THE INFLUENCE OF THE GLOBAL CRISIS ON THE SLOWDOWN OF THE
EMERGING MARKETS

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Thesis presented to Escola de Economia de Empresas de São Paulo of Fundação Getulio Vargas, as a requirement to obtain the title of Master in Economy.

Knowledge Field: International Master in Finance

Adviser: Prof. Dr. Emerson Marçal

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ABSTRACT

This paper investigates the empirical relationship between the 2007-2009 financial crisis, the 2010-2012 sovereign debt crisis and the recent emerging equity markets slowdown. The exposure of the emerging markets to the crisis of the developed markets is quantified using an interdependence factor model. The results show that emerging markets did suffer a shock from both crises, yet they recovered while the developed markets were still struggling. After the sovereign debt crisis emerging markets slowed down synchronized with the developed market’s recovery. The paper further analyses whether capital flows explain the connection between these two events, finding this relationship exists.

KEY WORDS: emerging markets, financial crisis, factor model, capital flows.
RESUMO

A presente dissertação investiga a relação empírica entre a crise financeira de 2007-2009, a crise da dívida soberana de 2010-2012 e a recente desaceleração dos mercados de capitais nos mercados emergentes. A exposição dos mercados emergentes à crise nos desenvolvidos é quantificada através de um modelo de interdependência de factores. Os resultados mostram que estes sofreram, de facto, um choque provocado por ambas as crises. No entanto, este foi um choque de curta duração enquanto os mercados desenvolvidos ainda lutavam com as consequências resultantes das sucessivas crises financeiras. A análise do modelo mostra ainda que após a crise da dívida soberana, enquanto os mercados desenvolvidos iniciam a sua recuperação, os emergentes desaceleram o seu crescimento. De forma a completar a análise do modelo foi efectuado um estudo sobre a influência dos fluxos de capitais entre os mercados emergentes e desenvolvidos na direcção do seu crescimento, revelando que existe uma relação entre estes dois eventos.

PALAVRAS CHAVE: mercados emergente, crise financeira, modelo de interdependência, fluxos de capital.
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1. Introduction

In the late 80’s the emerging economies embarked in a liberalization process enabling the opening of the financial markets and the liberalization of the stock markets. Starting at that moment the correlation with the developed economies increased substantially. Even though many emerging markets (EM) are still not completely integrated within the global markets (see Bekaert and Harvey (1995 and 2000) and Bekaert et al. (2011)), relaxing the regulated barriers allowed the markets to extend its openness to the exterior world, boosting the correlation between countries.

The relative contribution of the emerging markets to the world GDP over the developed markets (DM) has been increasing. After the liberalization process the emerging markets saw a sharp GDP growth, having almost doubled their weight on the global economy (from 20% to 40%), while the developed markets share decreased from 80% to 60% (see Figure 1 in appendix). The emerging equity markets development has been turbulent due to the significant crisis the world have been through in the last 20 years. After the shock the EM suffered with the 2008 financial crisis, it seemed like they were recovering well. However, after 2012 the performance of the EM seems to almost stagnate (see Figure 2 in appendix).

Given the increasing correlation between developed and emerging markets (see Figure 3 in appendix), the main goal of this project is to analyze if the slowdown of the EM was a consequence of the global crisis. Therefore, to analyze this correlation, a four factor model was developed to study the interdependence of a market with three external factors and one domestic factor, aiming at finding if the emerging equity markets suffered the external influence of the developed markets that most suffered with the
crisis. The project focus on the periods before, during and after the crisis in order to analyze how the interdependence between these countries changed over time.

Additionally, and in order to complete the previous analysis, a study on the relation between the EM slowdown and possible movements of capital between developed and emerging markets was prepared. The goal of this study is to investigate whether the movements in foreign portfolio investment during and after the crisis influenced the emerging equity market’s growth and slowdown.

2. Literature Review

There have been a number of empirical studies on global stock market crashes since the seminal work of King and Wadhwani (1990) following the October 1987 Black Monday. In a global context, international shock transmission has been widely examined through the analysis on “contagion” and “Volatility spillovers” across borders (e.g. Hamao, Masulis and Ng (1990); Baele (2005)). Both concepts aim at explaining shock transmission that cannot be justified by fundamentals or excessive co-movements. Several investigators have been studying how market integration promotes contagion (Bekaert, Harvey and Ng (2005)) and when there was evidence of contagion across borders as a consequence of financial crisis (e.g. Marçal, Pereira, Martin and Nakamura (2009) and Marçal and Pereira (2009)). This project intends to analyze crisis contagion to a specific group of countries. By adapting the model used by Bekaert, Ehrmann, Fratzscher and Mehl (2012), that studies the global equity markets contagion of the 2007-2009 financial crisis, the goal is to analyze how the 2007-2009 financial crisis and the 2010-2012 sovereign debt crisis in the Eurozone affected the emerging equity markets. Moreover, the previous analysis will be completed by trying to relate
the model’ results with the capital flows between developed and emerging markets. As far as it is known the subject of correlations between capital flows in different countries is not widely studied probably due to the limited data available. However, there are studies on the correlation between foreign investment and exchange rate fluctuations (e.g. Udomkerdmongkol, Görg, Morrissey (2006); Chakrabarti and Scholnick (2002)). Therefore, based on that literature, on capital flows fluctuations over the years and on other variables, this paper tries to establish a relationship between the equity markets slowdown and the capital flows between DM and EM during and after the crisis.

3. The Interdependence Model

The methodology followed to construct the model used during this project was inspired on the approach adopted by Bekaert, Ehrmann, Fratzscher and Mehl (2012) in analyzing the contagion of the financial crisis into domestic portfolios. In particular, this project focus only on the interdependence part of their model, specifically studying the emerging markets and making some slight changes to their methodology.

The model estimated is an international factor model with four factors, where all of the factors are capitalization-weighted market indexes. The model looks as follows:

\[ R_{i,t} = E_{t-1}[R_{i,t}] + \beta_{i,t}'F_t + e_{i,t} \]  \hspace{1cm} (1)

\[ F = (R^{US}, R^{EURO}, R^{PIIGS}, R^{D}) \]  \hspace{1cm} (2)

Where \( R_{i,t} \) is the return of a domestic portfolio \( i \) during week \( t \), \( E_{t-1}[R_{i,t}] \) is the intercept of the regression model assumed to be past expected values of future returns , \( F_t \) is the vector of the three external factors and one domestic factor and \( e_{i,t} \) is the residual term.
The role of the domestic factor (RD) in the model is to explain all variation of returns not explained by external factors. It was obtained by constructing a secondary portfolio, different from the domestic index considered for portfolio i as the explanatory variable. These secondary portfolios exclude therefore the securities that compose the dependent variable.

