IMPACT OF MACROECONOMIC VARIABLES ON STOCK PERFORMANCE; Evidence from Developed and Developing Countries

by

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Abstract

The increasing importance of the stock market in the economic development has been very rapid in the last few decades. Moreover, there is also an increasing importance of economic activity in stock market development. This indicates that there is a strong interaction of the stock markets with the economic activity, which has been subject of much research recently.

The main aim of this study is to examine the effect of macroeconomic variables on stock index prices. The importance of this impact is related to the Efficient Market Hypothesis (EMH), which assumes that stock prices reflect all available information from the market and economic activity. The main macroeconomic variables which are hypothesized to have a strong impact in stock prices are interest rate, inflation rate, exchange rate, money supply and industrial production. From the comparative study conducted between five developed countries; namely United States (US), United Kingdom (UK), Japan, Canada and Germany and five developing countries, including Brazil, Russia, India, China and South Africa (which stands for BRICS group) by using the cointegration analysis it is observed that the macroeconomic data have a long term association with the stock index prices only in US, Japan and South Africa. Based on the cointegration results, the Vector Autoregressive (VAR) and Vector Error Correction Method (VECM) analysis are applied. From these analyses, it is observed that there is quite a strong impact of macroeconomic variables in stock prices of developed countries, especially in US, Germany and Canada. On the other hand, from the BRICS group only in South Africa a strong explanatory power of macroeconomic variables in stock prices is observed, while in the other countries the impact is very poor. Lastly, because of the increasing impact of globalization a short study of how US macroeconomic variables affect the stock markets of the above mentioned countries is undertaken. From the VAR analysis it is observed that the US economy has strong impact in the stock markets of those countries with which it has a close economic and financial activity and especially the US industrial production is found to have a strong positive impact in the stock markets of all these countries.

The findings of this study give evidence on stock market behavior relative to the economic activity for specific countries, which is of important use for stock market analysts for investment options and especially for EMH analysis; for stock efficiency purposes.

Keywords: *stock prices, macroeconomic variables, EMH, cointegration, VAR, VECM*

Abstrakt

Rritja e rendesise se bursave te kembimit ne aktivitetin ekonomik ka qene shume e larte ne dekadat e fundit. Per me teper, edhe aktiviteti ekonomik ka nje ndikim shume te rendesishem ne performancen e bursave te kembimit. Kjo do te thote qe ka nje nderlidhje te madhe ndermjet ketyre dy sektoreve, e cila ka qene edhe objekt studimi ne kohet e fundit.

Qellimi kryesor i ketij studimi eshte shpjegimi qe kane variablat makroekonomike ne cmimet e indekseve ne bursa kembimi. Rendesia e ketij ndikimi lidhet me Hipotezen e Marketeve Eficiente e cila konstaton se cmimet e aseteve reflektojne te gjithe informacionin e mundshem te ekonomise ose te tregut perkates. Indikatoret kryesore makroekonomike qe supozohet te ndikojne ne cmimin e aseteve jane interesi, inflacioni, kembimi valuator, paraja e ofruar ne treg si dhe prodhimi industrial. Nga studimi krahasues i kryer ndermjet 5 vendeve te zhvilluara (SHBA, Angli, Japoni, Kanada dhe Gjermani) dhe grupit BRICS (i cili nenkupton Brazilin, Rusine, Indine, Kinen dhe Afriken e Jugut) duke perdorur analizen e cointegration vihet re se ekziston nje nderlidhje afatgjate ndermjet variablave makroekonomike dhe cmimeve te indeksit ne SHBA, Japoni dhe Afriken e Jugut. Duke u bazuar tek cointegration test, metodat e VAR dhe VECM perdoren, nga te cilat rezulton se ka nje shpjegim mjaft te forte nga sektori ekonomik per cmimin e indeksit ne vendet e zhvilluara, kryesisht ne SHBA, Kanada dhe Gjermani, ndersa per vendet ne zhvillim ky impakt eshte shume i vogel; vetem ne Afriken e Jugut vihet re nje impakt i forte. Se fundmi me rendesine e madhe te globalizimit merret parasysh dhe impakti qe kane variablat makroekonomike te SHBA-se ne cmimin e indekseve per vendet e lartpermendura. Duke perdorur analizen VAR, arrihet ne konkluzionin se keto indikatore kane nje impakt shume te forte ne cmimet e atyre marketeve me te cilat SHBA-ja ka lidhje te forta ekonomike dhe financiare dhe vlen te permendet qe prodhimi industrial ne SHBA eshte ndikues i forte dhe pozitiv ne rritjen e cmimeve te indeksit ne vendet e lartpermendura.

Keto rezultate japin konkluzione ne ndikimin e aktivitetit ekonomik ne cmimet e indekseve, qe mund te jenes shume te rendesishme per analistet e bursave te kembimit dhe sidomos per ata qe duan te studiojne EMH.

Fjalet kyce: *cmimet e aksioneve, variabla makroekonomike, EMH, VAR, VECM, kointegrim*

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Declaration Statement

1. The material included in this thesis is based on my original work except quotations and citations which have been duly acknowledged. I also declare that this thesis has not been previously submitted for the award of any degree, at Epoka University or any other university.

2. The study of which this thesis is part has consisted of:

i) Research Methods courses during the graduate study

ii) Examination of several articles as well as professional books on this subject.

Ditmir Sufaj

June 2016

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List of Abbreviations

EMH:	Efficient Market Hypothesis
US:	United States
UK:	United Kingdom
BRICS:	Brazil, Russia, India, China, South Africa
APT:	Arbitrage Pricing Theory
PVM:	Present Value Model
CPI:	Consumer Price Index
IP:	Industrial Production
CF:	Cash Flows
CAPM:	Capital Asset Pricing Model
RFR:	Risk Free Rate
ADF:	Augmented Dickey Fuller
VAR:	Vector Autoregressive
VECM:	Vector Error Correction Model

INTRODUCTION

Focus of the Study

The stock market is one of the main developments of the last century. The increasing importance of this market is especially reflected in developed countries, and has started to have significant increases also in the emerging markets. The stock market functions by trading publicly owned shares. The stability, well performing and efficiency of stock market are the main key indicators to enhance the investment in the financial markets.

This study is interested in stock price volatility relative to the macroeconomic activity changes. Normally the company specific factors such as market capitalization, trading volume, sales and capital structure are the main components that affect the stock prices. These are all internal factors that are at the individual level of companies, which cannot actually affect the entire market. Given that this study is interested in explaining the stock prices of the entire market (that is the index prices), variables that do impact the entire stock market are to be chosen. The economic activity or more specifically stated the macroeconomic indicators, are the best example of external factors affecting the stock market. These factors, leaded by interest rate (which is the main indicator of stock prices) have the ability to affect the entire stock market and cause major changes in stock index prices.

Objective of the Study

This study will provide a comparative analysis between developed and developing countries in terms of their stock market performance relative to the economic activity. Based on efficient market hypotheses (EMH), it is expected that stock prices reflect all available information. Since stock markets of developed countries are more efficient, it is hypothesized that they have a stronger relationship with the macroeconomic variables. Therefore one of the main hypotheses of this study is to indicate whether the stock prices are largely affected by macroeconomic variables in developed countries, and whether this impact is weaker in developing markets.

The main macroeconomic variables that are hypothesized to affect the stock prices are the interest rate, inflation, exchange rate, money supply and the industrial production. From all the factors that affect the stock prices, the interest rate is the most sensitive one; no other factor can

produce such an effect to the stock prices as the interest rates. All the other macroeconomic variables chosen have strong association with the interest rate. The next important hypothesis is the direction of impact these variables have on the stock index prices. Theoretically, interest is expected to have a negative effect, while the industrial production positive impact. On the other hand since the money supply, exchange rate and inflation rate can affect the prices in both directions; it remains to empirically determine their impact. Given this, the main objective of this paper is to examine the factors that cause a stock price increase, and indicate whether their effect is expected to be positive or negative in the economic activity and consequently in the stock price. As a summary, the main objectives of this thesis are:

1. Study of the stock market in general terms, and the main indicators that affect the stock prices
2. Based on literature and the methodology of this study a relationship will be established between the macroeconomic variables and the stock prices
3. Based on this established relationship, it can be determined in which countries the EMH is at its strong form efficiency and in which countries it is at the weak form efficiency.

Justification of the Study

The interaction of these two environments has been subject of much research over the past few decades. There are a lot of studies that try to document the relationship between the macroeconomic variables and the stock market. Most of these studies have found evidence that macroeconomic variables affect the stock prices mainly in very developed countries, while little evidence has been found on the effect of the macroeconomic variables in the stock market in developing countries. Finding evidence of strong relationship indicates efficiency of the particular stock market, while low impact indicates lack of efficiency in the particular stock market. Due to this reason a comparative study of developed and developing countries will be provided in this study. First of all the selection is based on stock market capitalization rankings; the five developed countries are the best in the rank, while the BRICS group is the best from the developing countries (The Money Project). The fast growing economies are chosen from developing countries, because even though they have had a good economic performance lately, their economic and especially the financial sector are not sophisticated, meaning that there exist many irregularities in their stock markets. Moreover from this comparative study, countries from

all regions of the world are selected, so that countries with different economic and financial characteristics will be analyzed.

Structure of the Study

Following the introduction part, a summary of the literature on this topic is given, which will help in documenting an interaction between the stock market and macroeconomic variables. In the next section, the stock market is explained in general terms. The main factors that affect the stock prices are mentioned, consistently with EMH. Furthermore a description of stock indexes and their role in the stock market is given. The following section is about the main macroeconomic variables that affect the stock prices, and the direction of impact they are hypothesized to have in the stock prices. The methodology part concludes the chapters of this study. In this section theory is converted into practice, by taking real case studies on five developed countries (US, UK, Japan, Canada and Germany) and the BRICS group. Using the cointegration method for long term association, together with VAR and VECM for sign of impact, the effect that macroeconomic variables have in their respective markets are indicated, giving also a detailed study of how the stock market is performing in different regions of the world. Furthermore with the increasing role of globalization and since US is the strongest country in the world, an impact of its macroeconomic variables into the stock markets of all these countries is analyzed. The last section of this study involves the conclusions part, which will summarize all the results of this paper and compare the theoretical background with empirical results of this study.

CHAPTER ONE: LITERATURE REVIEW

In this section previous studies will be analyzed, and evidence on the effect of macroeconomic variables on stock returns in different countries and different periods will be shown.

Some of the first authors starting to study the effect of macroeconomic variables in stock performance were (Chen, Roll, & Ross, 1986). They found out that especially the monetary aspects of the macroeconomic variables have a significant effect on the stock performance. Evidence was found that interest rate, risk premium and inflation rate are very important indicators in determining the stock performance in any country. According to them, this long term relationship exists because of the influence of economic factors in future dividends/cash flows and discount rates. They studied the stocks listed in New York Stock Exchange (NYSE) and found out that the average market is correctly priced in accordance to economic changes. Since then, a significant large number of other authors have been examining this topic.

Several authors have tried to capture the effect of macroeconomic indicators on stock returns by using the Arbitrage Pricing Theory (APT), which was firstly developed by (Ross, 1976). The APT is an asset pricing model, which indicates that the price of any asset is affected by many risk factors, having a special focus on macroeconomic variables. Following the lessons of (Ross, 1976) on APT, Chen et al. (1986) managed to use some macroeconomic variables that could explain the movement in stock prices. His results showed that industrial production, and changes in risk premiums were positively related to the stock returns, while the inflation rate and fed fund rates had a negative impact in stock returns.

(Fama, 1981) indicated that the best measurable method of indicating the stock return and macroeconomic variable relationship is the APT, which was explained on the above paragraphs, while (Fama, 1990) indicated that another alternative method of measuring the effect of macroeconomic variables on stock prices is through the Present Value Model (PVM), which relates the stock price to the expected future cash flows and the discount rates. According to this model, there are two main sources of variation in stock returns: (a) changes in expected cash flows (b) changes in discount rates (Fama, 1990). Any macroeconomic variable affecting these components would consequently influence the stock price. One advantage of PVM is that it

shows a long term relationship between macroeconomic variables and the stock market (as it measures the future expected cash flows and the expected discount rates.

