 14 and 15 summarizes the regression results under each asset pricing models in Brazil, China and India respectively.

Table 13:

Brazil (USD) 07-09	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	0.5618 (0.6305)	0.4354 (4.9187)	0.5130 (0.8751)	0.1480 (2.1206)	0.5719 (6.4937)	-0.0591 (-0.6205)	0.8537 (1.7658)	0.1367 (2.4068)	0.6354 (8.6821)	-0.1566 (-1.9355)	0.2698 (4.1752)
Value	2.2527 (2.0544)	0.2862 (2.6269)	1.0065 (1.6411)	0.1474 (2.0186)	-0.1593 (-1.7293)	0.8597 (8.6240)	1.1845 (1.9637)	0.1415 (1.9968)	-0.1262 (-1.3818)	0.8088 (8.0141)	0.1409 (1.7479)
Momentum	0.0481 (0.0398)	0.1245 (1.0378)	-0.5283 (-0.4472)	0.1668 (1.1857)	-0.2920 (-1.6449)	0.4327 (2.2532)	0.1964 (0.2083)	0.1428 (1.2890)	-0.1569 (-1.0994)	0.2254 (1.4293)	0.5740 (4.5555)
"Size+Value"	3.3855 (2.6171)	0.3273 (2.5467)	2.5409 (2.4233)	0.0536 (0.4297)	0.2603 (1.6522)	0.5236 (3.0724)	3.0625 (3.3025)	0.0363 (0.3335)	0.3575 (2.5466)	0.3744 (2.4130)	0.4132 (3.3330)
"Size+Momnt."	3.7559 (1.6831)	0.0992 (0.4475)	3.0513 (1.3281)	0.0715 (0.2613)	-0.1941 (-0.5623)	0.5028 (1.3465)	4.4504 (2.4166)	0.0250 (0.1157)	0.0667 (0.2394)	0.1026 (0.3330)	1.1082 (4.5016)

Most prominent difference in the sub-period analysis in Brazil is that under CAPM and Fama French models, alpha returns of the portfolios become insignificant except "size+value". In Carhart model, which controls for 4 risk factors; size, "size+value" and "size+momentum" strategies yield higher than 1% monthly abnormal returns. Combined strategies almost double their abnormal returns in Carhart Model during the crisis period compared to the averages from 2000 to 2013. High exchange rate and market volatilities during the crisis period is probably one of the reasons why some of the risk exposure coefficients of portfolios became insignificant.

Table 14:

China (USD) 07-09	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	1.5173 (2.5659)	0.0183 (0.4288)	0.4132 (1.6191)	-0.0341 (-1.9025)	0.5859 (12.9200)	-0.0130 (-0.2008)	0.3569 (1.3399)	-0.0355 (-1.9593)	0.5791 (12.4752)	-0.0042 (-0.0635)	-0.0559 (-0.7901)
Value	0.5261 (0.9152)	0.0645 (1.5571)	0.2159 (0.7760)	0.0288 (1.4725)	-0.0225 (-0.4558)	0.7968 (11.2932)	0.3259 (1.1480)	0.0315 (1.6317)	-0.0092 (-0.1869)	0.7796 (11.0772)	0.1093 (1.4497)
Momentum	-0.9418 (-1.7907)	0.0069 (0.1809)	-0.8120 (-1.4344)	0.0107 (0.2694)	-0.0894 (-0.8883)	0.0892 (0.6211)	-0.0323 (-0.1131)	0.0301 (1.5457)	0.0048 (0.0968)	-0.0328 (-0.4627)	0.7746 (10.2093)
"Size+Value"	1.7459 (1.9480)	0.1098 (1.7015)	0.3035 (0.7709)	0.0199 (0.7205)	0.5737 (8.2007)	0.8029 (8.0423)	0.3197 (0.7705)	0.0203 (0.7202)	0.5757 (7.9616)	0.8004 (7.7803)	0.0161 (0.1462)
"Size+Momnt."	0.1940 (0.2574)	0.0535 (0.9860)	-0.8509 (-1.3999)	0.0009 (0.0212)	0.5272 (4.8809)	0.1043 (0.6764)	-0.1189 (-0.2895)	0.0191 (0.6821)	0.6157 (8.6022)	-0.0102 (-0.1004)	0.7273 (6.6696)

In China, during the crisis period under all risk adjustment models, portfolios fail to yield significant abnormal returns above their risk exposures, but size strategy with CAPM assumptions. Portfolio returns seem to only co-move with their respective risk exposures (size strategy only significantly affected by size risk premium and so on) The analysis shows that foreign investor cannot be able to earn significant abnormal returns in China during a global crisis period.