Since the ultimate goal of constructing this model is to analyze the influence that the global crisis had on the equity emerging markets’ returns, the external regressors being considered are representative of the developed markets that most suffered with the crisis. By considering not just a US factor but also a EURO and a PIIGS (Portugal, Italy, Ireland, Greece and Spain) factor we are aiming at finding which crisis within the developed world influenced the EM economies the most; directly the 2007 – 2009 US credit crisis or the subsequent Eurozone sovereign debt crisis. For the same reason, and in order to analyze if the interdependence relation changed over time, the model was applied to different time periods, a pre-crisis period (2003 – 2006), a US crisis period (2007 – 2009), a sovereign debt crisis period (2010 – 2012) and finally a post-crisis period (2013). As already mentioned each factor and portfolio i inputs are the returns of capitalization-weighted indexes\(^1\). The PIIGS factor was estimated as a weighted average\(^2\) of the returns of the countries that form this group.

The returns are estimated as log returns and, in order to compute them, end of the week stock prices in US dollars were collected from the Bloomberg database for each of the

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\(^1\) The indexes representing the external country-factors are: S&P 100 (USA), EURO MSCI, PSI-20 (Portugal), ISEQ (Ireland), FTSE MIB (Italy), FTASE (Greece), IBEX (Spain).

\(^2\) The weighted average of returns is calculated by the average return of all PIIGS stocks indexes adjusted by the relative Market Capitalization (relative Market Capitalization is given by the sum of all companies Market Capitalization of one index, divided by the sum of Market Capitalization of all indexes).
indexes. The sample period goes from 1 January 2003 to 31 December 2013 and the sample contains 574 weekly observations for the five country-representative portfolios.

As the final goal is to analyze the results of this model for the emerging markets, five different models were constructed. A first one representing the EM in general, using for that an index that measures the equity market performance of the global emerging markets (MSCI Emerging Markets). Four other versions were calculated for each of the BRIC countries (Brazil, Russia, India and China)\(^3\), that were chosen as an example to represent the emerging markets in a more detailed analysis of the interdependence results. For each of these five versions, a model for each of the time intervals previously mentioned was built.

With this model, the risk exposure of each of the portfolios being considered is captured by the four factors. Under the null hypothesis, the interdependence between the portfolios is determined by the factor exposure ($\beta$).

### 3.1. Model Estimation and Diagnostics

The interdependence model is a time series regression, or more precisely, a static model given the nature of its variables. In this regression the independent variables are the returns of the country representative-factors (vector $F$ composed by three external factors and one domestic factor) and the dependent variables are the returns of the domestic portfolio $i$ ($i$ is representing each of the four BRIC and the EM MSCI). Therefore, the method of ordinary least squares (OLS) was used to estimate the factor’s exposure parameters ($\beta$). Each of the parameters will measure the partial effect of the corresponding independent variable ($F_i$).

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\(^3\) Indexes used for this countries: Bovespa 100 (Brazil), MSCI Russia, BSE 100 (India) and CSI 100 (China).
A multiple regression model seems the most appropriate way to construct a model in this situation given that it allows the independent variables to be correlated, making an analysis where all the other factors are effectively hold fixed, while examining the effect of a particular independent variable on the dependent variable. That is, analyzing the *ceteris paribus* effect that a change in one of the country-factors, corresponding to the developed countries, will have on the portfolios of emerging markets. However, no independent variables can be constant neither can exist an exact linear correlation between them, or the model would fall in the problem of perfect collinearity that would bias the OLS estimations. There is some correlation between the country-factor variables used for this model, for the time intervals studied, but there is no perfect collinearity. Nonetheless, there are some pairs of variables that present excessively large correlations that could still bias the results (see Table 1 in appendix). Therefore, the model was corrected for that effect by eliminating the variables with lower statistical significance from those pairs of variables presenting excess correlation.

In order to ensure that the OLS estimators are the best linear unbiased estimators (BLUEs) and that the usual OLS standard errors, \( t \) statistics and \( F \) statistics can be used for statistical inference there are five assumptions that the model needs to follow. This procedure is called the classical linear model assumptions.

The first assumption states that the stochastic process\(^4\) must follow a model that is linear in its parameters. The second one is about no perfect collinearity (already explained above). The third one implies a zero conditional mean, indicating that for each \( t \), the expected value of the error \( e_{i,t} \), given the explanatory variables for *all* time periods, is zero:

\(^4\) The sequence of random variables indexed by time used in this model
\[ E \left( e_t | R_t^{US}, R_t^{EURO}, R_t^{PHEG}, R_t^D \right) = E \left( e_t | F_t \right) = 0 \] (3)

With the three previous assumptions it is already possible to establish the unbiasedness of the OLS estimations. However, according to Goss-Markov, to ensure the estimators are BLUE two additional assumptions were added: homoscedasticity and no serial correlation.

The concept of homoscedasticity means that the standard deviations of the errors \( (e_i) \) are constant and do not depended of the independent variables. This procedure ensures that each probability distribution for the dependent variables has the same standard deviation, regardless of the independent variables. Is important to clarify that the heteroscedasticity\(^5\) does not cause the OLS estimator to be biased or inconsistent but can invalidate the error terms and test statistics.

Since heteroscedasticity is inherent to equity prices and the model uses log returns calculated using the indexes’ stock prices, it is important to correct the model for the heteroscedasticity of the errors. Therefore, using the White covariance matrix estimator, heteroscedasticity-consistent (White) standard errors were added to the parameter estimates (In appendix 2 an example is displayed of the output of one of the versions of the model, including a table with the White standard errors added to the parameters).