Some of the latest studies in this topic conducted by (Patelis, 1997) and (Thorbecke, 1997) take as basis the PVM to determine the share price. The share price of any stock is determined by expected future cash flows discounted in the present with a required return, according to (Elton & Gruber, 1991). As explained by (Thorbecke, 1997), since the stock prices reflect the present value of future cash flows, monetary policy can positively affect the price either by increasing the future cash flows or by lowering the discount rate. From his study, it was found out that the monetary policy components, especially the fed funds rate (which have a direct effect in required return) have a significant impact in predicting the stock market returns.

An important development in this field of study was the cointegration analysis, which would provide a different approach on examining the co movements between macroeconomic indicators and stock returns. According to (Granger, 1986), the presence of cointegration among relevant factors statistically speaking, indicates that a linear combination of non stationary time series exhibits a stationary series. The advantage of this approach relies in its ability to explore dynamic co movements among variables taken into study. This method started to be used by (Mukherjee & Naka, 1995), on the Japanese stock market. They found out that Japanese stock market is cointegrated with six macroeconomic variables, including money supply, inflation rate, exchange rate, long term bond rates, short term interest rates and the industrial production. They concluded that the efficiency of the Japanese stock market has a lot of contribution in this relationship. As for the short term relationship little evidence was found in their study.

Based on the study of (Gibbons, 1982), he found out that there exists a negative correlation between expected inflation and real returns, even though this negative correlation is considered as a spurious one by (Fama, 1991). He arguments this correlation as spurious, because the inflation rate has negative effect on the discount rate, but at the same time it has a positive effect on the cash flows and due to this reason the exact effect cannot be determined. Another study, conducted by (Geske & Roll, 1983) indicated that stock prices in US are positively related to the economic activity and negatively related to inflation, which is consistent with (Fama, 1981), but not with (Fama, 1991). The effect of inflation rate, even though having controversial opinion, has been empirically documented as having a negative effect in stock prices (Fama & Shwert, 1997) (Geske & Roll, 1983). From the negative effect of required return (discount rate) on stock

current prices, interest rates have a negative impact in stock prices; indicating that higher interest rates will lower the present value of any stock's price (Chen et al. 1986). The real economic activity, including GNP, IP or employment rate will always have a positive effect on future cash flows and consequently this positive effect will be reflected also in stock prices (Fama, 1990). According to (Geske & Roll, 1983) exchange rates have an impact on stock prices in terms of trade effect. If the domestic currency will depreciate, it means that the goods in this country will become cheaper, and consequently other countries will be willing to buy from this country, consequently increasing the exports of this country. Higher exports mean that the goods of any company are going to be sold more and more, so the quantity of sold products will increase and consequently they will have more cash return from their sales, leading to higher stock prices.

Another two authors, (Maysami & Koh, 2000), studied the effect of macroeconomic variables in Singapore by using cointegration test in the VECM. They found that stock market in Singapore is cointegrated with five macroeconomic variables, including the interest rates, inflation rate, money supply, exchange rate and industrial production. Another two authors, (Cheung & Ng, 1998) would use the cointegration method technique with quarterly data in five countries, including Canada, Germany, Italy, Japan and US. They concluded that there are long term co movements between the stock index in each country and the specific economic factors, including money supply, oil prices, industrial production and GNP.

From the studies of (Bodie, 1976), (Fama, 1981), (Geske & Roll, 1983), (Pearce & Roley, 1983) (Pearce & Roley, 1985) it was observed that inflation rate and money growth have a negative effect on aggregate stock returns; while it has been difficult to establish a clear result of the impact of real sector macroeconomic variables on stock returns.

The vulnerability of stock price changes is attributed especially to the following three macroeconomic variables, including interest rate, exchange rate and inflation rate (Dufey & Srinivasulu, 1983) (Oxelheim & Wihlborg, 1989). Based on their study the choice of any variable that affect the stock market returns is based on international equilibrium relationships and the relative prices in any country are a reflection of macroeconomic changes (either shocks or booms) involving the real activity variables, such as GDP, demand and the monetary policy variables which have a larger impact on stock returns.

The Malaysian stock market and the effect that macroeconomic variables have on it were studied by (Habibullah & Baharumshah, 2000). They used (Toda & Yamamoto, 1995) methodology in order to establish the lead and lag relationship between variables. The macroeconomic variables included in the model are: money supply, Consumer Price Index (CPI), interest rates (T-bill rates), exchange rate (real effective exchange rate) and the GNP. Their results indicated that money supply and interest rates lead the stock prices, but the opposite happens with CPI, GNP and exchange rate, which are lead by stock prices.

In the study of (Nasseh & Strauss., 2000) it was found out that there is a significant long term relationship between stock prices and domestic or international economic activity in some European countries, including Germany, Italy, France, the Netherlands and Switzerland. Their study was based on the cointegration method, so that a long run co movement between the variables was observed.

From the study of (Poon & Taylor, 1991), it was examined the direction of causality between stock prices, interest rates and money supply in the United States. There was a feedback system characterizing the relationship between stock prices and money supply, mainly with money supply causing the variations in stock price levels and vice versa. As for interest rates, there is causality from them to the stock prices, but not vice versa; meaning that interest rates cause variations in stock prices.

In the comparative study of (Humpe & Macmillan, 2009), by using the cointegration analysis it was observed that stock prices are cointegrated with interest rate, CPI, IP and money supply. In US, interest rate and CPI are found to be significant and negative in VECM, while the IP is significant and positive. No significant impact of money supply is observed. On the other hand, for the Japan case, adopting the VECM model, it is observed that only IP and money supply are significant, with the first one having a positive impact, while the second one a negative one. No significant impact of interest rate and CPI is found on stock prices. This is explained with the crisis in the Japanese economy during the 90’s.

In another study, conducted by (Bailey & Chung, 1995) in Mexico, it was taken into consideration the influence of political risk and exchange rates in the stock market returns. The main finding is that the equity market is consistently moving with the exposures in the free market dollar premium and being also negatively affected by political risks.

By using the causality test (Abdalla & Murinde, 1997) would investigate the co movements between the exchange rate and stock prices in Korea, India, Pakistan and the Philippines. They observed monthly data from 1985 to 1994. There is causality from exchange rates to stock returns, but not vice versa.

The cointegration relationship of macroeconomic variables and stock prices was observed by (Muradoglu & Metin, 1996) in Turkey. They conclude that there are different variables explaining stock returns in different time periods (one variable affecting them in one period, doesn't necessarily affect them in another period) and that especially the influence of monetary policy variables change through time, while exchange rate is significant through time, as markets are becoming more mature and more globally oriented nowadays.

From a study in 41 developed and developing countries using data from 1976 to 1993, (Levine & Zervos, 1996) investigated the relationship between the stock market prices and economic indicators. They included investments, GDP, political risk, monetary policy variables and exchange rate as macroeconomic indicators. They found a strong positive co movement between these variables and the stock returns in respective countries, indicating that as the economy would grow, its growth would be reflected also in the stock prices, by observing increases in them. Three authors, namely (Bilson, Brailsford, & Hooper, 2001) found evidence that stock returns are a strong indicator of explaining the economic growth. From their evidence it was observed that this property of stock market is observed only in developed countries, while the stock markets in developing countries had no explanatory power over the economic growth, concluding that misleading or weak results will be received from these markets, because of the lack of an efficient stock market in those countries. This argument was a support for (Wai & Patrick, 1973) study, which indicated that economic growth doesn't have a strong impact on stock performance in developing countries.

Further support on the effect of macroeconomic indicators on stock performance was given by (Dimitrova, 2005). He used a short run model of testing whether there was an upward trend in the stock market. The macroeconomic variables he took into consideration were interest rates, exchange rate, output, inflation rate, and foreign output and oil prices for model specification. He used monthly data from 1990 to 2004 and the countries taken into study were the US and UK. From the results he indicated that there is negative relationship of exchange rates to stock prices when exchange rate is the lead variable, while there was a positive link when the stock prices

were the leading variable. At the same time, it was observed that the effect of stock prices was positive on output and the association of inflation rate to the stock prices was negative.

(Brown & Otsuki, 1990) examine the effect of money supply, production index, exchange rate, oil prices and discount rates in determining the asset prices for Japanese equities. They find a significant association of these variables with the variability in stock prices, which further proves the theoretical aspects mentioned above. According to the study of (Hamao, 1988) for US and Japan, there are six variables that have a strong significant effect on stock prices, namely CPI, money supply, exchange rate, IP, long term government bond rate (LGB) and money market rates (CMR). He hypothesized that inflation and interest rate have a significant impact on security pricing, while industrial production, exchange rates and money supply do not affect the stock market pricing.

According to (Chen, Roll, & Ross, 1986) the variables that systematically affect the stock market returns are: long and short term interest rates, IP, CPI, money supply and the high and low grade bond spreads (having high effect on discount rates). This study was paralleled by (Poon & Taylor, 1991) in UK, by using the same variables. They found low evidence of macroeconomic variables affecting the stock prices, especially relative to their effect in the US market. They assume that the used model by (Chen, Roll, & Ross, 1986) may lead to spurious regression.

The study of (Soenen & Johnson, 2001) investigated the effect of industrial production and CPI on stock market prices for China. The study would use monthly data from 1994-1998 and different Chinese shares would be examined. They found a very weak impact of inflation on stock prices, while the industrial production had a positive and significant impact in Chinese stock prices. In another study they examined the relationship between a set of macroeconomic variables and the index of Chinese stock market. By employing heteroskedastic cointegration, they found that a significant relationship exists between the index of the Chinese stock market and macroeconomic variables. They concluded that exchange rate and interest rate have a negative relationship with the index of Chinese stock market.

(Rapach, 2001) analyzed the long run relationship between inflation and the stock prices. Using macroeconomic data from sixteen developed countries, it was concluded that there is a weak relationship between inflation and stock prices.

As a summary the main findings from literature give evidence that initially all the authors were focused on APT, which would explain the stock prices in terms of unspecified risk factors. Later on the PVM was introduced, which had the advantage of exploring a long term association of the stock price and the factors affecting it. From this method, any factor causing changes either in future CF or discount rate, is expected to have an impact also in the stock prices. From all the macroeconomic variables, monetary policy ones are found to have a strong impact in stock prices, while real macroeconomic indicators have little impact in stock prices. Mainly the cointegration test has been used in establishing a relationship between the macroeconomic variables and stock prices, together with causality tests. From these tests, it was mainly observed that the macroeconomic variables have a very strong impact in index prices of developed countries, while in the emerging markets little evidence has been found. Lastly, as indicated by (Chen, Roll, & Ross, 1986) there is no satisfactory theory that would conclude the impact of macroeconomic variables in stock prices is in one direction. This simply means that this impact is dynamic; changing in different times, because of specific factors.

CHAPTER TWO: STOCK PRICES, EFFICIENT MARKET HYPOTHESIS AND STOCK INDEXES

Stock markets, differently from other financial markets have removed the "intermediation effect". The funds flow directly from lenders to borrower in the stock market, rather than using an intermediary (such as banks) for the flow of funds. This kind of investment is of course riskier, as prices tend to be more volatile, but at the same time higher returns are attained in these kinds of investments. The role of stock markets, relative to financial intermediaries (especially in developed countries) has been increasing very rapidly. The main determinants of stock prices together with the efficient market hypothesis and the stock indexes will be studied in this section.

2.1. Stock Price Determinants

Before starting with any specific formula that shows the determinants of stock prices, it has to be stated that demand and supply for any security (as for any other good) are the main determinants of the stock prices. Higher demand than supply raises the stock prices, while higher supply than demand lowers the stock prices. One would wonder: "which are the main components that drive the demand and supply for stocks?" Again as for any other good, the performance of the company (net earnings) determines the stock price. The higher earnings can be achieved by having efficient sales and reduced costs. These earnings will increase the future cash flows and as it will be indicated below, they will consequently increase also the stock prices (Ross, Westerfield, & Jordan, 2008). This is only a preface for understanding the main driver of stock prices. In the following paragraphs, the specific formulas will indicate each individual component that affects the stock prices.

