ISCTE Business School
Instituto Universitário de Lisboa

THE ROLE OF MACROECONOMICS IN THE PORTUGUESE STOCK MARKET

Paulo José Ribeiro Gonçalves

Project submitted as partial requirement for the conferral of
Master in Finance

Supervisor:
Prof. José Dias Curto, Prof. Associado, ISCTE Business School, Departamento de Métodos Quantitativos

April 2012

Resumo

Este estudo investiga a relação entre variáveis macroeconómicas e o retorno das ações (PSI 20 e suas empresas), usando dados mensais que variam de Janeiro de 1999 a Novembro de 2011. As variáveis macroeconómicas utilizadas neste estudo são o índice de preços no consumidor (como uma proxy para a inflação), índice de produção industrial, taxa de câmbio (EUR/USD), taxas de juro (taxa de juro a 10 anos e EURIBOR de três meses) e agregado monetário (M2). O modelo de estimação dos mínimos quadrados ordinários (OLS) foi utilizado para estabelecer a relação entre variáveis macroeconómicas e retornos do mercado de ações. Os resultados empíricos revelam que existem alguns casos em que se verifica uma relação estatisticamente significativa entre retornos das acções e nossas variáveis macroeconómicas. Conclui-se ainda que as variáveis macroeconómicas afectam os retornos do PSI 20 e as suas empresas da mesma forma. Os resultados por nós obtidos podem ainda fornecer algumas indicações a gerentes de empresas, investidores e corretores.

Palavras-chave: Fatores de risco · Variáveis macroeconómicas · Modelo OLS · PSI 20.

JEL Sistema de Classificação: E44 · C32

Abstract

This study investigates the relation between macroeconomic variables and stock market returns (PSI 20 index and its companies) using monthly data that ranging from January 1999 to November 2011. Macroeconomic variables used in this study are consumer price index (as a proxy for inflation), industrial production index, foreign exchange rate (EUR/USD), interest rates (ten-year interest rate and EURIBOR three-month) and money supply (M2). The ordinary least square estimation (OLS) model was used in establishing the relation between macroeconomic variables and stock market returns. Empirical findings reveal that there are a few cases where a significant relation between stock market returns and our macroeconomic variables occur. Thus, is clear that the way macroeconomic affects the returns of the PSI 20 index and its companies are the same. The results may provide some insight to corporate managers, investors and brokers.

Keywords: Risk Factors · Macroeconomic Variables · OLS model · PSI 20 Index.

JEL Classification System: E44 · C32

Table of Contents

List of Tables

1. Introduction

Numerous empirical studies have investigated the predictability of stock returns using macroeconomic variables.

Financial theory suggests that macro-economic variables should systematically affect stock market returns where individual asset prices are influenced by the wide variety of unanticipated events and that some events have a more pervasive effect on asset prices than do others.

In a more superficial approach, macroeconomic variables such as interest rates, exchange rates and inflation have been used as key variables in many financial models. An example, when computing the NPV of a project which if positive will add value to the company and increase its stock price, interest rates and inflation, apart from the growth rate, they are the most influential variables in computing the NPV which is such a central tool to estimate a company's true value. The way projects and investments are financed and selected is based also, on the analysis of these macroeconomic variables. Therefore, short-run and long-run management, financial, accounting and portfolio decisions can be made upon the analysis of the relation these variables have with equity value.

Coherent with the investors' ability to diversify, modern financial theory has focused on methodical or *systematic* influences as the presumable source of investment risk (i.e. Chen *et al.*, 1986).

This is not surprising, as macroeconomic variables likely exert important influences on firms' expected cash flows, as well as the rate at which these cash flows are discounted. More formally, insofar as macroeconomic variables affect future investment opportunities and consumption, they are key *state variables* in asset-pricing models (Sharpe, 1964; Merton, 1973; Breeden, 1979; Campbell and Cochrane, 2000) and can represent priced factors in Arbitrage Pricing Theory (Ross, 1976) but also risk factors in Modern Portfolio Theory (Harry Markowitz, 1959).