When estimating the model different model specifications were estimated. Starting with the full model, including all independent variables, and step-by-step excluding the variables with the least statistical significant parameters until only the significant parameters with a 5% significance level were left. The aim of this approach was to exclude the irrelevant variables to ensure the estimators were not biased. In addition and

\(^5\) When homoscedasticity is not present
as mentioned before this approach also helped in correcting for high correlations, as well as in eliminating the variables that could cause the heteroscedasticity of the errors, by selecting only those versions of the model that passed the heteroscedasticity-consistent White test.

Due to temporal correlation in most time series data and since this is not a dynamic model, it is very important to explicitly make assumptions about the temporal correlation in the errors and about the relationship between the errors and the explanatory variables in all time periods. Therefore, it is important to state that the errors in two different time periods should be uncorrelated, conditional on the independent variables (implying no serial correlation).

In order to ensure all the aforementioned assumptions were not violated, and to evaluate the adequacy and performance of the model, besides some of the already mentioned methodologies, the following steps were followed:

1) Analyze if the residuals plotted against the predicted values show no trends or patterns. If any type of patterns such as a “cone” or a “sphere” shapes were found, the model was considered not fit and with unequal variances.

2) Examine the predicted values against the actual. If the predicted values seemed extremely outside of the range of the response variable, it was considered as an indicator that the model was incorrect for those cases. If the predicted values seemed reasonable, the model was accepted assuming it was a good fit.

When the model is computed with several data samples it is possible that the model may show signs of misspecification due to changing interdependences or to time-periods with short samples. Therefore the aforementioned tests were applied to all the versions
of the model calculated and, from the 20 versions obtained, only one did not approve all the tests: Russia for the time period 2003-2006. Consequently, this version will not be considered for subsequent conclusions. (Appendix 2 contains a report with the tests performed to one of the versions of the model as an example).

Before concluding the analysis of the model it is also important to measure its goodness-of-fit looking at the $R^2$ values, to be more precise, to the adjusted $R^2$ as it concerns a multiple regression. These values will indicate the proportion of the sample variation of the dependent variable that is explained by the independent variables collectively, ensuring the OLS estimation is a reliable estimation of the *ceteris paribus* effects of each independent variable. For that reason, it can be said that this variables are generally a good fit for this module since in the majority of the cases the adj.$R^2$ ranges between 70% and 93%⁶ (see Table 2 in appendix). As observed in the Table 2 (in appendix) there is also a lower value (16%), however this value belongs to one of the versions of the models previously mentioned that did not passed the previous tests. Therefore there is no reason for concern about this value.

Finally, in order to analyze if there is a relationship between the emerging markets’ returns and the factor’s returns the null hypothesis of the factor exposure being equal to zero ($H_0: \beta = 0$) had to be tested, against the two-sided alternative of being different from zero ($H_1: \beta \neq 0$). Using a 95% confidence interval, it was concluded if the parameters were statically significant depending on the rejection of the null hypothesis.

The model created allows the study of the interdependence between a domestic portfolio and the external portfolios. Therefore, if the hypothesis on whether the three first

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⁶ The large adj.$R^2$ are mainly caused by the domestic factor included in the model that should explain a great part of the dependent variables return’s variation.
parameters are zero ($\beta_{i,US}$, $\beta_{i,EURO}$, $\beta_{i,PIGS}$) could not be rejected, than no external influence on the dependent variables was considered to exist.

4. Model Results

During this section the results of the interdependence model previously presented are interpreted. The first step is to identify which are the statistical significant parameters. Table 3 (in appendix) contains only those statistically significant parameters for each of the dependent variables selected to represent the emerging markets (BRIC indexes and MSCI EM) for each time interval.

Looking into the results, it can be observed that, as it would be expected the domestic factor is present in any time interval and in all the versions of the model. In contrast, the same is not true for the influence of the other country-factors, which changes from period to period and from portfolio to portfolio. Therefore, a more detailed analysis of the results obtained was made. For this analysis it is important to evaluate the parameters signs and values in order to quantify the magnitude and the direction of the influence the country-factors will have on the emerging markets.

The following results in this section are based on US dollars returns for all the variables included in the model. The same model was also computed with returns in local currency but there were no significant differences in terms of the interpretation of the results.

4.1. Pre-Crisis, 2003 - 2006

As it can be observed on Figure 2 (in appendix), this was a period of rapid growth of the equity market’s performance for the emerging countries. Since these markets were
becoming more open to external markets after the liberalization process they went through, it makes sense that they show some interdependence with external factors. The general index for EM shows interdependence with the USA ($\beta_{EM,USA} = 0.25$) and with PIIGS countries ($\beta_{EM,PIIGS} = 0.41$). The model shows a positive parameter for those relations, which actually makes sense given the emerging stock markets growth and also the USA and PIIGS stock markets growth at the same time. Between 2003 and 2006, the USA was going through a period of expansion after the dot.com bubble crash previously experienced around 2000. At the same time, countries like Portugal, Italy or Spain faced consecutive years of stock markets growth (see Figure 4 in appendix).

On the other hand, when focusing on the BRIC countries, only Brazil, Russia and India show evidence of external influence. Brazil presents a strong relation with the USA ($\beta_{BRAZIL,USA} = 0.66$) and a smaller relation with the PIIGS ($\beta_{BRAZIL,PIIGS} = 0.31$), while India presents interdependence only with the USA ($\beta_{INDIA,USA} = 0.23$).

In the case of Russia, the results do not seem realistic as it is found a $\beta_{RUSSIA,PIIGS} = 0.85$ jointly with a $\beta_{RUSSIA,D} = 0.05$, meaning that Russia had been significantly more affected by external factors than domestic ones. In fact the model does not pass all the fundamental assumptions previously mentioned, therefore it is not going to be taken into account for the final conclusions. However, a possible explanation for the result of this relationship with the PIIGS is that both markets were growing significantly at the time. In 2005 the Russian stock market increased the number of stocks traded per day by 90%. Between 2004 and 2005 thirteen IPOs and six secondary offerings occurred in Russia, representing a combined value of $5.2bn in 2005 (see Goriaev and Zabotkin (2006)). Moreover, the MSCI Russia Index, the one used as an independent variable,
showed an annual performance ranging from 0.19% to 80.17% between 2003 and 2006 (Morgan Stanley Capital International (2014)). At the same time, and as already mentioned, the Italian, Portuguese and Spanish stock markets saw consecutive years of growth. Therefore, a spurious relationship might be present in this case, meaning that this interdependence coefficient might be wrongly inferred due to the coincidence of both markets growth and to a confounding hidden factor. Since the Russian market was opening to the exterior is possible that Russia was exposed to these markets, however it does not seem very realistic to have such a strong interdependence with the PIIGS and such a small interdependence with a domestic portfolio.