One of the main assumptions for determining the stock prices is the Gordon growth model, assuming the dividends have a constant growth forever, which makes the assumption of the stock price, as:

$$Price = \frac{D_1}{R-g} \qquad \textbf{Eq. 1}$$

Where D_1 is the dividend, R is the required return and g is the constant growth rate of the dividends (Ross, Westerfield, & Jordan, 2008). The other assumption, which is more widely used

(assuming there are different cash flows each year), is by discounting back in the present all the future cash flows with the respective discount rate.

$$Price = \sum_{i=1}^{t} \frac{CF}{(1+R)^t} \qquad \textbf{Eq. 2}$$

Where CF is the future cash flows (including the dividend payments and stock price at last year), R is the required return or the discount rate needed to discount the cash flows back in present and t is the number of periods (Ross, Westerfield, & Jordan, 2008). Another important consideration is the APT, which was developed by (Ross, 1976) and was mentioned in the previous section.

The formula of APT is:

$$E(R_j) = r_f + \beta_{j1}RP_1 + \beta_{j2}RP_2 + \beta_{j3}RP_3 + \beta_{j4}RP_4 + \ldots + \beta_{jn}RP_n \quad \textbf{Eq. 3}$$

Where;

$E(R_j)$ = the expected return on any security

r_f = risk free rate, generally it includes t-bill rates

β_j = the sensitivity of any securities return relative to the risk factors

RP = the risk premium that is linked to the specific factors

The main idea of APT is that the expected return on any security relies on two main components; macroeconomic/asset specific impacts and the assets sensitivity to these impacts. It takes the general linear regression form as explained above. Initially the study of APT was focused only on individual stock prices, but in later studies it was being used in the aggregate stock market, given that a change in a specific macroeconomic variable, would be reflected not only in one equity, but in the whole market, being underlined as systematic risk factor. The range of factors affecting the stock prices in the APT was not initially specified; being ranged as an unknown number of unknown factor affecting security returns by (Ross, 1976). Later on, the duo of (Roll & Ross, 1980) identified these factors as namely: unanticipated change in the inflation, the term structure of interest rates, industrial production, and risk premiums. The validity of this theory was examined by them in 1986 in the US stock market, finding significant relationship of these variables with the stock returns.

The last important development, which is considered to be the modern finance equation, is the Capital Asset Pricing Model (CAPM). From this theory, the expected return on any security is explained as follows:

$$E(Rx) = RFR + \{E(Rm) - RFR\} * \beta x \qquad \textbf{Eq. 4}$$

Where;

$E(Rx)$ = the expected return on individual assets

RFR = the risk free rate

$E(Rm)$ = the expected return on the market and;

βx = the riskiness of an individual asset relative to the market

This formula indicates that the expected return on an individual asset, doesn't depend only on asset specific factors, but also on the overall market (measured by expected return on market) and by the government discount rates (measured by RFR). From the expected return on the prices, the future price may be predicted.

From the stock price returns it is assumed that the actual return on a stock is composed of the expected return and unexpected return

$$R = E(R) + U \qquad \textbf{Eq. 5}$$

This means that the actual return on a stock can differ from the expected return (measured by CAPM) only because of the unexpected portion of return.

The E(R) can be measured either by using the CAPM or the Dividend Growth Model. Taking into consideration the unexpected portion of return, it can be split into two parts, which are the systematic portion and unsystematic portion.

$$U = Systematic\ Portion\ (m) + Unsystematic\ Portion\ (\mathcal{E}) \qquad \textbf{Eq. 6}$$

Systematic portion is the part that influences a large number of assets, or most of the assets and is also known as market risk. While unsystematic part is known as asset specific risk and it affects only individual assets. Components of the systematic portion are mainly the macroeconomic variables, while components of unsystematic portion are the asset specific factors, such as sales level, net earnings, capital structure etc. If holding a portfolio or an index is being taken into consideration, the unsystematic risk can be diversified away since it corresponds

to only specific assets and therefore it can be ignored. On the other hand, systematic part of the risk cannot be diversified away, as it affects all assets. This means that any macroeconomic variable change is likely going to cause changes in all securities prices. Since an index is composed of all securities being listed in the stock exchange, this is a strong indication that the macroeconomic variables (which are part of the systematic risk) have a strong impact in the index prices (Ross, Westerfield, & Jordan, 2008). This is one of the most important reasons why this study pays a special focus on macroeconomic variables.

2.2. Efficient Market Hypothesis (EMH)

When the stock market and the stock prices are taken into consideration, a significant importance should be given to the EMH, which was initially developed by (Fama, 1970). According to his study, EMH shows the speed of stock price changes to the relevant information available to the companies. He concluded that if the market is efficient, then it is impossible to beat it (impossible to find undervalued or overvalued assets), as the prices will reflect all the available information (the prices will move in response to news). He further stated that EMH works more at the micro level, rather than at the macro level; indicating that the market are more micro-efficient rather than macro-efficient, which indicated that EMH is better suited to the individual stock, rather than to the aggregate market. This finding was updated by (Fama, 1991) as he found out that the prices were very responsive to the macro environment. He explained this change due to the development and advanced technological improvements in stock markets.

Since the markets are not always efficient (at least not all markets), the EMH is divided into three subfields, which are: *weak form efficiency*, *semi strong* and *strong form efficiency*. The *weak form efficiency* relies only on the historical data to predict the future stock prices and therefore it is not very reliable. According to (Fama, 1970) the stock prices cannot be predicted by historical data, and therefore he calls this form as weak efficiency, which indicates that it doesn't show the fair value of the stock prices, since the stock prices follow a random walk. The *semi strong form of efficiency* relies on historical data and all the public information available to the company for future stock prices prediction. The last one, which is the most important one and the most reliable one, is the *strong form efficiency*, which assumes that analysts rely on historical data, public information and the private information that belongs to the companies. Due to this reason, since also the private information is available for future prices prediction, this stock

market form of efficiency is considered as quite reliable. Generally the stock markets of very developed countries (especially US) operate under the strong form hypothesis. Taking into study countries that operate on strong form hypothesis, is likely going to give more reliable results also, as the stock prices will reflect all the changes that occur to any of the macroeconomic variable affecting them. The EMH theory differs a lot from CAPM theory mentioned above; since according to CAPM, undervalued and overvalued assets can be dictated and those dictating them can beat the market (the difference of actual return to the expected return is the part that beats the market). This shows that either of these theories is incomplete. Despite this, since both theories belong more to investing and portfolio setting strategies rather than their relation to macro environment, more details will not be given on them, but it is important to mention that based on EMH theories, evidence has been found, especially in the last 30 years, that macroeconomic variables are an important component for the future stock prices changes (Reilly & Brown, 2012).

2.3. Stock Market Indexes

The use of stock indexes is to make measurements of the value of a portion of the stock market. The price of the index is generally computed from the weighted average price of all the listed stock in a particular market. Examples of stock market indexes are: NASDAQ Composite (NASDAQ Stock Exchange), S&P 500 (New York Stock Exchange), FTSE 100 (London Stock Exchange), DJI (New York Stock Exchange and NASDAQ), MSCI (European Index) etc. Stock index is a tool that stock market managers use for describing the market (used as benchmark) and comparing the specific assets to the overall market. Stock indexes are not to be invested directly in them, but rather any investor can track its prices and determine where to invest (Reilly & Brown, 2012).

The indexes can either be *global* or *national*. *Global indexes* are composed of international companies, irrespective of the country at which they operate. This kind of index provides a benchmark in the global context. Examples of such indexes are S&P Global 100 and MSCI World. *National indexes* are composed of only companies that operate within a country, and consequently represent the performance of the stock market in a given nation only. The importance of national indexes relies on the reflection of the investor's sentiment on the state of economy. This means that these indexes will reflect in a high portion, also the economic changes

of the respective country. This is the reason why the largest indexes are those that rely on a national level, as they reflect very rapidly the changes in the economic environment (Reilly & Brown, 2012). It is important to mention that this study will take into consideration only national indexes, which will reflect the most important aspect that it is looking for (changes in economic indicators). All the indexes mentioned in the first paragraph are examples of national indexes.

According to the weighting, the indexes are either *price weighted indexes* or *capitalization (market value) weighted indexes.* In the *price weighted indexes*, a price change in a single small company, will have a significant effect on the price of the index, even though the weight of that company in the index is very low. The second type, *capitalization weighted index,* which is much widely being used nowadays, affects the price of the index according to the weight that specific companies have in the index. Being so, a small price change in a large company, will affect more the price of the index than a large change in a small company. This method has the big advantage of classifying the effect according to the weights and therefore it is considered as more effective (Reilly & Brown, 2012).

As a summary, when an analysis is required for studying the stock prices behavior, instead of taking individual securities one by one, the index is taken into study, since it encompasses all the securities within it, and it is very likely expected to give similar results to a group of assets if taken individually (Reilly & Brown, 2012). From the literature in the previous section, it was observed that almost all authors were using the indexes as indicators for stock prices. Because of this reason and since the weighted average prices of any market will give nearly the index prices, this study will also take into consideration only the index prices of the respective markets.

CHAPTER THREE: MACROECONOMIC VARIABLES AND THEIR RELATION TO STOCK PRICES

First of all, before entering to the explanation of specific macroeconomic variables, a short description of macroeconomics and microeconomics will be made. Macroeconomics is the field of study that studies the economy as a whole, while microeconomics studies the individual and business choices on consumption, saving, investment etc. Economics is the sum of them, meaning that it deals with the whole economy, but at the same time considers the individual decision making (Friedman, 1968). In this study the effect of macroeconomic variables on stock performance will be considered. Normally there are important microeconomic indicators that affect the stock performance, which were indicated also above as the main indicators for stock prices (the main drivers of demand and supply for stocks; including net earnings, sales, capital structure, costs etc); and these are all at the micro level. The macroeconomic factors affect these components and consequently they can affect also the stock prices. Therefore this study will provide indirect components that affect the stock prices, through the effect they have in main determinants that drive the supply and demand for stocks (Chen, Roll, & Ross, 1986).

Talking about the macroeconomic instruments, it has to be taken into consideration that it is mainly divided into two subfields, one of which is the fiscal instruments and the other one is the monetary instruments of macroeconomic variables. Within the fiscal policy, because of taxing and investment strategies, variable such as GDP, IP, unemployment rate, budget deficit and trade balances are directly affected. It is important to mention that fiscal policy is always conducted by executives from the government. On the other hand, within the monetary policy, components such as inflation rate, interest rate, money supply and the exchange rate are to be considered. The monetary policy is subject of the central bank, and its main aim is to have a low and stable inflation and sufficient liquidity in the market (Mishkin, 2000). This is a preface for understanding the macroeconomic environment, and in the below paragraphs the impact of these variables on the stock price valuation will be shown. It is important to mention, that only those macroeconomic variables that are considered to have a strong impact on stock performance will be taken for the study.

In order to properly determine the impact of the economic environment on stock returns, the stock valuation formulas have to be taken into consideration.

From the four equations examined in the previous section, it can be concluded that any variable having a strong effect on the components of these formula, is very likely supposed to have a strong effect also in the stock price. Since there are no specified variables of affecting the stock prices in the asset pricing model, this study will rely on the existing literature of the variables that mostly affect the stock performance. The impact of all the macroeconomic variables will be linked based on the above mentioned formulas.

As indicated by (Mishkin, 2002) the main indicators for measuring the economic performance are GDP, unemployment rate, inflation rate, interest rate, money supply, fiscal policy, debt measures and the exchange rate. Out of these, based on the analyzed literature, the variables that have a very strong impact on stock market activity are: interest rate, inflation rate, money supply, industrial production and exchange rate as they have a direct impact on corporate cash flows and discount rates. The effect of these variables on the above shown formulas will be singled out.

3.1. Interest Rates

Interest rate (which is directly associated to the above mentioned formulas) is expected to affect negatively the price of assets from the borrowed literature and from the formulas shown above. From the above formulas dividend or future cash flows are divided to the discount rate (which is the interest rate), and any increase in the required return, will automatically reduce the price of the stock. Furthermore, a lower interest rate means that investment will be higher and consequently the future cash flows will be higher, indicating that stock prices will be higher with lower interest rates (Fisher, 1930). The interest rates, both short term and long term ones, because of the position of discount rate in the formula of stock prices, are unquestionably expected to have a negative effect in the present value of stock prices. These conclusions from the formulas were further proven theoretically by (French, Schwert, & Stambaugh, 1987), who argued that higher interest rates, will increase the required return and consequently the stock price will be lower. Another two authors, namely (Allen & Jagtiani, 1997) even though accepting the negative effect of interest rates on stock prices, point out that their effect has been reducing dramatically especially after 90’s, because of the invention of derivative contracts, who were set for hedging purpose and would give fixed interest rates even for the future.