The need to understand risk and incorporate it in investors decisions in order to provide investment performance measurement incite, led to the formulation of the denominated Post-Modern Portfolio Theory (Sumnicht, 2008; Swisher and Kasten, 2005) which is mainly an *upgrade* to the Modern Portfolio Theory by usage of a new risk factor brought up by Sortino and Meer (1991) known as Downside risk which seems to provide a more reliable tool for choosing the "best" portfolio.

The point is, risk must be measured in order to make flawless investment decisions and for that many risk factors have been considered and used in order to model it, but is known that even the most used risk measures like standard deviation and beta are incomplete measures by itself which is shown by Sortino and Meer (1991) and Swisher and Kasten (2005). Also, Coaker (2006) findings reflect the fact that the investment environment is constantly shifting in a random fashion. Investor utility and the securities markets are affected by much more than return and risk (standard deviation).

Therefore, the main problem or flaw is the inability to accurately capture risk, that's why the *updates* to the past financial theories were made by changing or integrating more risk factors in the mix to achieve a *bullet proof* model.

Up to now, studies have provided the basis for the belief that a long-term equilibrium exists between stock prices and macroeconomic variables. Therefore, macroeconomic variables must be seen also as a risk component and posteriorly integrated in the most used financial models but to do so, is necessary to understand their real impact, if any, in the stock returns performance and in a wide variety of macroeconomic variables, which ones must be used as extra-market risk factors.

Moreover, in order to understand the relation between macroeconomic variables and stock returns and also, identify the most fitting macroeconomic factors, many researchers have been studying the relation between macroeconomic factors and stock returns in a global scale.

Different countries and different macroeconomic factors have been linked and tested with the purpose of achieving that main goal. An overview of all the analyzed researches brought up the idea that the significance of each macroeconomic factor and his sign varies with the country (Rapach et al., 2004), industry (Günsel and Çukur, 2007) and lags (in a short- or long-term analysis) used to infer the relation between stock returns and state variables in terms of changes in the level of prices or in its volatility.

Now the fundamental question must be made, which of these variables should be used as market risk factors?

This can only be answered by analyzing their relation with the stock returns which we are going to study and establish in this thesis.

Moreover, identifying macro variables that influence aggregate equity returns has two direct benefits. First, it may indicate hedging opportunities for investors. Second, if investors as a group are averse to fluctuations in these variables, they may constitute priced factors.

Nevertheless, and to the best of our knowledge, few studies were made linking macroeconomic variables and the PSI 20 and even fewer of the released researches worldwide have tried to understand if the relation between macroeconomic variables and a country stock index is the same as the relation between macroeconomic variables and the stand-alone index companies.

In conclusion, our purpose is to study the relation between macroeconomic shocks and stock returns of the PSI 20 and its components. Also, conclude if the relation changes from company to company, which is expected to happen due to the specific industry features and infer if the average signal obtain for the relation between the macroeconomic variables with the twenty PSI 20 companies is the same for the PSI 20 Index.

The remainder of this thesis is as follows: Section 2 consists in a detailed literature review. Section 3 presents the econometric methodology applied to the variables in study. Section 4 deals with the data (i.e. selection of the macroeconomic variables, sources and expected outcome) and empirical results. Section 5 contains a summary of our findings and concluding remarks.

2. Literature Review

In the literature review we found that several macroeconomic factors have been considered as explanatory factors of stock markets returns, namely the inflation rate, industrial production, interest rate, exchange rate and money supply. Among many others, these state variables were the most used by the reviewed researches and therefore, they will be the focus of our literature review and research and their power to explain the stock returns variations comparatively to our findings.