4.2. USA Credit Crisis, 2007 – 2009

The financial crisis of 2007 – 2009 was the hardest global financial recession since the Great Depression, according to the IMF’s 2008 World Economic Outlook. The origin of this crisis was in the USA due to a combination of factors such as a housing bubble, easy credit conditions, subprime and predatory lending due to lack of regulation and increasing financial engineering. Ultimately, all of these factors together led to the collapse of several financial institutions and to a systemic collapse. Due to the severity of the situation and to the equity markets global integration, the effects of this crisis were spread way beyond the United States, leading to a serious global economic recession in 2008. Therefore, the reaction of emerging markets to this recession is going to be further studied.

Different results were found for this period for the five models created. First of all, looking at the general EM results there are still external influences driven by the PIIGS and the USA, although in a smaller amount ($\beta_{EM, PIIGS} = 0.38$; $\beta_{EM, USA} = 0.22$). As there
is high correlation between the PIIGS and the USA during this period, it is possible that the PIIGS factor is capturing some of the relevance of the US factor exposure. Another possible explanation for the coefficient’s results might be related with the exposure of the EM companies to these two groups of countries. The higher correlation of the EM Index’ EPS (Earnings per Share) with the PIIGS’ EPS indicates the EM companies present more interrelationship with the PIIGS than with the USA (corr_{EM, USA} = 0.61; corr_{EM, PIIGS} = 0.87).

The fact that there is still a significant factor exposure for the USA indicates that the EM were affected by its financial downturn. Given that the sign of that parameter is positive it suggests that the EM suffered a recession during this period, influenced by the USA credit crisis. However, as the global peak of this financial recession was in 2008, it is possible that the positive returns of 2007, before the burst of the bubble, might be causing the parameter to be small.

In the more detailed case of the BRIC countries there is not a homogeneous result. China indicates no external influence, with the only significant parameter being the domestic factor ($\beta_{\text{CHINA}, D} = 0.98$). In the case of India, the model indicates only a positive coefficient with the USA ($\beta_{\text{India}, \text{USA}} = 0.27$), demonstrating it suffered the same effect previously explained for the EM in general. Russia indicates interdependence only with the PIIGS ($\beta_{\text{RUSSIA}, \text{PIIGS}} = 0.54$) and, finally, Brazil shows positive coefficients with both USA and PIIGS ($\beta_{\text{BRAZIL, PIIGS}} = 0.26$ and $\beta_{\text{BRAZIL, USA}} = 0.22$). Once again, as these two groups of countries present higher correlations in this period compared to 2003-2006 it is possible that the inclusion of both factors is dragging the corresponding coefficients down.
Concluding, during this period some of the emerging markets suffered directly the negative shock of the USA crisis. However, the exposure parameters found were not very high. As the peak of this crisis was in 2008, the positive returns of the pre-crisis months of 2007 might be influencing the magnitude of the parameters. Additionally, the recovery from the financial crisis was not synchronized between different markets during 2009.

The results for the emerging markets and for each one of the BRIC were different. These differences do not necessarily mean that the estimations are wrong. On the contrary, since the emerging countries are not equally exposed to the USA they do not suffer the shock uniformly. As the BRIC represent only four countries of the EM MSCI, the interdependence parameter might be influenced by the other emerging market’s performances. For example, the EM countries that have their currency pegged to the dollar probably suffered a more intense shock, nevertheless is not the case of the BRIC, since all have flexible/managed currencies.

4.3. Eurozone Sovereign Debt Crisis, 2010 – 2012

Following the United States credit crisis, the Sovereign Debt crisis have been affecting the Eurozone since 2009 when countries like Ireland and Greece started to face difficulties in their banking systems. However, this crisis was brought to heel in 2010 when peripheral European countries required eminent bailout funds. At this time, a sentiment of fear of financial contagion that could collapse the euro started to be felt across all the European countries.

This crisis was characterized by a period of time in which several countries were facing the collapse of its financial institutions, high government debt and hiking bond yields in
government securities. The rating agencies downgraded the government debt of several Eurozone countries, having some of them arrived to a point of junk status. The countries receiving funding were required to meet austerity measures to slow down the growth of public debt, affecting several other economic sectors within those countries. The debt crisis led to a crisis of confidence for European businesses and economies. This crisis was however asymmetrical within Europe, where countries like Germany not only did not suffer from it but were actually facing economic expansion. In this section is studied the reaction of the EM to the European crisis given the correspondent exposure.

Using the EM general index as independent variable, the external parameters for the EURO and PIIGS factors were statistically significant. However, as these two parameters are highly correlated, in order to ensure that one was not capturing the other’s influence, an individual analysis\(^7\) of each of them was computed. As a result the corresponding interdependence were \(\beta_{EM, PIIGS} = 0.1\) with the PIIGS and \(\beta_{EM, EURO} = 0.14\) with the EURO. Looking into the correlations on Table 1 (in appendix) one can see that the domestic factor shows high correlation with two external factors, consequently it might be capturing power out of the two external factors.

Nevertheless, despite presenting the same correlation with both the EURO and the PIIGS, the interdependence coefficient with the EURO is slightly higher. A possible explanation for this result might be related with the composition of the EURO MSCI index that is representing the EURO countries. About \(79\%\)^8 of this index is composed by securities of the European countries that were least affected by the crisis. As already mentioned this crisis mostly affected the periphery of Europe and \(79\%\) of the

\(^7\) This analysis excludes the corresponding correlated factor but it still includes the domestic factor.

\(^8\) The weight was calculated by the sum of each country’s securities weight in the index, from all composing countries excluding the PIIGS.
EURO MSCI depends on northern European markets that were rather facing an asymmetric shock relatively to the periphery (see Table 4 and Figure 5). In addition, the small magnitude of the parameters might also be related to the fact that EM started to slow down around 2012 and those values might be influencing the parameter’s magnitude. Concluding, the sovereign debt crisis caused only a limited impact on EM. Meaning that, as the PIIGS saw a downturn in their markets, the EM did not have a strong reaction in the same direction. On the other hand, it seems that the EM were following closer other European countries rather than the underperforming PIIGS (see Figure 5 in appendix).