3.2. Inflation

Studies of (Fama & Shwert, 1997), (Chen, Roll, & Ross, 1986) and (Jaffe & Mandelker, 1976) gave results of a negative relationship between inflation rate and the stock returns. This conclusion came from the theory that any increase in the inflation rate, leads to tightening policies, which will further raise the risk free rate and consequently the discount rate used for the valuation of stock prices. Inflation rate is expected to affect the prices through different channels. One assumption, by using the Keynesian theories, is that any increase in the inflation, indicated an increase in the nominal interest rates, and from the present value model of the stock prices it was shown that discount rates have a strong negative impact in stock pricing. On the other hand, some assume that the increase in discount rate from inflation will be offset by the increase in cash flows, since it stimulates the economic activity. That is not supposed to be the case, since cash flows do not grow by the same rate as the discount rate. This is attributed to (Defina, 1991) who states that there are nominal contracts that do not allow the immediate change in revenues and costs. According to this theory the sales level, are predetermined at a specific price for a specified period, and even though the inflation level may get higher during this period, the cash flows are not to be changed because of these predetermined nominal contracts.

One of the most important cases of the negative effect of inflation on stock prices, as indicated by (Defina, 1991) is during 1970's. During that period there was a rapid increase in the inflation rate, in the global level, and it was observed that the stock prices fell by almost 50 percent in their values. The negative correlation of inflation with stock prices is documented also by (Fama & Shwert, 1997) and (Geske & Roll, 1983). There are authors who found also positive relationship between inflation rate and stock returns. Among these (Tanggaard, 2002) found a moderate positive association of inflation rate with stock returns in US and a strong positive one in Denmark. (Sharpe, 2002) on the other hand finds a negative relationship between inflation and stock prices in the US.

3.3. Exchange Rates

As for the exchange rate (Mukherjee & Naka, 1995) hypothesize a positive relation between it and the stock prices. As the domestic currency depreciates, domestic goods become cheaper, which will lead to increases in exports, cash flows and consequently also in stock prices. The depreciation in domestic currency means an increase in directly quoted exchange rates (as the

value of domestic currency is expressed in term of the fixed value of a foreign currency; the higher the exchange rate, the less valuable is the domestic currency, as with 1 unit of foreign currency, you can buy more of the domestic currency) and therefore from this assumption, it is concluded that stock prices are positively affected by the exchange rate. If currency appreciates the opposite of the above case occurs. Despite this theory, many things depend also on the type of market. If the stock market is more an importing one, it means that it is going to benefit from the appreciated currency, while if the stock market is one of more exporting goods, then it is expected that the currency depreciation will have a positive impact on it. This means that both scenarios are expected in any stock market.

The effect of exchange rate on stock prices is indirectly proven also by the two famous theories, namely purchasing power parity and international fisher effect (Mandura, 2008). Purchasing power parity relates the exchange rate to the inflation rate and relies on the law of one price. This indicates that goods have the equal price in each country, as the exchange rate will always adjust to the inflation differences. This means that inflation is an important determinant of the exchange rate. The formula of purchasing power parity is as follows:

$$p = \frac{1+domestic\ \ inflation}{1+foreign\ \ inflation} - 1 \qquad \textbf{Eq. 7}$$

This indicates that as the domestic inflation increases, the expected percent change in foreign currency (p) will increase, meaning inflation rate has a negative effect on domestic currency. Since inflation has a negative effect on stock prices and in exchange rate, it means exchange rate and stock prices move in the same direction (Mandura, 2008).

The other theory, which is the International Fisher Effect, relates the exchange rate to the interest rate. The assumption here is that exchange rates are adjusted according to the interest rates of the respective countries. The formula is same as for the purchasing power parity; the only difference is that here the interest rate is used instead of inflation rate.

$$ef = \frac{1+domestic\ \ interest\ \ rate}{1+foreign\ \ interest\ \ rate} - 1 \qquad \textbf{Eq. 8}$$

The same conclusion is drawn also here; as the domestic interest rate increases, the percent change in the foreign currency (e_f) will be positive, indicating the inverse relationship between the interest rate and the domestic currency. Since the interest rate, negatively affects also the

stock prices, this means the exchange rate moves in the same direction with the stock prices, assuming that there exists a positive relationship between them (Mandura, 2008).

(Chen, Roll, & Ross, 1986) hypothesized a positive relationship between the exchange rate and stock prices (negative relationship with the domestic currency). From the study of (Mukherjee & Naka, 1995), (Achsaniand & Strohe, 2002), (Ajayi & Mougoue, 1996) it was confirmed the positive impact of the exchange rate on the stock prices both in the short term and long term, while the impact of stock prices on exchange rate is negative in short term, but positive in the long term.

3.4. Money Supply

The effect of money supply on stock prices remains an empirical one, according to (Mukherjee & Naka, 1995). First assumption, as stated also by (Fama, 1981) is that an increase in money supply, increases the inflation rate; this will further increase the discount rate, because of the fisher effect and consequently the stock price will fall. On the other hand, money supply provides a positive effect relative to the economic stimulus, which will raise the corporate cash flows and the stock prices. The aggregate effect will depend on the extent of the effect of changes in discount rate and the cash flows. The positive effect of money supply on stock prices was documented by (Maysami & Koh, 2000), who would find a positive association between them in Singapore.

Based on the study of (Asprem, 1989) it was found out that money supply has a positive impact on the stock prices of ten European countries. From these assumptions, it can be concluded that money supply and inflation rate are very much associated with each other, and they likely have the same assumptions, even though the negative effects of inflation are higher and therefore they are taken as separate variables in the study. From the findings of (Mukherjee & Naka, 1995), (Maysami & Koh, 2000) and (Kwon & Shin, 1999), it was concluded that there was a positive association between money supply and stock market returns.

3.5. Industrial Production

Industrial production measures the industrial sector of the economy in any country. It includes manufacturing, mining and utility sectors. These are also the most important sectors for any company listed in stock exchanges. The importance of Industrial Production relies on its fast sensitivity to the interest rates and the sensitivity it gives to the interest rates. Lower interest rates

will likely increase industrial production, which will consequently increase also the stock prices (Chen, Roll, & Ross, 1986). The effect of industrial production on stock prices is hypothesized by (Fama, 1990), (Geske & Roll, 1983) as a positive one. Since industrial production is expected to have a positive effect on the cash flows, it will consequently positively affect the stock price. Also the finding of (Chen, Roll, & Ross, 1986) further proved this theory; indicating that industrial production was a significant factor in explaining the stock returns.

As a conclusion of this analysis, and based on one of the most thorough studies on the topic conducted by (Chen, Roll, & Ross, 1986) it is assumed that factors that positively affect the economic growth and the future cash flows will have the same effect on stock prices, while the variables that raise the required return are assumed to have an adverse effect in stock prices. From these assumptions, they concluded that interest rates and inflation rate have a negative impact on stock prices, while industrial production has a positive impact. The impact of exchange rate (even though most take it as positive) is dependent on the type of market. As for the money supply, as (Fama, 1981) has indicated, because of its positive relation to the inflation rate, it is expected to negatively impact the stock prices. On the other hand, money supply brings also economic stimulus, which increases corporate cash flows and the stock prices. Therefore, due to these arguments the effect of money supply on stock prices remains an empirical one; to be determined by real data.

CHAPTER FOUR: DATA, METHODOLOGY AND ANALYSIS

After making a thorough study on the theoretical aspects of this topic, this section will deal will real data. The necessary tests will be conducted so that the results of the methodology will make a comparison of the five developed countries and the BRICS group and furthermore these results will be compared to the previous studies indicated in the literature.

4.1. Data

Based on the components mentioned in the above sections, for selecting the proper data and conducting a professional analysis on the effect of macroeconomic variables on stock performance, the following data are to be used for the analysis:

The following ten indexes are to represent the stock markets of all countries:

LSP: index in NYSE, located in US

LFTSE: index in London Stock Exchange (LSE), located in US

LTSX: index in Toronto Stock Exchange, located in Canada

LDAX: index in Deutsche Börse, located in Germany

LTOPIX: index in Tokyo Stock Exchange, located in Japan

LBVSP: Index in Sao Paolo Stock Exchange, located in Brazil

LRTSI: Index in Moscow Exchange, located in Russia

LBSE: Index in Bombay Stock Exchange, located in India

LSSE: Index in Shanghai Stock Exchange, located in China

LJSE: Index in Johannesburg Stock Exchange, located in South Africa

The monthly prices are taken for index data. Note that all data have the letter “L” before them, which represents the logarithmic form. All the index data are converted into logarithmic form in order to smooth the difference with the other data. As for the macroeconomic data the following variables are to be used:

INT: stands for T-bill rates in respective countries

LCPI: stands for inflation rate in respective countries, expressed with an index of 100, with 2000 as the base year

EXCH: stands for exchange rate in respective countries, directly quoted relative to US dollar

LM2: stands for money supply in respective countries, expressed in currency amount

LIP: stands for industrial production of the respective countries, expressed in index terms, with 2000 as the base year.

Note again, that the letter "L" is used before CPI, M2 and IP, which stands again for logarithmic form, used in order to smooth the difference with the other data.

All the data collected are from 2000-2014 on a monthly basis. For the stock index prices (Yahoo Finance) was used, while for the collection of macroeconomic data, (Economic Research; Federal Reserve Bank of St. Louis) which has available economic data for more than sixty eight countries was used. The software package used for the analysis is E-Views.

Some missing data are: IP missing for China and South Africa; M2 is missing for Germany.

4.2. Graphical Analysis of Data in US and Brazil

Given that many countries are included in this study, only for two of them there will be shown graphically how the data have been moving during the given years.

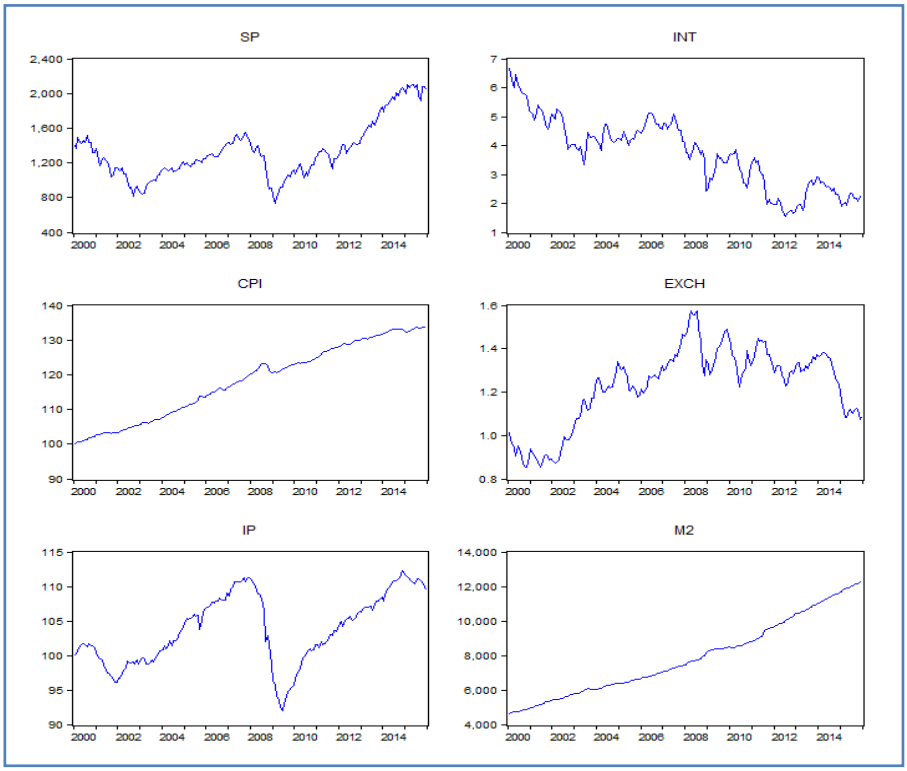

Figure 1: S&P, interest rate, CPI, exchange rate, industrial production and money supply in US

From the Figure 1 shown above (generated from Eviews) it is graphically observed that SP has had quite a positive linear trend. There are only two downturns, one in 2001, mainly because of terrorist attacks and the other one in 2008, because of the global financial crisis. The INT is downward sloping gradually. There is a slight increase after the crisis in 2008, while thereafter it keeps gradually declining. The CPI and M2 have a linear positive trend, which faces no downturns at all. This is mainly because of the developments of the economy. The EXCH is increasing up to 2008 (which indicates weaker currency), while after 2008 it has been gradually falling (which indicates stronger currency). Lastly the IP has the same trend as the SP, since it faces two main downturns in 2001 and 2008. It is mainly expected that all the developed countries do have a similar trend in their own variables to the US variables, especially during 2008's.