Table 15:

India (USD) 07-09	CAPM		Fama French				Carhart				
	α	$\beta(\text{MRP})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	α	$\beta(\text{MRP})$	$\beta(\text{SMB})$	$\beta(\text{HML})$	$\beta(\text{WML})$
Size	0.1898 (0.2520)	-0.0135 (-0.2600)	0.4607 (1.0494)	-0.1168 (-2.8567)	0.5832 (6.7227)	0.1499 (1.1457)	0.3714 (1.0771)	-0.0970 (-2.9976)	0.5415 (7.8906)	0.2806 (2.6354)	0.1897 (4.5871)
Value	0.6859 (1.1984)	0.2078 (5.2689)	0.5702 (2.4491)	0.0314 (1.4462)	0.1739 (3.7804)	0.6487 (9.3501)	0.5571 (2.3887)	0.0343 (1.5666)	0.1678 (3.6148)	0.6679 (9.2761)	0.0279 (0.9989)
Momentum	0.0873 (0.0745)	-0.2212 (-2.7399)	0.3257 (0.2735)	-0.1175 (-1.0597)	0.1402 (0.5956)	-0.4969 (-1.4002)	-0.0351 (-0.0898)	-0.0375 (-1.0230)	-0.0281 (-0.3622)	0.0310 (0.2568)	0.7662 (16.3622)
"Size+Value"	1.2547 (1.0291)	0.0508 (0.6047)	1.4837 (2.8963)	-0.2146 (-4.4973)	0.8346 (8.2445)	0.7019 (4.5982)	1.4242 (2.9321)	-0.2013 (-4.4184)	0.8068 (8.3453)	0.7890 (5.2610)	0.1264 (2.1701)
"Size+Momnt."	1.0377 (0.7277)	-0.3236 (-3.2928)	1.5263 (1.1567)	-0.3505 (-2.8527)	0.7463 (2.8620)	-0.2447 (-0.6224)	1.1693 (1.6310)	-0.2713 (-4.0340)	0.5797 (4.0627)	0.2776 (1.2543)	0.7582 (8.8182)

Effects in India is similar to China. Portfolio analysis under CAPM yields no significant abnormal returns. Only "size+value" portfolio persistently achieves abnormal returns even during crisis period in India. Fama French model fails to explain momentum strategy returns through risk factors and under all models it fails to achieve significant abnormal returns. Value strategy's 0.56% monthly abnormal return in Carhart 4 Factor model is too low to be economically viable arbitrage strategy. During the crisis sub-period, size and "size+momentum" strategies lose the significant average abnormal returns they had with all models when analysed between 2000 to 2013 in Table 10.

Part 4: Implications

Results found in this paper indicate that UIP inefficiency can be very influential on zero-investment portfolios in Emerging Markets. Exchange rate and interest rate fluctuations can affect foreign investors' USD abnormal returns earned in Emerging Markets. In contrast to results of Porta, Lakonishok, Shleifer and Vishny (1997), Jegadeesh, Narasimhan (2001) and Banz (1981) in developed markets, performance of size, value and momentum portfolios are not persistent between emerging

market countries. Both domestic and foreign investor would choose to invest in Brazil rather than China and India based on abnormal return results. Zero-investment portfolio strategies of value, size+value and size+momentum in Brazil yielded more than monthly 1% abnormal returns to both foreign and domestic investors under Carhart model, which controls for 4 risk factors. This shows that zero-investment portfolio returns are most persistent in Brazil during the analysed time horizon. This persistence is valid for global crisis period too. India seems to provide significant abnormal returns for zero-investment portfolios if CAPM assumptions are adopted or if investor invests in combined strategies such as “size+momentum” or “size+value.” There isn’t any significant zero-investment portfolio arbitrage opportunity in all different cases or during a global crisis in China. The results show that the hypothesis of earning higher abnormal returns in emerging markets than developed countries with zero-investment portfolios is only viable with correct strategy and country combinations. Unlike results in the developed countries, the results in emerging markets do not persist between countries.