In what concerns the BRIC countries, one can see that they are divided in two groups: India and Brazil reveal positive parameters with the USA ($\beta_{Brazil, USA} = 0.33; \beta_{INDIA, USA} = 0.3$), while Russia and China show positive parameters with the EURO ($\beta_{Russia, EURO} = 0.22, \beta_{China, EURO} = 0.11$). Nonetheless, both results can be interpreted the same way. As already mentioned the EURO MSCI as a whole was not facing a recession during this period and the USA was already recovering from the previous crisis, therefore the EM appear to be slightly following the countries that were least struggling, indicating they did not suffer strong contagion from this crisis.

Contrary to the other BRIC, India appears to be following USA downturn and recovery, as it is the only country showing positive coefficients with USA in both periods of crisis.

To sum up, by the results shown by the model it seems like the EM did not suffer strong influence from this crisis, at least not immediately. However, it cannot be concluded
that they were not infected by this crisis at all, as there were signs of contagion on the EM index, though very small.

Looking at Figure 2 (in appendix) one can see that after 2009 the equity market performance of the emerging markets still grew, allowing for the possibility that this European recession may have boosted that growth with capital flows. Fearing the European situation investors might have preferred to invest in emerging markets during this period. Later in this paper will be performed a study on this specific subject.

4.4. Post-Crisis, 2013

As the developed markets are recovering from the consecutive crisis, it seems like the Emerging markets are starting to show a slowdown. One can see that, despite the bounced path of the equity emerging markets during the last six years, it appears they are now suffering a slowdown in 2013 (see Figure 2 in appendix).

Looking at the model results one can see that the EM shows a negative parameter with the PIIGS ($\beta_{EM, PIIGS} = -0.25$) and a positive parameter with the EURO countries ($\beta_{EM, EURO} = 0.32$). The PIIGS faster growth and the negative coefficient found, indicate that the EM were underperforming, or at least growing at a much slower pace. Even though the EM were not highly influenced during the time of the sovereign debt crisis, it appears that they are now affected by the DM recovery.

These results leave open the possibility of an influence driven by capital flows. On one hand, during the crisis capital inflows into EM may have influenced these economies positively. On the other hand, since 2013 capital outflows might have influenced EM negatively, causing the slowdown.
Nonetheless, looking deeper into each BRIC the same results cannot be found. This means that the EM-DM relationship was spread over the emerging countries in a non-homogeneous way. From the model results, it appears that these countries only presented positive interdependence with countries that were growing/recovering during 2013. In the case of China or India there are no signs of external influences.

5. Capital Flows

The first database of emerging markets’ equity returns was collected only twenty years ago by the World Bank, for a conference on the “Portfolio Flows to emerging equity markets”. At the time, the concept of Foreign Portfolio Investment (FPI) in EM was relatively recent (as opposed to direct investment) and, with that conference, the World Bank aimed at better understanding the risks that foreign portfolio investors faced in emerging markets (Bekaert and Harvey (2014)). In this section, it is going to be analyzed if the slowdown of the emerging markets was a cause of the movements of capital between the FPI of the EM and the FPI of the DM that may have occurred during and after crisis.

As mentioned in the previous section, the EM’s performance behavior during and after the crisis opened two questions: What is making these equity markets grow as the DM are suffering consecutive crisis? Why are currently the EM lacking on growth while the DM are recovering? Therefore, in an attempt to answer these questions the paper analyzes whether during the crisis there were capital flows leaving the developed markets and entering the emerging markets boosting its equity markets growth. In the same way, it analyzes if afterwards, when the DM started to recover from the crisis,
there were capital flows in the opposite direction causing the slowdown of the emerging equity markets.

Given that it was only possible to obtain yearly data on a period of 10 years, it would not be reasonable to rely on correlations or models results with so few variables. Therefore, the analysis will alternatively go through three different steps: 1) analyze the growth rate of the FPI’s amounts jointly with the coefficients of exposure previously calculated; 2) Go through the evolution of the EM’s equity valuations; 3) Study the performance of the DM market against the EM currencies movements.

5.1. FPI Performance and the Interdependence Results

Firstly, yearly data of the outwards and inwards of Foreign Portfolio Investment for the countries involved in the analysis was collected for the time period between 2003 and 2013. The paper analyzes the FPI amounts for the USA individually, while for the other countries the FPI amounts are computed at group levels (EM and PIIGS), rather than at individual country level. At the European level, only the PIIGS were analyzed since these were the ones mostly affected by the sovereign crisis. At the EM level, FPI amounts differed substantially between countries and, therefore, a more specific analysis for i.e. the BRIC countries was left out.

While every market was showing positive growth in its FPI inflows from 2006 to 2007 (the US increasing by 9%, the PIIGS by 28% and the EM by 33%), from 2007 to 2008 there was clearly a disturbance on portfolio investment worldwide. The PIIGS and the EM’s net inflows decreased by 169% and 10%, respectively, and the US’s net inflows

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9 All the data collected in US dollars.

10 Net Inflows were calculated by subtracting to the FPI inflows the outflows of the same year.
decreased by 12%, meaning that even though inflows increased by 2% it was not enough to surpass the amounts of outflows (see Figure 6 and 7 in appendix).

In the next period (2008-2009), while PIIGS and USA outflows were still growing and causing negative net inflows (with the USA showing a 0% increase in the inflows and 9% increase in outflows, and the PIIGS experiencing a higher increase of 16% in its outflows than in its inflows, 13%), EM’s net inflows rapidly recovered increasing by 44% (see Figure 7 in appendix). In the previous section it was found a positive coefficient between the EM and the USA for the period of 2007-2009 indicating the EM had suffered a shock linked to the US crisis. The small magnitude of the coefficient suggested that it should have been a short-lived shock and, as it can be seen with the FPI results, the EM recovered faster. These outcomes suggest that there might be a possible connection between the DM increasing outflows and EM increasing inflows, investors may have preferred to invest in the EM and consequently changed their capital allocations geographically.