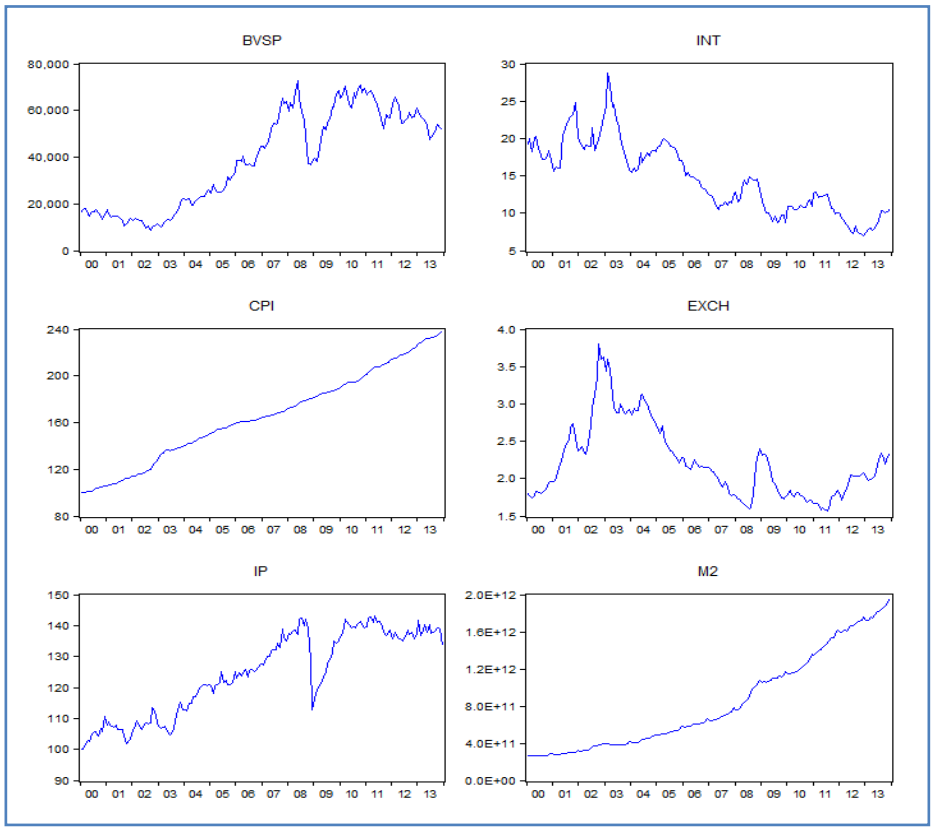

Figure 2: BVSP, interest rate, CPI, exchange rate, industrial production and money supply in Brazil

Referring to figure 2, it is observed that BVSP has a similar trend as previously was shown for the SP. The only decline in this case is observed in 2008, because of the global crisis. The INT has the opposite direction to the BVSP values, which means it is gradually declining during

the given period. CPI and M2 are quite similar to the US case. IP has the same observations as the BVSP index, with gradual increases and only a sharp decline in 2008. Lastly the EXCH has been gradually declining after 2003, which gives evidence of a stronger currency. Mainly both figures give support to the theoretical literature studied in the previous paragraphs, which is INT moves in opposite direction to the index prices, IP moves in the same direction, while M2, CPI and EXCH are to be determined by the modeling, since they don't show quite a direct effect in the index prices.

4.3. Methodology

Based on the literature and according to the econometric estimation of time series data, there are three main steps required to establish a relationship between the variables taken into study.

First of all, the unit root test has to be undertaken, and test whether the variables are stationary or not. If unit root is present at the level, then it means that variables are non stationary and they have to be checked for stationarity at the first difference. Such differencing will take away the long run responses. The Augmented Dickey Fuller (ADF) test will be used to check for the unit root of the data (Toda & Yamamoto, 1995). The formula is as follows:

$$\Delta Y_{t} = \alpha + \beta t + \Sigma \theta i Y_{t-i} + \varepsilon_{t} \qquad \textbf{Eq. 9}$$

Where;

Y_{t} is the macroeconomic time series

t is the time trend

ε_{t} is the error term

The hypotheses of ADF test are as follows, null and alternative respectively;

H_0: $\theta = 0$ (Unit Root is present, times series need to be differenced to make them stationary)

H_1: $\theta < 0$ (Unit root is not present, time series do not need to be differenced)

For better understanding the presence of long run relationship between the economic variables and stock prices, the next estimation will be used, which is the cointegration test. The concept of cointegration was introduced by (Granger, 1986) with regard to non stationary variables. If the variables are cointegrated, they tend to move together in the long run, but deviate from the short run relationship. Since variables are assumed to drift together over time (long run relationship) then the cointegration test becomes necessary. The variables are said to be cointegrated if they

are non-stationary in levels and they are integrated of the same order (a linear combination between them is stationary; such a combination indicates the long run relationship between the variables).

According to Johansen test there are two different likelihood ratio tests of the significance of these canonical correlations: the trace test and maximum Eigen value test, shown below respectively;

$$J_{TRACE} = -T * \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad \textbf{Eq. 10}$$

$$J_{MAX} = -T * \ln(1 - \lambda_{r+1}) \quad \textbf{Eq. 11}$$

In both equations T denotes the sample size, while λ_i is the i'th largest canonical correlation. The null hypothesis on Trace test is that there are r cointegrating vectors; while the alternative hypothesis is that there are n cointegrating vectors. On the other hand according to Maximum eigenvalue test the null hypothesis is that there are r cointegrating vectors, against the alternative hypothesis of r+1 cointegrating vectors. The data have to be non stationary when the cointegration equation is run.

If cointegration is observed between the variables, then the VECM will be used, which will represent the variables in the most efficient way and furthermore it encompasses any other specific adjustment of the variables. The VECM studies both the short and long run dynamics co movements that affect the stock price variations. If no co-integration is found between the variables, then the VAR Analysis will be used to indicate the relationship between data (Granger, 1986). The normal equations for VECM would be:

$$\begin{aligned} D^1(LSP) = {} & \boldsymbol{\beta 1 * LSP(-1) + \beta 2 * INT(-1) + \beta 3 * LCPI(-1) + \beta 4 * EXCH(-1 * LM2(-1) + \beta 6 * LIP(-1)} \\ & + \boldsymbol{\beta 7} + \beta 1 * D(LSP(-1)) + \beta 2 * D(LSP(-2)) + \beta 3 * D(LSP(-3)) + \beta 4 * D(LSP(-4)) + \beta 5 \\ & * D(INT(-1)) + \beta 6 * D(INT(-2)) + \beta 7 * D(INT(-3)) + \beta 8 * D(INT(-4)) + \beta 9 * D(LCPI(-1)) \\ & + \beta 10 * D(LCPI(-2)) + \beta 11 * D(LCPI(-3)) + \beta 12 * D(LCPI(-4)) + \beta 13 * D(EXCH(-1)) + \beta 14 \\ & * D(EXCH(-2)) + \beta 15 * D(EXCH(-3)) + \beta 16 * D(EXCH(-4)) + \beta 17 * D(LM2(-1)) + \beta 18 \\ & * D(LM2(-2)) + \beta 19 * D(LM2(-3)) + \beta 20 * D(LM2(-4)) + \beta 21 * D(LIP(-1)) + \beta 22 \\ & * D(LIP(-2)) + \beta 23 * D(LIP(-3)) + \beta 24 * D(LIP(-4)) + \beta 25 \end{aligned}$$

Eq. 12

The bold highlighted equation considers only the long run association of stock market with the macroeconomic variables while the remaining part is the corrected model for the short term period, including only four lags. Normally, VECM is a system of equation and each variable would have to be expressed as dependent relative to the independent variables, but since this

[1] Note that the letter "D" before all variables, indicates the first difference of the variables

study considers only the effect of macroeconomic variables in index prices, the other equations are ignored. Therefore for each case only the first equation will be considered.

For example, equation 13 would be the next equation (in the system of equations) but since it is not in this study's interest to examine other dynamics rather than the effect of macroeconomic variables in the stock price, they are not to be considered.

$$D(INT) = \boldsymbol{\beta 1 * LSP(-1) + \beta 2 * INT(-1) + \beta 3 * LCPI(-1) + \beta 4 * EXCH(-1 * LM2(-1) + \beta 6 * LIP(-1) + \beta 7} + \beta 1 * D(LSP(-1)) + \beta 2 * D(LSP(-2)) + \beta 3 * D(LSP(-3)) + \beta 4 * D(LSP(-4)) + \beta 5 * D(INT(-1)) + \beta 6 * D(INT(-2)) + \beta 7 * D(INT(-3)) + \beta 8 * D(INT(-4)) + \beta 9 * D(LCPI(-1)) + \beta 10 * D(LCPI(-2)) + \beta 11 * D(LCPI(-3)) + \beta 12 * D(LCPI(-4)) + \beta 13 * D(EXCH(-1)) + \beta 14 * D(EXCH(-2)) + \beta 15 * D(EXCH(-3)) + \beta 16 * D(EXCH(-4)) + \beta 17 * D(LM2(-1)) + \beta 18 * D(LM2(-2)) + \beta 19 * D(LM2(-3)) + \beta 20 * D(LM2(-4)) + \beta 21 * D(LIP(-1)) + \beta 22 * D(LIP(-2)) + \beta 23 * D(LIP(-3)) + \beta 24 * D(LIP(-4)) + \beta 25$$

Eq. 13

The VAR is quite similar to VECM, just it doesn't consider the cointegration equation between the variables; therefore the bold highlighted part of the equation will not be shown. VAR equation is as follows:

$$D(LSP) = \beta 1 * D(LSP(-1)) + \beta 2 * D(LSP(-2)) + \beta 3 * D(LSP(-3)) + \beta 4 * D(LSP(-4)) + \beta 5 * D(INT(-1)) + \beta 6 * D(INT(-2)) + \beta 7 * D(INT(-3)) + \beta 8 * D(INT(-4)) + \beta 9 * D(LCPI(-1)) + \beta 10 * D(LCPI(-2)) + \beta 11 * D(LCPI(-3)) + \beta 12 * D(LCPI(-4)) + \beta 13 * D(EXCH(-1)) + \beta 14 * D(EXCH(-2)) + \beta 15 * D(EXCH(-3)) + \beta 16 * D(EXCH(-4)) + \beta 17 * D(LM2(-1)) + \beta 18 * D(LM2(-2)) + \beta 19 * D(LM2(-3)) + \beta 20 * D(LM2(-4)) + \beta 21 * D(LIP(-1)) + \beta 22 * D(LIP(-2)) + \beta 23 * D(LIP(-3)) + \beta 24 * D(LIP(-4)) + \beta 25$$

Eq. 14

Equation 14 shows the association of the variables within four months. It is also a system of equations as VECM; again only the first equation will be considered.

As a summary, if data are not co-integrated VECM can't be used; instead the VAR will be used. Actually both these models are a system of equations, but in this study only the first equation is important. The number of lags used in the model will be 4 lags; that means the current stock prices will be checked prior to 4 months before, in order to observe a significant relationship. Even in the first equation, for both VAR and VECM the effect of different lags that index has in its own values will not be considered, since it is not an objective of this study. For the significance level, if model is significant at 5% level (1.96 value of T-statistics), it will be assumed as a strong impact, while the significance at 10% level (1.67 value of T-statistics) will be considered as weak or poor significance.