Table 16 has information on Sharpe and Treynor performance measures. From domestic investor’s perspective except momentum portfolio in China, all zero-investment portfolios are able to surpass the market in terms of return per total risk taken. It should be noted that Treynor ratio values should be considered as absolute values because all excess returns of portfolios are positive, thus negative Treynor ratio is a result of negative market beta. To hedge against market risk, negative market exposure is better, which means that portfolios are able to move in opposite directions with the market, providing hedging opportunity. Treynor measure of combined portfolio strategies are more consistent between countries. Performance measures for foreign investor from 2000 to 2013 show that combined zero-investment portfolio strategies usually provide higher return per risk. Individual strategies can fail to obtain higher Sharpe ratios than the market in some cases. In China, size and value strategies have higher Sharpe and Treynor measures. Portfolios in China had low abnormal returns, but returns per risk seem to be higher. Combined with the low correlation with US market, China can be a viable option for foreign investor for diversification benefits. In all countries, momentum strategy seems to yield very low performance per both systemic and total risk compared to the market.

Table 16:

		2000-13 (Local)		2000-13 (USD)		2007-09 (USD)	
		Sharpe	Treynor	Sharpe	Treynor	Sharpe	Treynor
Brazil	Size	0.0629	-1.2683	-0.0017	-0.0295	0.2077	15.5348
	Value	0.3698	-46.2873	0.2149	3.4821	0.4022	24.3859
	Momentum	0.1760	-4.8491	0.0989	2.1304	0.0406	57.1613
	SmallValue-BigGrowth	0.3847	-9.5001	0.2495	5.2070	0.4907	25.0263
	SmallWinner-BigLoser	0.3003	-6.0236	0.2492	11.9342	0.3040	130.8874
	Market	0.0523		0.1245		0.1934	
China	Size	0.2155	17.2882	0.2764	24.0259	0.4675	185.4247
	Value	0.1808	10.9215	0.2358	15.0631	0.2231	52.7095
	Momentum	0.0308	-5.6863	0.0710	-11.8322	-0.3052	438.4595
	SmallValue-BigGrowth	0.2589	12.3740	0.2932	14.5740	0.4016	48.5459
	SmallWinner-BigLoser	0.1258	17.0372	0.1478	21.8650	0.0886	81.5635
	Market	0.0746		0.0998		0.2647	
India	Size	0.2586	-10.4395	0.2202	29.2451	0.0372	-327.5862
	Value	0.2392	10.0428	0.1908	4.5642	0.2376	21.7664
	Momentum	0.1179	-2.3489	0.0893	-3.8916	-0.0430	-34.3146
	SmallValue-BigGrowth	0.3067	107.2301	0.2802	15.5960	0.1878	141.4678
	SmallWinner-BigLoser	0.2613	-6.6559	0.2446	-11.1546	0.0450	-29.6774
	Market	0.1040		0.1207		0.1282	

Higher abnormal returns of zero-investment portfolios in Brazil can be explained by the low number of firms and low volume trades in Sao Paulo Stock Exchange. This can be creating market inefficiencies enabling for arbitrage opportunities. India and China both has more than 1000 firms in its stock exchanges and trading volume is around \$0.5 trillion (Datastream). Brazilian market may also have other risk factors affecting stock returns and compensating investors based on that, which this paper didn't incorporate. It could be also that China is providing much higher diversification benefits, thus this comes with an expense, lowering expected returns of investors.

Part 5: Conclusion

Zero-investment portfolios in emerging markets have been neglected compared to the research done in developed markets. Rapid development of stock exchanges, increasing trading volumes and diversification needs of investors are recently directing interest towards emerging markets. By analysing strategies in Brazil, China and India stock exchanges, this paper concludes that it is possible for both domestic and foreign investors to earn significant abnormal returns in emerging markets. However, the results are highly dependent on the structure of the strategy and the country. Cakici and Tan (2012), also states the segmentation in emerging markets, while analysing risk factor significances in emerging market countries. This segmentation may be based on the development level of a country, as this affects the market inefficiencies. In most of the cases examined in the previous parts, combinations of different strategies performed better than individual strategies. Effects of mixing strategies is more apparent on portfolio returns in India. Merging strategies also decreases transaction costs, thus increasing net returns of both domestic and foreign investors. Returns in Brazil and India persist after adjusting for exchange rate fluctuations. This is positive from

an international investor's point of view. On the other hand, Chinese market has the lowest correlation with US market. It could be argued if the diversification benefit is worth the lower returns of zero-investment portfolios in China, as it depends on the market exposures of these portfolios. In conclusion, it is possible for foreign investors to earn alpha returns in emerging markets even during global crisis period, but results depend on the country and strategy because of the emerging market segmentation.