From 2009 to 2010 as the US inflows started to recover leading to an increase in net inflows of 2%, PIIGS situation was becoming more dramatic with an additional 82% decrease in net inflows and 5% increase in outflows. At this time, the EM net inflows continued to show a positive growth of 28%.

As seen in the previous section, the EM proved to be exposed to the sovereign crisis, although less than to the 2007-2009 financial crisis. This result can also be observed on its FPI development. From 2010 to 2011, the EM net inflows still increased but at a much smaller rate of 1%. This time the shock was different from the one suffered with the previous crisis in which EM’s inflows decreased. As PIIGS and USA outflows
continue to grow and surpass its inflows, which seemed almost stagnated given the minor changes, the EM continued to grow recovering its net inflows in 11% from 2011 to 2012.

From 2012 to 2013 the EM saw a sudden sharp decrease of 63% in its net inflows. At this time US inflows were growing at 4% and PIIGS’s at 11% (representing an acceleration of PIIGS flows when comparing with the previous year growth). Additionally, the negative coefficient of exposure of the EM to the PIIGS found for 2013 also indicated they were moving in opposite directions. These results would suggest that that there might be a connection between the DM’s global crisis recovery and the EM’s slowdown. However, when looking at Figure 7 (in appendix) one can see that during 2013 the USA and PIIGS net inflows continued to fall, meaning that its outflows continued to overpass the inflows. In addition, the decrease in the EM FPI was not only on the inflows but also on the outflows (decreased around 62% as well). The aforementioned results consistently suggest that during the crisis period (2007-2012) investors had geographically changed their preferences, nevertheless in the after crisis period (2013) the same cannot be concluded. As there were actually less capitals leaving the EM and the increase in the capitals entering the DM was not significant, it is not possible to conclude there were in fact movements of capitals flying back to the DM economies only based on this information. Actually, these results open the question on whether the situation of the EM FPI in 2013 is a consequence rather than a cause of the EM equity markets slowdown.
5.2. Equities Valuation

If there were capitals flying from the DM to the EM during the crisis, it would be expected that the EM companies would increase their market value during this period. According to the Institute of International Finance, after 2009 the price-to-book ratios of EM equities were more expensive than the ones of DM companies. In an attempt to corroborate that theory and analyze if the valuation of the EM companies had a positive movement during the crisis, the P/E (price-to-earnings) ratios of both DM and EM companies\(^\text{11}\) were calculated. The P/E (Price-to-Earnings) ratio indicates how much an investor is willing to pay per dollar generated by the underlying company. Therefore, if the EM P/E is increasing it means that the investors believe stronger on the fundamentals behind these assets and consequently invest more on them.

Looking at Figure 8 (in appendix) one can see that the P/E of EM increased sharply after dropping around 2008, overpassing the values for USA during 2009, suggesting the EM equities were relatively more expensive than the US equities during this crisis period, regarding the corresponding fundamentals. In the same way, looking at Figure 9 (in appendix) one can see that the same relation is true between the P/E of EM and the P/E of PIIGS from early 2009 to mid-2010.

After 2012 the P/E of the EM decreased as the P/E of the US increased. Therefore, suggesting investors were again putting more faith into DM equities and preferring to invest in this group of countries. These valuations may indicate a geographic shift in investors’ preferences in line with the previous analysis, suggesting a movement of capitals during and after crisis.

\(^{11}\) The values that are going to be used for this analysis correspond to the P/E of the indexes previously used during the paper (EM MSCI, PIIGS and S&P100) and were downloaded from Bloomberg database.
5.3. Foreign Investment and Currency Fluctuations

If there are foreign portfolio inflows into a country, there is commonly a demand for the country’s currency. Empirical studies have proven that depreciated local currency attracts foreign investment (e.g. Udomkerdmongkol, Görg, Morrissey (2006); Chakrabarti and Scholnick (2002)). Increasing foreign investment represents increasing currency demand and should be a pressure for relative change of value between both countries, even though foreign portfolio investment may not be the main driver of a currency relative valuation.12

The performance of the FPI inflows and outflows of DM and EM during and after crisis was analyzed in previous subsections. In this subsection the performance of the DM indexes with the EM local currency evolution is going to be compared. If there were capitals leaving the DM contributing to a negative return of local equity markets and if these capitals would be entering the EM, there could be a positive correlation between the DM index returns and the EM foreign-exchange rates returns.

Given that this analysis aims to support the previous study of the FPI movements, it will focus only on the periods to which the main relations were found. Therefore, it will target 2009 when the distance between increasing net inflows of EM and increasing outflows of DM was higher and 2013, when the EM suffered a strong shock in their foreign investment. The BRIC individual currencies were used as example for EM currencies.

12 The main drivers of currency appreciation and depreciation should be: relative product prices, monetary policy, inflation rate differences and partner countries income changes.
In Figures 10 and 11 (in appendix) are the scatter plots showing the correlation and the linear regression between the variables being analyzed. As it can be seen, during 2009 all the foreign-exchange rates studied show a positive relationship both with the PIIGS and the USA\textsuperscript{13}. Meaning that as these two DM indexes were falling, the EM currencies were appreciating. In some cases the $R^2$ given by the scatter plots are very small. This is expected since foreign portfolio investment is not a main driver of the currency fluctuations. These result aligned with the fact that foreign portfolio inflows were sharply increasing in EM during this period of time, suggests that there was a geographic shift in the investor’s preferences to the EM.

For the after crisis period the same effect is present but with the inverse flow. It suggests that the capitals were now flowing back to the DM as their indexes were appreciating, while the EM foreign exchange currencies depreciated (in Figure 12 in appendix the evolution of the performance of the DM can be observed, confirming it was increasing in the period after crisis).

5.4. Capital Flows conclusions

According to the literature, EM have become “darlings” of international investors over the past decade, attracting capital to their fast-growing industries and delivering a boost to the global economy (Sergie (2014)). However in contrast to developed economies, investors are commonly not willing to accumulate their currency, meaning that if some instability is starting to be felt capitals rush out the local currency to the DM. This chain of events, leaves a great deal of devalued local currency and has already caused crisis in several regions over the past decades (Sergie (2014)). Capital flows can be

\textsuperscript{13} China is not included in the scatter plot group as it did not show any significant value.
inconsistent and after years of foreign portfolio inflows it can suddenly shift and investment is dragged out of EM.