4.4. Analysis

4.4.1. Analysis of ADF Test for Unit Root

First of all, the unit root results will be shown for all countries. If at levels all data are found to be non-stationary and at first difference stationary, the co-integration analysis can be used. If not, only VAR will be used. Table 1 in Appendix A shows all the results for unit root test.

Using the probability values and comparing them to the 5% significance level, it can be observed that all variables are non stationary (they have unit root) at levels, expect INT in Russia and LCPI in India. It means that these two variables are stationary from levels and therefore the co-integration cannot be run in these cases. For the other cases, the first differences of the variables have to be taken, and if the variables are integrated of same order (become stationary at first difference) then the cointegration model can be run; if not VAR will be used. From the results in table 2 of Appendix A, it is observed that LCPI is not stationary in Germany at first difference; therefore cointegration cannot be run in this case; considering China, Russia and UK, LM2 is not stationary at first difference (which means it is not integrated of same order with the other data) and therefore the cointegration cannot be used. This indicates the second difference of these data has to be taken, that is to observe if they become stationary on that point. As seen from table 3, in Appendix A, these data become stationary on second difference. From this initial analysis, the countries at which the cointegration test is not to be used are: India and Russia, since LCPI and INT are respectively stationary in levels; China, Germany and UK; since LM2 and LCPI are not integrated of same order with the other variables (that is all the variables do not become stationary in the same order). Due to this reason in these countries only the VAR analysis will be used. On the other hand in Brazil, Canada, Japan, South Africa and US the cointegration analysis can be used.

4.4.2. Analysis of Johansen Cointegration Test

For the cointegration analysis the Johansen Cointegration test is used, which has two main methods the Trace and Maximum Eigenvalue methods. Both of them actually give similar results. Depending on the number of variables it has a null hypothesis as follows

H_0: None: It means there is no cointegration equation among variables

H_0: At most one: It means that there is at most one cointegration equation among variables

H_0: At most two: It means there are two cointegration equations among variables

The null hypothesis continues in this way depending on the number of variables in the equation. In this case, since there are five independent variables and one dependent variable, it means that there can be at most five cointegration equations. Still, this study is not interested in the interrelation among the other variables; the only effect that is to be revealed from this study is the effect of macroeconomic variables in stock performance, and neither vice versa or interrelation among them. Due to this reason, only "None" and "At Most One" hypothesis will be considered. If "none" is not rejected it means that variables are not cointegrated. If "none" is rejected and "at most one" is not rejected, it means there is one cointegration equation in the model. The reason this study requires only one cointegration equation is that only the impact of macroeconomic variables on stock performance is of interest. If also the "at most one" hypothesis is rejected, it means we are not interested in other cointegration equations (equations that explain the interrelation of macroeconomic variables among each other), so it is assumed as if there is no cointegration in the model.

From the table 4 in Appendix B, considering the Brazil case, according to Trace model there are 4 cointegration equations, while according to Maximum Eigenvalue there are only 2 cointegration equations. Therefore since at most one hypothesis is rejected, it is assumed there is no cointegration in the model of this study. The next country is Canada, and observing the tables of Trace and Max Eigenvalue model, it is observed that "None" hypothesis is not rejected, which means there is no cointegration equation among these variables. For the Japan case, it is observed that the "none" hypothesis is rejected, while the "at most one" hypothesis is accepted. This means there is one cointegration equation among the variables. The same situation as for Japan is observed also in South Africa, which means there is one cointegration equation in that case among the variables. Lastly, in US there is cointegration based on Trace Test, while according to Maximum Eigenvalue test there is no cointegration. Since the software doesn't give a precise decision, it is up to the user to decide whether to accept or not the cointegration. Since, even the Maximum Eigenvalue test gives an approximate cointegration ("none" is very near to 5%) the Trace test will be taken as basis. Based on this study it means that only with Japan, South Africa and US will be preceded with the VECM, while for the rest of the countries the VAR will be used.

4.4.3. VAR and VECM analysis in all countries separately

In running the VAR model, 4 lags will be considered. Out of 8 lags, on average 4 lags are found to represent the equations in the best way possible, therefore for all regressions 4 lags will be used. Coefficients and their significance will be observed one by one for each variable and for each country.

For the Brazil case, considering LBVSP index prices (refer to Table 5, Appendix C), it is observed that only LM2 is significant and negative at lag 3, and INT is significant and negative only at 10% level (which indicates weak impact) in lag 4. The coefficients are consistent with the theory, but the weak association is a sign of weak form efficiency of the stock market, since it doesn't reflect all available information.

Considering Canada (refer to Table 6, Appendix C), for the LTSX index it can be observed that INT has no significant impact, LCPI is very significant and negative with 4 lag periods, LM2 is significant and positive at lag 1, while IP is significant and positive with one lag period. This is again consistent with the theory, and given that the effect of LIP is consistent with the hypothesized sign, it is observed that LCPI is having a negative effect in the stock prices, meaning that it is causing more increases in the discount rate, rather than in the CF; while the positive impact of LM2 shows that it is causing higher increases in the CF, rather than in the discount rate. The surprising part is that INT has no significant impact in LTSX prices, which may be due to the reason that there are other important internal factors that offset the impact of INT on LTSX prices.

The next country is *China* (refer to Table 7, Appendix C), which showed no long run relationship among variables; therefore the VAR analysis will be used. The only variable that affects the LSSE index prices within 4 months is the INT, which has a negative and very significant value at the second lag time. This is again consistent with theory, but the lack of co-movement with other factors may be a sign of deficiencies in the Shanghai Stock Market.

Considering the LDAX index of *Deutsche Börse* (refer to Table 8, Appendix C), even though no long term relationship was found, it is observed that INT has a negative significant impact in the index prices at lag four, which is consistent with theory; on the other hand the LIP has a significant positive impact in index prices at lag 2; there is no significant impact of LCPI in

index prices; while the EXCH is negatively significant at the 10% significance level only (which indicates weak impact).

The next country, which is *India* (refer to Table 9, Appendix C), as observed by the VAR analysis, there is no significant effect of macroeconomic variables in the LBSE prices. Only LM2 is significant and positive in its first lag at 10% significance level, while there is no other variable affecting the stock market. This may be a sign of poor market performance, especially in reflecting the available information from the economy.

For the *Russian* case (refer to Table 10, Appendix C), it is observed that LM2 and INT have no significant effect, EXCH is positively affecting the LRTSI prices at lag 1 and lag 3. LCPI has a weak negative effect on lag 4 (significant at 10%), while LIP has a positive effect at lag 2. These are actually consistent with theory, but there is weak association with the LCPI (since is only significant at 10% critical value) and the lack of effect from interest rate in this stock market shows that may be deficiencies in this stock market for reflecting all available information.

In the *London Stock Exchange* (refer to Table 11, Appendix C), as indicated also from literature, there is weak explanation of the LFTSE prices by the macroeconomic environment. LM2 is significant and negative at lag 3 only at 10% significance level (weak impact); LCPI is positive at lag 2 and negative at lag 4. This is consistent with the theory of two way approach of the LCPI effect on stock market. While the EXCH has a poor negative explanatory power at lag one, since it is significant only at 10% level. Still the lack of INT explanation shows how consistent this model is with existing literature. One of the main explanations from this weak impact in LFTSE prices is that there are many foreign companies listed in London Stock Exchange, and therefore they may be more dependent on their countries economic indicators rather than UK economic indicators.

From the cointegration test, only in Japan, South Africa and US the data were observed to be cointegrated. Therefore the VECM will be used in these three cases, which gives the dynamics of long run and short run among the variables and the stock market.

First of all, from VECM results in *Japan* (refer to Table 12, Appendix C), it is shown that in the long run, there is a strong positive effect of LIP in LTOPIX; there is a strong negative impact of EXCH, a positive strong impact of LCPI, a positive weak impact of LM2 and a negative

impact of INT in the LTOPIX. Since LCPI has a positive impact in the stock market, it means that it has more stimulation in the economic activity than being a factor of increasing the interest rate. While the effect of IP and interest rate is completely consistent with theory. On the other side, in the short run, no interaction is observed among these variables; only M2 has a weak impact at lag 1. The stability of Japan economy may be an indication of why there is no impact in the short run as indicated also by (Mukherjee & Naka, 1995).

The VECM is run on *South African* LJSE index (refer to Table 13, Appendix C) and it is observed that there is a strong long run impact of the macroeconomic variables. The LCPI and LM2 affect negatively the stock prices; there is no effect of EXCH in the long run, while the INT has a negative effect in the stock prices. Observing the VECM corrected coefficients for the short run, it is seen that LCPI has a negative significant impact in lag 3, EXCH has a negative impact in lag one, and positive impact in lag 2 (change of signs consistent with theory), and INT has a negative significant impact at lag 1. Actually, the results of South African stock market are one of the best, indicating a very efficient market.

Last but not least, the LSP prices of *NYSE* are largely affected by the macroeconomic variables (refer to Table 14, Appendix C). From the VECM results it is observed that INT and LM2 have a negative impact on stock prices in the long run, LCPI and EXCH have a positive impact, while the LIP doesn't explain the stock index prices in the long run. It is also indicated that in the short term all the variables affect the LSP prices apart from EXCH. It is seen that LM2 has a negative and very significant effect in stock market at lag 1, LIP has a strong positive effect at lag 1 and 2, LCPI has a strong negative effect at lag 4, and the INT has a negative effect on the stock market at lag 4. All the signs of these variables are actually consistent with the theory explained in the literature part, so it can be concluded the NYSE is highly affect by the macroeconomic environment, and the significance of this shows the efficiency of US stock market in reflecting all available information.

From the summarized information in Table 15, Appendix C, it is concluded that the explanatory power of macroeconomic variables in BRICS group is much lower than in the developed countries. In Brazil, only LM2 is strongly significant, while INT has weak impact; in China only the INT has strong impact; in India no strong significant effect, only LM2 has a weak impact; In Russia only the EXCH and LIP show strong impact, LCPI has a weak effect on

LRTSI; while in South Africa actually it is concluded that macroeconomic variables have quite a strong effect in the LJSE prices.

On the other hand, taking into account the developed countries, in Canada it is quite strong, only INT and EXCH have no strong impact; in Germany only LCPI doesn't have a significant impact, while the impact of EXCH is poor; in Japan all the variables are significant in long run, but weak evidence is found in short run; in UK only LCPI is strongly significant; EXCH and LM2 have a weak impact, while in US all variables are significant. This shows that in developed countries, the explanatory effect of macroeconomic variables on stock index prices is much stronger than in BRICS group. Basically, what this concludes is that in developed countries the prices have a better reflection of available information, which is a strong support of EMH. While in the BRICS group, there is no strong evidence that prices reflect all available information, which doesn't strongly support the EMH. In both groups the only exceptions are South Africa from BRICS group, which shows quite a strong impact in stock prices, and UK from developed countries that shows weak impact of macroeconomic variables on stock prices, which is actually also consistent with literature.

4.4.4. Impact of US macroeconomic variables in stock prices of all countries

The increasing importance of globalization makes necessary the conduction of another important study; that is how the US economy affects the stock prices of all countries taken into consideration. As it is known, US has the strongest economic and financial system in the world and any change in its main factors, is likely going to cause changes in the markets of other countries. This was further proven in the 2008 global crisis, which initiated in the US, and given the importance of this country on the global economy it was spread all around the world. The VAR analysis will be used here to indicate the impact that all these variables have on the different stock markets. The dependent variable will be the stock index in each country separately, while the independent variables will be INT, CPI, EXCH, M2 and IP of US. From the results shown in Table 16, Appendix D it is observed that the INT of US is having a negative impact in the stock index prices of Brazil, Canada and Germany at lag 4, while in the other countries no significant impact is found. The CPI of US is found to have negative significant impact on the stock markets of Canada, India, Russia and UK at lag 4; while no significant impact is found in the other countries. The EXCH is found to have a weak positive significant impact (at 10% level) only in China at lag 1, while no significance is found in the other stock

markets. The US IP is found to have a strong positive impact in the stock index prices of all countries in lag 1; while in lag 4 poor negative impact is found in Brazil and India. This is an important finding, which concludes that US industrial production is quite an important factor in explaining the stock prices. Lastly, the US M2 variable is found to have a strong negative impact in the stock markets of Brazil, Canada, Germany, South Africa and UK at lag 1.