Part 6: Limitations and Suggestions to Future Studies

It is possible to earn abnormal returns both in developed and emerging markets with zero-investment portfolios. This paper shows that strategies based on size, value and momentum managed to yield alpha returns even after controlling for 4 risk factors. Some returns persisted after adjusting for exchange rate fluctuations. However, investing in international markets does not only introduce exchange rate inefficiency. Market frictions, such as high transaction fees and double taxation by different countries may diminish earned alpha returns. On the other hand, there may be other risk factor justifying these returns. Due to time demanding nature of the portfolio construction, this paper couldn't analyse other zero-investment strategies such as post event announcement drift, return reversal or betting against beta. Future studies could dwell on other risk factors or zero-investment portfolio strategies to look for and analyse alpha returns in emerging markets.

References:

- Al-Mwalla and Karasneh. (2011). "Fama & French Three Factor Model: Evidence from Emerging Market." *European Journal of Economics, Finance and Administrative Sciences*, Issue 41.
- Carhart, M. M. (1997). "On Persistence in Mutual Fund Performance." *The Journal of Finance* 52: 57–82.
- Didier, Tatiana and Hevia, Constantino and Schmukler, Sergio L. (2011). "How Resilient and Countercyclical Were Emerging Economies to the Global Financial Crisis?" *World Bank Policy Research Working Paper No. 5637*.
- Fama, Eugene and French, Kenneth. (1993). "Common risk factors in the returns on stocks and bonds." *Journal of Financial Economics*, 33, issue 1, p. 3-56.
- Fisher, Gregg S. and Shah, Ronnie and Titman, Sheridan. (2015). "Combining Value and Momentum". *Journal of Investment Management*, Forthcoming.
- Froot and Thaler. (1990). "Anomalies: Foreign Exchange." *The Journal of Economics Perspectives*, Vol. 4, No. 3, pp179-192.
- Griffin, J. M. (2002). "Are the Fama and French Factors Global or Country Specific?". *Review of Financial Studies* 15 (3): 783–803.
- Groot, Wilma and Pang, Juan and Swinkels, Laurentius (Laurens) Adrianus Petrus. (2012). "The Cross-Section of Stock Returns in Frontier Emerging Markets." *Journal of Empirical Finance*, Vol. 19, Issue 5, pp. 796-818.
- Hanauer, M. X. and Linhart, M. (2015), "Size, Value, and Momentum in Emerging Market Stock Returns: Integrated or Segmented Pricing?" *Asia-Pacific Journal of Financial Studies*, 44: 175–214.
- Iqbal, Javed & Brooks, Robert & Galagedera, Don U.A. (2010). "Testing conditional asset pricing models: An emerging market perspective." *Journal of International Money and Finance*, Elsevier, vol. 29(5), pages 897-918.
- Jegadeesh, Narasimhan, and Titman Sheridan. (1993). "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency." *The Journal of Finance* 48.1, 65-91.
- Jegadeesh, Narasimhan, and Titman Sheridan. (2001). "Profitability of Momentum Strategies: An Evaluation of Alternative Explanations." *The Journal of Finance* 56.2, 699-720.

- John Lintner. (1965). "The Valuation of Risk Assets and Selection of Risky Investments in Stock Portfolios and Capital Budgets." *The Review of Economics and Statistics*, Vol.47, No.1, pp. 13-37.
- Rafael La Porta, Josef Lakonishok, Andrei Shleifer, Robert Vishny. (1997). "Good News for Value Stocks: Further Evidence on Market Efficiency." *Journal of Finance*, Vol. 52, no. 2, 859-873.
- Ribeiro and Veronesi. (2002). "The Excess Comovement of International Stock Markets in Bad Times." <http://faculty.chicagobooth.edu/pietro.veronesi/research/cross.pdf>
- Rolf W. Banz. (1981). "The Relationship Between Return and Market Value of Common Stocks." *Journal of Financial Economics*, vol. 9, issue 1, pages 3-18.
- Stefano Marmi, (2013) Scuola Normale Superiore [SNS], Data Library from http://homepage.sns.it/marmi/Data_Library.html#datalibrary
- William N. Goetzmann & Lingfeng Li & K. Geert Rouwenhorst, (2005). "Long-Term Global Market Correlations," *Journal of Business*, University of Chicago Press, vol. 78(1), pages 1-38.
- William Sharpe. (1964). "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." *Journal of Finance*, vol. 19, issue 3, pages 425-442.