During the previous subsections it was possible to find that during the crisis (2009-2012) net inflows of EM substantially increased as the DM’s decreased and the DM outflows increased, suggesting there was a relation between the two. Afterwards, it was possible to see that during the beginning of the same time period, the valuation of the EM equities increased, indicating investors were valuing these equities more highly during the crisis than before. In addition, a positive correlation was found between EM foreign-exchange rates and the DM indexes, meaning that as the indexes were falling the currencies were appreciating. The three aforementioned results together, indicate that there was in fact a geographic change in investor’s preferences and, therefore, movements of capitals from the DM to the EM.

Looking into Figure 13 (in appendix), it is possible to see that according to the Morgan Stanley Research Team (2013), a sharp rise in net portfolio flows towards DM equity and debt markets supported EM currencies between 2009 and early 2011, thus supporting the results previously found. Their theory adds that this portfolio flows are being supported by QE (Quantitative Easing)14 and the growth differentials between the EM and DM. However, they argue that as QE decelerates and growth differentials narrow (according to their economists’ aggregated forecasts), portfolio flows will not provide currencies the same level of support.

During the after crisis period (2013), the EM saw a sudden steep decrease in its net inflows at the same time as the US and PIIGS inflows were growing. After 2012, the

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14 QE is a monetary policy used by central banks to increase an economy money supply by purchasing government securities or other securities from the market, in an effort to promote increased lending and liquidity.
EM P/Es decreased to values lower than the DM P/Es suggesting investors were now pricing the EM equities lower and thus investing less. In addition, the relationship between the DM indexes and the foreign exchange rates also suggests the investors preferences returned to the DM. Therefore, even though the increase in the capitals entering the DM was not significant and there was also a decrease in the EM outflows, there is evidence that investor’s changed their preferences by stopping investing in the EM to invest back in the DM. This result is in accordance with what was said in the previous paragraph, with the FED announcement of the tapering\textsuperscript{15}, the portfolio flows decreased not supporting the EM local currencies anymore.

Furthermore, the negative coefficient of exposure of the EM to the PIIGS found for 2013 also indicates the performance of the EM was negatively affected by the recovery of the DM. Given that the EM show a negative coefficient with a group of countries that was recovering at the time and that capitals were flowing from EM to DM, one can conclude that the decrease in EM inflows and the slowdown of the EM are both connected of the DM recovery. However, it was not possible to find causality between these two effects, meaning that it is not clear whether the capital flows decrease to EM is a consequence or a cause of the EM slowdown.

6. Final Conclusions and main difficulties

Across the paper the analysis faced several difficulties. First of all, when applying the same model to different sets of data it is very difficult to find that it is applicable and useful in all cases. Therefore, after testing the fit of the model, some of the versions that could be important to the final conclusions had to be excluded.

\textsuperscript{15} Reduction of Liquidity supply programs as the QE
Furthermore, the goal is to prove if there is a causality effect between the DM and the EM, that is, if the DM are influencing the EM. However, with a regression it is difficult to assess whether the effect is coming from the regressor or the regressants. It is only certain that the relationship exists between the two. A future step in order to ensure casualty would be to further study the model with different lags. Additionally, in order to complete the model’ results it would also be interesting to study different time periods more focused on main events, given that the study results might have been biased towards the week or month before and after “turning events”. For example, instead of starting the pre-crisis period on the beginning of January of 2007, start it on the day that Lehman Brothers filed for bankruptcy, September 15, 2008. Moreover, the stock markets are subject to several factors and sometimes it is not possible to capture the entire exposure if there are hidden factors that are not selected within the regression.

It was also difficult to analyze the BRIC countries as a representation of the whole EM, due to the diversity of results within each of the BRIC countries. Individual analysis were useful in order to understand that general conclusions on the EM are not equally applicable across all emerging economies. Within the periods analyzed they may have suffered external influences differently spread throughout sub periods.

The Chinese market is substantially larger and more closed to external capital flows when compared to other EM, which is consistent with its strict monetary policy of capital controls. Therefore it is reasonable to find less significant coefficients of exposure with external markets and to find low values for the coefficients found.

It was possible to find the EM countries were exposed to the DM at some level. The model indicates the EM suffered a short-lived shock during the US and sovereign debt
crisis, not strong enough to affect the performance of the equity markets of this countries for a long period of time, given that they were able to quickly recover while others were still struggling. Nonetheless, the magnitude of the coefficients of exposure indicated that the shock caused by the US credit crisis was stronger than the one caused by the sovereign debt crisis. The model results also showed that as the DM were recovering in 2013 the EM started to decelerate its performance, showing a negative coefficient of exposure with the PIIGS, which started to recover at the time. This leaves the question open about the movements of capital between these two groups of countries.

The second part of the study focus on finding a relation between the equity EM slowdown and the capitals flying from the DM to the EM and backwards. The fact that it was only possible to find yearly data for the FPI made it unreasonable to use a model similar to the previous one to obtain conclusions. Moreover, the fact that it was not possible to distinguish the target of this foreign investment (equity or debt markets), might bias the analysis given that only the flows entering the equity markets should have been analyzed. The analysis including the currency fluctuations may also present a similar bias, as there might exist a relation between currency and fixed income fluctuations. Therefore, a future step in order to ensure the accuracy of the results would be to include an analysis on debt markets.

The joint analysis of the FPI performance, the interdependence model results, the EM valuations and the EM foreign exchange rates against the performance of the DM indexes, suggested that there might have been a geographic change in the investor’s preferences during the crisis (changing from DM to EM during 2009-2012) and after the
crisis (shifting back to the DM after 2012). Even though it was not possible to find the exact causality effect between the equity emerging markets slowdown and the decreased in EM foreign portfolio inflows, it was possible to conclude they are both connected to the developed markets recovery from the successive financial crisis.
7. References


International Monetary Fund. 2008. World Economic Outlook. IMF.


Morgan Stanley Capital International (MSCI). 2014. MSCI Russia Index. MSCI.


8. Appendices


FIGURE 2 – EMERGING EQUITY MARKET EVOLUTION OF EMERGING MARKETS. SOURCE: STOOQ DATABASE.
FIGURE 3 – GROWTH IN CORRELATION BETWEEN EMERGING AND DEVELOPED MARKETS. SOURCE: MSCI.