Basically, these findings conclude that there is quite a strong impact of US economy in the stock markets of these countries. Especially the INT, CPI and M2 show that US economy is affecting the stock markets of those countries with which it has strong association in economic and financial activities. The EXCH is not found very significant, while the IP was quite an important finding, since it was affecting all these countries. It was shown that when the US IP is increasing, the stock market prices of these countries will increase, showing a strong association between them.

One important point to mention here is that, in particular countries, the US economy is having more explanatory power than the countries respective macroeconomic variables. That is observed especially in UK, Brazil, Canada and Germany. There is strong association of these countries in terms of economic and financial activities and this may be one of the main reasons why it is having such a strong effect in their economies.

CONCLUSIONS

Overall Conclusion

The main aim of this study is to explain how the stock market is affected by the macroeconomic variables. Many results were shown on theoretical basis as well as on real data and econometric tests. Based on theory it was mainly assumed that there should be an effect of macroeconomic variables on stock performance. Normally this was very much dependent on EMH, which states that only at markets that prices reflect all available information, it is possible to observe an impact of macroeconomic variables on stock performance. From literature it was hypothesized that interest rate is expected to have a negative impact in stock prices, while industrial production a positive impact in stock price. The impact of CPI, money supply and exchange rate remains quite intriguing since they can affect the prices from two different sides. Because of the suspicious effects of these variables, it was important to determine in which side they are affecting the stock market. From the comparative analysis made in five developed and five fast developing countries (BRICS group) it was observed that macroeconomic variables have more explanatory power in the stock index prices of developed countries. This is especially reflected in US, Canada, Germany and Japan. As explained also from literature it was concluded that the main reason for this explanatory power, is the efficient stock markets in these countries, as the prices reflect all available information from the external factors, such as the economic environment. While in the BRICS group, poor explanatory power of macroeconomic variables is found on stock index prices. This is especially observed in Brazil, China and India; while in Russia it is somehow good and surprisingly in South Africa it is quite good, almost to the level of US. Therefore from the BRICS group, only in South Africa is observed a strong impact of economic environment in stock prices. The poor explanatory power in other countries of this group shows that even though the economies of these countries are growing very fast, they are facing problems in the efficiency of their stock markets. This is actually consistent with many findings from literature and from hypothesized theory of EMH. Lastly, because of globalization effects, the impact that US macroeconomic variables have on these stock markets was taken into consideration. It is mainly observed that US economic activity, has explanatory power on those markets that there exists a strong association within their respective economic and financial activities, and especially the industrial production was found to have a strong positive impact in

all these countries. This means that the strongest global economy (which is US) has quite a strong explanatory power over the markets of other countries.

These results will be important in determining the sign of impact for macroeconomic variables on index prices in specific countries, for a specified period of time. It can be very useful for stock market analysts in determining the investment options, based on the established relationship. Especially important is the impact of CPI, EXCH and M2 since they can affect the stock markets in different manners; therefore it will be determined if the extent of their impact is more positive or negative regarding the stock prices. Lastly the analysts of EMH can find out the efficiency of the markets taken into study, by observing the strength of impact that macroeconomic variables have on their index prices.

Implications

This study relied much on the existing literature to build the proper model of explaining the stock market indexes by macroeconomic variables. One of the main implications of this study is that company internal factors are expected to have the largest impact in the stock prices, and therefore it may be that the impact of any macroeconomic variable is offset by the market specific factors.

Another main implication of this study is that the previous studies have been conducted all prior to 2000. This means that there are not really current studies on this field, which document a proper relationship between the macroeconomic variables and the stock market. From the previous studies a strong relationship was found between the stock index prices and macroeconomic variables, in both developed and developing countries. While on the current study, it is still good for some developed countries, while in the fast developing group it is quite poor, except for South Africa. This decline in explanatory power of macroeconomic variables in stock market may be also as a reason of globalization. Since in the stock markets of mentioned countries, there are many foreign companies it means they are not very much dependent on domestic interest rates, expect for interest rate, which is expected to have the same effect in all companies. Its own countries domestic macroeconomic policies of the foreign company may have a stronger effect than the macroeconomic policies of the country at which it is listed.

Limitations of the Study

One of the main limitations that were faced in this study is that from literature, many authors were relying only in the long run association between the variables, by using only the cointegration test. Moreover, they were more concerned in causality among the variables and the interrelation among all variables, while this study had to take into consideration only the impact of macroeconomic variables in stock prices. Since the macroeconomic variables have a dynamic impact in the overall activity in any country, it was difficult to build a concluding direction of impact in the stock market. Only for interest rate and industrial production it was possible to theoretically indicate the direction of impact, while for the three remaining variables it was changing from one study to another. Another small pitfall is the missing data, such as money supply in Germany and industrial production in China and South Africa, given that no available information was publicly shown for them. This means that in these countries the model is not exactly equal with the models of other countries, since one variable is missing

Further Studies

The importance of this study relies on the fact that not only it shows whether the macroeconomic environment is having an impact in the stock market, but at the same time it shows the significance and the direction of movement. As observed from literature and compared to this study, it is concluded that the effect of macroeconomic variables in stock prices, is not stable in different periods of time. Prior to 2000's it was quite strong; while at this current study it is observed that this impact has been decreasing and it is actually quite poor in some countries. Personally, I think that this impact will be even weaker in the next twenty years, because of the international factors affecting the stock markets. Therefore this is a strong reason, why this kind of study has to be conducted frequently; so that the changes in this impact can be observed. This kind of study will at one side, show the efficiency of the stock market and at the other side, it will give hindsight at whether globalization is reducing the explanatory power of economic activity in stock prices.

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APPENDIXES

Appendix A: Unit Root Test

Table 1: Unit Root Test at levels for all variables in all countries

Variables	Unit Root Results (probabilities) at levels (significance level = 5%)									
	BR	CAN	CHI	GER	IND	JAP	RUSS	So.A	UK	US
Index	0.7626	0.6685	0.6017	0.7827	0.9381	0.6032	0.3955	0.9084	0.5085	0.8693
INT	0.5465	0.2981	0.1307	0.8583	0.3055	0.3085	0.000*	0.5182	0.5715	0.2032
LCPI	0.5116	0.5145	0.9858	0.7509	0.016*	0.2266	0.2382	0.884	0.9994	0.5772
EXCH	0.3291	0.5885	0.9452	0.4207	0.8695	0.6759	0.0747	0.5213	0.3204	0.3668
LM2	0.9021	0.8583	0.7334		0.7193	0.9254	0.201	0.2846	0.1764	0.9002
LIP	0.3468	0.1999		0.4222	0.5355	0.1037	0.6888		0.827	0.088

Table 2: Unit Root Test at first difference for all variables in all countries

Variables	Unit Root Results (probabilities) at 1st difference (significance level = 5%)									
	BR	CAN	CHI	GER	IND	JAP	RUSS	So.A	UK	US
Index	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
INT	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000
LCPI	0.000	0.000	0.000	0.13*		0.000	0.046	0.000	0.047	0.000
EXCH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
LM2	0.045	0.00	0.15*		0.000	0.025	0.07*	0.000	0.39*	0.000
LIP	0.000	0.000		0.000	0.000	0.000	0.000		0.000	0.0116

Table 3: Unit Root Test at Second Difference for all variables in all Countries

Variables	Unit Root Results (probabilities) at 2nd difference (significance level = 5%)			
	CHI	GER	RUSS	UK
LCPI		0.000		
LM2	0.000		0.000	0.000

Appendix B: Cointegration Tests for five countries

Table 4: Cointegration Results for Brazil, Canada, Japan, South Africa and US

	Brazil		Canada		Japan		So Africa		USA	
Test	Trace	Max	Trace	Max	Trace	Max	Trace	Max	Trace	Max
None	0	0.0194	0.814*	0.909*	0.0042	0.0193	0.0022	0.0028	0.0196	0.071*
At most 1	0.0001	0.0155	0.8052	0.8909	0.108*	0.096*	0.184*	0.382*	0.163*	0.1834
At most 2	0.0053	0.081*	0.7623	0.7519	0. 493	0.4771	0.3147	0.4154	0.5051	0.8067
At most 3	0.0339	0.1659	0.767	0.7898	0.7178	0.6852	0.4333	0.4481	0.4424	0.7307
At most 4	0.08*	0.1387	0.3803	0.3803	0.7759	0.7081	0.3293	0.3293	0.3156	0.3013
At most 5	0.0952	0.0952	0.1939	0.1939	0.8465	0.8465			0.3883	0.3883
Decision	NO	NO	NO	NO	YES	YES	YES	YES	YES	NO

Appendix C: VAR and VECM Analysis

Table 5: VAR analysis in the Brazil Case; included coefficients and T-statistic values

BRAZIL	DLBVSP			
	Lag 1	Lag 2	Lag 3	Lag 4
DINT	0.008613	-0.01071*	-0.00433	-0.00294
	[1.35380]	[-1.69979]	[-0.63333]	[-0.42932]
DLCPI	1.537551	-3.73919	-0.42996	1.964636
	[0.59862]	[-1.28250]	[-0.14836]	[0.81716]
DEXCH	-0.02102	-0.02261	0.093501	-0.00104
	[-0.24737]	[-0.22563]	[0.98378]	[-0.01223]
DLM2	-0.47208	-0.04537	-0.94448*	0.193644
	[-1.20155]	[-0.12065]	[-2.58282]	[0.52426]
DLIP	0.065789	0.335159	-0.15891	-0.45794
	[0.20534]	[1.04225]	[-0.49271]	[-1.45474]

Table 6: VAR analysis in the Canada Case; included coefficients and T-statistic values

CANADA	DLTSX			
	Lag 1	Lag 2	Lag 3	Lag 4
DINT	0.006925	0.004072	0.017801	-0. 0053
	[0.38468]	[0.22227]	[1.01990]	[-0.3406]
DLCPI	-1.2716	-0.8327	0.706696	-3.5697*
	[-1.42071]	[-0.93587]	[0.76845]	[-3.96181]
DEXCH	-0.24745	0.031917	0.040507	-0.11917
	[-1.34860]	[0.17373]	[0.22900]	[-0.77114]
DLM2	1.430525*	0.056187	0.214141	0.229764
	[2.25488]	[0.08957]	[0.34945]	[0.38396]
DLIP	1.05111*	-0.27031	-0.41276	-0.50637
	[2.89269]	[-0.74969]	[-1.17179]	[-1.38405]

Table 7: VAR analysis in the China Case; included coefficients and T-statistic values

CHINA	DLSSE			
	Lag 1	Lag 2	Lag 3	Lag 4
DINT	-0.04603	-0.12111*	-0.01624	-0.04477
	[-0.89667]	[-2.32031]	[-0.30232]	[-0.86427]
DLCPI	0.727685	0.605708	1.054568	-0.68559
	[0.65051]	[0.53234]	[0.92955]	[-0.67383]
DEXCH	-0.35241	0.483104	-0.38951	0.446907
	[-1.22839]	[1.48002]	[-1.16428]	[1.51249]
DLM2	-0.10949	-0.13554	-0.02667	0.164352
	[-0.20088]	[-0.18370]	[-0.03620]	[0.28863]

Table 8: VAR analysis in the Germany Case; included coefficients and T-statistic values

	DLDAX			
GERMANY	Lag 1	Lag 2	Lag 3	Lag 4
DINT	-0.00413	0.00068	0.048679	-0.08929*
	[-0.11723]	[0.01897]	[1.37783]	[-2.56219]
DLCPI	0.011434	-0.24668	-1.64682	-0.75301
	[0.00789]	[-0.11731]	[-0.78378]	[-0.51105]
DEXCH	-0.07165	0.397056	-0.46194*	-0.01803
	[-0.26493]	[1.41562]	[-1.76908]	[-0.06967]
DLIP	-0.06932	0.43772*	-0.27203	-0.11499
	[-0.20326]	[2.24979]	[-0.86112]	[-0.35793]

Table 9: VAR analysis in the India Case; included coefficients and T-statistic values