CORRELATIONS - \( \rho \)

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TABLE 1 – CORRELATIONS BETWEEN THE INDEPENDENT VARIABLES OF THE MODEL, CALCULATED USING THE WEAKLY PRICES DOWNLOAD FROM BLOOMBERG.
### GOODNESS OF FIT - R²

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<th>INDIA</th>
<th>CHINA</th>
<th>EM</th>
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<td>2003 - 2006</td>
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**TABLE 2 – ADJUSTED R² VALUES FOR THE 5 VERSIONS OF THE MODEL CALCULATED.**

### SIGNIFICANT COEFFICIENTS - β

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#### 4 FACTORS, RUSSIA

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<td>2013</td>
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<td>-</td>
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**TABLE 3 – STATISTICALLY SIGNIFICANT COEFFICIENTS OBTAINED BY THE INTERDEPENDENCE MODEL. IN ORANGE IS THE VERSION OF THE MODEL THAT DID NOT APPROVE THE STATISTICAL TESTS, DESPITE PRESENTING SIGNIFICANT COEFFICIENTS.**
FIGURE 4 – PERFORMANCE OF THE PIIGS STOCK MARKETS IN THE LAST 10 YEARS, USING THE CAPITALIZATION-WEIGHTED INDEXES OF PORTUGAL, SPAIN, ITALY AND IRELAND AS AN EXAMPLE. SOURCE: YAHOO FINANCE AND STOOQ DATABASE.

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<td>TOTAL</td>
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TABLE 4 – EURO MSCI INDEX COMPOSITION. IN BLUE ARE THE NORTHERN EUROPEAN COUNTRIES TOTALING AROUND 79% OF THE INDEX MARKET CAPITALIZATION WEIGHT. SOURCE: MSCI.
FIGURE 5 – PERFORMANCE OF THE COUNTRIES COMPOSING MORE THAN 75% OF THE EURO MSCI INDEX IN THE LAST 10 YEARS. SOURCE: YAHOO FINANCE AND STOOQ DATABASE.
FIGURE 6 – FPI INFLOWS OF EM, PIIGS AND US AGAINST FPI OUTFLOWS OF PIIGS AND US. SOURCE: IMF

FIGURE 7 – NET INFLOWS DEVELOPMENT OF EM, USA AND PIIGS. SOURCE: IMF
Figure 8 – Evolution of the P/E ratios of the S&P 100 and the EM MSCI between 2003 and 2013. Source: Bloomberg Database

Figure 9 – Evolution of the P/E ratios of the S&P 100 and the PIIGS portfolio of indexes between late 2008 and 2010. Source: Bloomberg Database
FIGURE 10 – SCATTER PLOTS OF THE RELATION BETWEEN THE S&P 100 AND THE BRAZILIAN, INDIAN AND RUSSIAN FOREIGN-EXCHANGE RATES BASED ON THE DOLLAR, USING LOG RETURNS CALCULATED WITH PRICES COLLECTED FROM BLOOMBERG DATABASE. THE LINEAR REGRESSION FUNCTIONS ON THE BOTTOM OF EACH GRAPH ARE IN CHRONOLOGICAL ORDER.
FIGURE 11 – SCATTER PLOTS OF THE RELATION BETWEEN THE PIIGS AND THE BRAZILIAN, INDIAN AND RUSSIAN FOREIGN-EXCHANGE RATES BASED ON THE DOLLAR, USING LOG RETURNS CALCULATED WITH PRICES COLLECTED FROM BLOOMBERG DATABASE. THE LINEAR REGRESSION FUNCTIONS ON THE BOTTOM OF EACH GRAPH ARE IN CHRONOLOGICAL ORDER.
FIGURE 12 – PERFORMANCE OF S&P 100 AND PIIGS (INDEXED TO 1/1/2003 = 100). SOURCE: BLOOMBERG DATABASE.

FIGURE 13 – RELATION BETWEEN EM CURRENCIES AND NET PORTFOLIOS FLOWS. SOURCE: MORGAN STANLEY RESEARCH, HAVER ANALYTICS. SOURCE: MSCI.
The REG Procedure
Model: Linear_Regression_Model
Dependent Variable: EM MSCI

<table>
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<tr>
<th>Source</th>
<th>DF</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Pr &gt; F</th>
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| Source            | DF | Sum of Squares | Mean Square |
| Root MSE          |    | 0.01           | 0.01        |
| Dependent Mean    |    | 0.00           | 0.00        |
| Coeff Var         |    | 224.55         |             |

R-Square          | 0.7471 |
Adj R-Sq          | 0.7433 |

| Variable | DF | Parameter Estimate | Standard Error | t Value | Pr > |t| | Heteroscedasticity Consistent |
|----------|----|-------------------|----------------|---------|------|----------------|----------------|----------------|----------------|----------------|
|          |    |                   |                |         |      | Standard Error | t Value | Pr > |t| | Standard Error | t Value | Pr > |t| |
| Intercept| 1  | 0.00              | 0.00           | 0.50    | 0.62 | 0.00           | 0.45    | 0.65 |
| EM       | 1  | 0.51              | 0.04           | 12.92   | <.0001 | 0.10           | 5.19    | <.0001 |
| PIIGS    | 1  | 0.41              | 0.06           | 6.67    | <.0001 | 0.10           | 3.97    | <.0001 |
| USA      | 1  | 0.25              | 0.07           | 3.77    | 0.00 | 0.08           | 3.26    | 0.00 |

Distribution of Residuals for EM MSCI

- Normal
- Kernel
The REG Procedure
Model: Linear_Regression_Model
Dependent Variable: EM MSCI
10. Acronyms

BLUE – Best Linear Unbiased Estimator
BRIC – Brazil, Russia, India and China
DM – Developed Markets
EM – Emerging Markets
EPS – Earnings per Share
FPI – Foreign Portfolio Investment
GDP – Growth Domestic Product
IPO – Initial Public Offer
MSCI – Morgan Stanley Capital Investment
OLS – Ordinary Least Squares
P/E – Price to Earnings Ratio
PIIGS – Portugal, Ireland, Italy, Greece and Spain
QQ plot – Quantile-Quantile plot
US/USA – United States of America