INDIA	DLBSE			
	Lag 1	Lag 2	Lag 3	Lag 4
DINT	0.0184113	0.0181232	-0.0204694	-0.010669
	[0.88733]	[0.96424]	[-1.06024]	[-0.52113]
DLCPI	-0.6074015	1.4804712	-1.1445361	0.2811143
	[-0.75225]	[1.18646]	[-0.91991]	[0.34467]
DEXCH	-0.6721215	0.310998	0.3656835	0.1684324
	[-1.59009]	[0.74577]	[0.90400]	[0.44410]
DLM2	0.804463*	0.2444251	-0.037477	0.2016725
	[1.79059]	[0.51758]	[-0.08093]	[0.46222]
DLIP	-0.1765453	0.3246962	0.3217929	-0.0592436
	[-0.48054]	[0.77094]	[0.75973]	[-0.15268]

Table 10: VAR analysis in the Russian Case; included coefficients and T-statistic values

RUSSIA	DLRTSI			
	Lag 1	Lag 2	Lag 3	Lag 4
DINT	0.0101113	-0.0116064	0.000226	0.0026539
	[0.63135]	[-0.53852]	[0.01110]	[0.17918]
DLCPI	-0.1894341	3.8536231	0.0941675	-4.401691*
	[-0.07775]	[1.29435]	[0.03109]	[-1.91243]
DEXCH	1.249063*	-0.0075342	0.768039*	0.392888
	[2.81251]	[-0.01818]	[1.92734]	[1.01629]
DLM2	0.2159346	0.5508553	0.3431843	-0.0503795
	[0.82591]	[1.44167]	[0.88861]	[-0.18870]
DLIP	0.9548782	1.249378*	0.8264375	0.736546
	[1.60417]	[2.12081]	[1.38779]	[1.27824]

Table 11: VAR analysis in the UK Case; included coefficients and T-statistic values

UK	DLFTSE			
	Lag 1	Lag 2	Lag 3	Lag 4
DINT	-0.032641	0.0221632	0.0026522	-0.0337947
	[-1.13112]	[0.64192]	[0.07484]	[-1.21689]
DLCPI	-1.55908	2.418080*	-1.5162364	-2.433528*
	[-1.38430]	[2.26684]	[-1.34398]	[-2.14308]
DEXCH	-0.529854*	0.1821775	-0.2639085	-0.1811169
	[-1.81350]	[0.61515]	[-0.89010]	[-0.63823]
DLM2	0.3676613	-0.8245787	-1.319549*	-0.3215544
	[0.61627]	[-1.02795]	[-1.74902]	[-0.59789]
DLIP	0.5742948	-0.105795	0.3056591	0.1679512
	[1.47061]	[-0.24829]	[0.73770]	[0.43559]

Table 12: VECM analysis in the Japan Case; included coefficients and T-statistic values

JAPAN	DLTOPIX				
	co eq.	lag 1	lag 2	lag 3	lag 4
DINT	-0.284016*	-0.0325717	0.2373291	0.1493926	0.0275552
	[-2.22830]	[-0.23755]	[1.46358]	[1.03558]	[0.19325]
DLCPI	5.022520*	1.0613568	1.5500475	0.0228306	0.5355641
	[4.73903]	[0.49012]	[0.72806]	[0.01098]	[0.25432]
DLEXCH	-2.603595*	-0.3393676	-0.0372722	-0.2713227	-0.0903417
	[-10.5770]	[-1.18615]	[-0.13074]	[-0.98922]	[-0.34980]
DLM2	2.033545*	-2.83170*	-1.7074376	-1.259076	-2.77410*
	[1.70102]	[-1.80852]	[-1.13933]	[-0.84553]	[-1.91651]
DLIP	1.3739306*	-0.1231705	0.2074376	-0.2994676	-0.014105
	[3.45494]	[-0.58611]	[0.93313]	[-1.33553]	[-0.06510]

Table 13: VECM analysis in the South Africa Case; included coefficients and T-statistic values

South AFRICA	DLJSE				
	co eq.	lag 1	lag 2	lag 3	lag 4
DINT	-0.258471*	-0.035701*	-0.0151576	-0.0084299	-0.0093798
	[-5.60589]	[-2.33386]	[-0.91779]	[-0.51306]	[-0.60799]
DLCPI	-2.502729*	1.1794265	0.2369952	-2.072956*	0.8217977
	[-2.07940]	[1.17111]	[0.22887]	[-2.00506]	[0.81807]
DLEXCH	0.038348	-0.02459*	0.02556*	-0.0101642	-0.0032017
	[0.70650]	[-2.03503]	[1.99468]	[-0.78970]	[-0.26282]
DLM2	-0.81631*	0.4715288	0.1056183	0.2218548	-0.0725283
	[-1.89653]	[1.65137]	[0.37351]	[0.77841]	[-0.26643]

Table 14: VECM analysis in the US Case; included coefficients and T-statistic values

US	DLSP				
	co eq.	lag 1	lag 2	lag 3	lag 4
DINT	-0.266797*	-0.0076968	-0.0182824	0.0169353	-0.034528*
	[-5.31614]	[-0.42128]	[-1.01094]	[0.99856]	[-2.13714]
DLCPI	3.992218*	0.16335	-1.4443284	0.2141603	-3.938957*
	[1.67293]	[0.08591]	[-0.72498]	[0.10993]	[-2.07005]
DLEXCH	0.651682*	0.0559428	0.061106	0.0028854	0.1617735
	[2.94781]	[0.46316]	[0.47307]	[0.02249]	[1.32417]
DLM2	-3.053514*	-2.145438*	0.2194091	0.3867773	0.7373396
	[-3.69178]	[-2.41812]	[0.25159]	[0.44383]	[0.86070]
DLIP	-0.6241303	1.957872*	1.005511*	-0.5248413	-0.6074677
	[-1.17049]	[3.45917]	[1.90350]	[-0.97784]	[-1.09978]

Table 15: Summary of Variables affecting the stock prices in all countries

Summary of variables that affect the stock indexes							
Country/Variables		INT	LCPI	EXCH	LM2	LIP	Overall
Developing	Brazil	weak	no	no	yes	no	weak
	China	yes	no	no	no	-	weak
	India	no	no	no	weak	no	very weak
	Russia	no	weak	yes	no	yes	semi-strong
	South Africa	yes	yes	yes	weak	-	strong
Developed	Canada	no	yes	no	yes	yes	strong
	Germany	yes	no	weak	-	yes	semi-strong
	Japan	yes	yes	yes	weak	yes	strong
	UK	no	yes	weak	weak	no	weak
	US	yes	yes	yes	yes	yes	very strong

Appendix D: Explanatory power of US macroeconomic variables in stock index prices

Table 16: Effect of US macroeconomic variables on Stock Prices of all Countries

		Impact of US Macroeconomic Variables in different stock markets								
		BVSP	TSX	SSE	DAX	BSE	TOPIX	RTSI	JSE	FTSE
INT	lag 1	0.0076	0.02218	0.02831	-0.0417	-0.018	-0.015	0.059	-0.000	-0.015
		[0.272]	[1.366]	[0.963]	[-1.538]	[-0.700]	[-0.501]	[1.325]	[-0.027]	[-0.883]
	lag 2	-0.0370	-0.0260	-0.0334	-0.0078	-0.0221	0.02026	-0.0661	-0.0195	-0.0257
		[-1.28]	[-1.600]	[-1.105]	[-0.287]	[-0.818]	[0.688]	[-1.504]	[-0.948]	[-1.485]
	lag 3	0.0242	0.0115	0.0406	0.0397	0.04339	0.00237	0.0539	0.0098	0.01969
		[0.852]	[0.725]	[1.363]	[1.495]	[1.634]	[0.086]	[1.259]	[0.486]	[1.177]
	lag 4	-0.072*	-0.039*	-0.0152	-0.043*	-0.0314	-0.0220	-0.0421	-0.0262	-0.018
		[-2.63]	[-2.577]	[-0.520]	[-1.760]	[-1.198]	[-0.858]	[-1.023]	[-1.339]	[-1.179]
CPI	lag 1	-0.9763	-1.5619	4.07972	-0.8608	-1.8320	-2.5835	-5.800	-2.7265	-0.5614
		[-0.29]	[-0.815]	[-1.136]	[0.290]	[-0.582]	[-0.891]	[-1.148]	[-1.125]	[-0.291]
	lag 2	-3.248	-3.297*	-5.8442	-0.0730	-0.7751	4.38168	-6.1683	-0.484	0.0502
		[-0.93]	[-1.676]	[-1.556]	[-0.023]	[-0.234]	[1.420]	[-1.194]	[-0.194]	[0.024]
	lag 3	1.5211	1.28752	-5.940	-0.8884	2.70840	-4.7337	-3.2360	0.37037	0.41618
		[0.442]	[0.659]	[-1.616]	[-0.295]	[0.835]	[-1.517]	[-0.636]	[0.152]	[0.212]
	lag 4	-2.0831	-3.005*	0.2116	-4.7269	-6.837*	-2.3747	-10.49*	-1.4734	-4.129*
		[-0.64]	[-1.682]	[0.060]	[-1.654]	[-2.244]	[-0.821]	[-2.178]	[-0.641]	[-2.212]
EXCH	lag 1	0.0858	0.19942	0.4362*	0.10317	0.27100	0.12860	0.32671	0.11931	0.13022
		[0.380]	[1.647]	[1.892]	[0.548]	[1.333]	[0.688]	[1.009]	[0.767]	[1.061]

	lag 2	0.1639	0.04973	-0.3332	-0.2820	0.06348	-0.0779	0.27922	-0.0207	-0.0842
		[0.698]	[0.393]	[-1.363]	[-1.409]	[0.295]	[-0.406]	[0.820]	[-0.126]	[-0.644]
	lag 3	-0.0687	0.0248	0.16881	0.21939	-0.2067	0.12317	0.55791	0.0489	-0.0401
		[-0.29]	[0.198]	[0.697]	[1.107]	[-0.966]	[0.665]	[1.650]	[0.302]	[-0.309]
	lag 4	-0.2181	0.04176	-0.234	0.04494	-0.2038	0.02010	0.148	-0.0563	0.12715
		[-1.01]	[0.351]	[-1.014]	[0.238]	[-0.998]	[0.110]	[0.462]	[-0.368]	[1.042]
IP	lag 1	3.897*	2.1254*	1.7271*	2.5106*	3.6216*	2.5705*	4.3836*	1.8696*	1.8879*
		[4.034]	[4.151]	[1.785]	[3.050]	[3.994]	[3.502]	[3.202]	[2.833]	[3.451]
	lag 2	1.5348	0.54639	-0.1101	0.92887	1.04963	0.89444	1.39954	0.53268	0.76013
		[1.616]	[1.054]	[-0.115]	[1.161]	[1.219]	[1.101]	[1.018]	[0.816]	[1.413]
	lag 3	-1.0492	-0.0719	0.21660	-1.1769	-0.9600	-1.726*	-0.0062	-0.0773	-0.8747
		[-1.07]	[-0.138]	[0.218]	[-1.423]	[-1.091]	[-2.108]	[-0.004]	[-0.117]	[-1.591]
	lag 4	-2.311*	-1.0243	-0.5824	-0.8591	-2.337*	-0.3331	-1.1950	-1.1526	-0.664
		[-2.26]	[-1.245]	[-0.567]	[-0.992]	[-2.529]	[-0.382]	[-0.835]	[-1.292]	[-1.158]
M2	lag 1	-2.789*	-2.110*	-1.6913	-2.415*	-1.2677	1.08618	-3.4386	-2.137*	-1.882*
		[-1.76]	[-2.431]	[-1.018]	[-1.747]	[-0.851]	[0.785]	[-1.474]	[-1.932]	[-2.099]
	lag 2	0.7827	-0.030	1.34300	0.1524	1.41594	1.34762	-1.3256	0.66554	0.08254
		[0.500]	[-0.035]	[0.833]	[0.113]	[0.975]	[0.978]	[-0.587]	[0.614]	[0.094]
	lag 3	1.4686	0.55550	-1.4449	0.40156	-1.6633	-1.621	1.62099	0.54603	0.24244
		[0.958]	[0.659]	[-0.904]	[0.300]	[-1.149]	[-1.180]	[0.722]	[0.508]	[0.277]
	lag 4	0.29733	0.61553	1.02276	0.20549	0.98579	0.21722	2.8044	0.19220	0.94317
		[0.195]	[0.740]	[0.652]	[0.154]	[0.698]	[0.162]	[1.263]	[0.181]	[1.084]