In most studies consumer price index was used has a proxy for the inflation impact in the stock returns. Chen et al. (1986), Flannery and Protopapadakis (2001), Rapach et al. (2004), Menike (2006) and Singh et al. (2010) findings characterize the relation between inflation and stock returns as having a significant negative impact in the stock returns. Contradictorily, Fama and Gibbons (1982), Panetta (2001) and Maysami et al. (2004), also Hachicha and Chaabane (2007) found a significant positive relation between inflation and stock returns. According to Maysami et al. (2004: 68) “A possible explanation for the positive relation might be the government’s active role in preventing prices escalation as the economy continued to improve after the 1997 crisis”. Evidence of inexistence of any significant relation between equity returns and inflation was found by Floros (2004), Shanken and Weinstein (2006), also by Pilinkus (2009). Theoretically speaking, inflation has a direct effect over the consumer prices which affect the purchasing power of the population and therefore, the companies’ revenue. Causality should then exist as the stock prices reflect the capital owned by the company and the performance of their business which suffer great impact from changes in the consumer behavior.

Thus, in accordance to these studies, we conclude that consumer price index as a proxy for the inflation variable may have a negative impact on stock returns.

For the macroeconomic factor, industrial production, the results found by Fama (1981), Chen et al. (1986), Panetta (2001), Maysami et al. (2004), Shanken and Weinstein (2006), Mansor et al. (2009) as well as Savasa and Samiloglub (2010) pointed to significant positive relation between stock returns and industrial production. Chen et al. (1986) argued that the positive relation reflects the value of insuring against real systematic production risks.

Although, negative relation (Günsel and Çukur, 2007; Büyükşalvarcı, 2010) as well as no significant relation (Flannery and Protopapadakis, 2001; Rapach et al., 2004) between industrial production and stock returns were found. But in an overall, a significant positive relation between these variables is the expected result.

When studying the interest rates impact on stock market returns, researchers used mainly two proxies while trying to understand and catalog which may better explain the performance of stock returns. This two were term spread (i.e. the difference between the long-term government bond yield and the 3-month Treasury bill rate) and risk premium (i.e. the difference between the Baa and under bond portfolio returns and the return on a portfolio of long-term government bonds), both used by Chen et al. (1986), Panetta (2001), Shanken and Weinstein (2006) and Günsel and Çukur (2007).

Rapach et al. (2004), Menike (2006) and Büyükşalvarcı (2010) findings says that interest rates have a significant negative effect in the stock returns while Günsel and Çukur (2007) found out a significant positive relation. For Chen et al. (1986) and Panetta (2001) the sign varies between the variables term spread and risk premium. Chen et al. (1986) identified a significant negative relation between term structure and stock returns, and a significantly positive relation between risk premium and stock returns. While Panetta (2001) stated, in his analysis of the Italian stock returns that, term spread has a significant positive relation with the Italian index stock returns versus a significant negative relation between risk premium and stock returns.

Maysami et al. (2004: 68) found in their research that short- and long-term interest rates have respectively significant positive and negative relations with the Singapore's stock market returns. They justified their findings by saying: "The reason is probably that long-term interest rate serve as a better proxy for the nominal risk-free component used in the discount rate in the stock valuation models and may also serve as a surrogate for expected inflation in the discount rate."

Rapach et al. (2004: 23) yet account the "…interest rates are generally more consistent and reliable predictors of stock returns than a number of other macroeconomic variables, and that this is true for a large number of industrialized countries". Nevertheless, in accordance to these studies we conclude that short- and long-term interest rates are expected to have a negative correlation with the stock returns while risk premium and term structure are expected to have a positive relation with stock returns.

In studies carried out by Menike (2006), Singh et al. (2010), Büyükşalvarcı (2010) and Savasa and Samiloglub (2010), they all corroborate the existence of a significant negative relation between stock returns and exchange rate. However, Nantwi and Kuwornu (2011) and Pilinkus (2009) found no relation between equity returns and exchange rate. Günsel and Çukur (2007: 147) explained this inexistence of causality between these two variables by stating that a "…company may use some tools such as derivatives to eliminate exchange rate risk. Therefore, it is not very surprising not to find any relation between effective exchange rate and industry returns." Other researchers like Mansor et al. (2009) and Panetta (2001) found a positive relation between exchange rate and stock returns. Maysami et al. (2004: 69) "…explained that with the high import and export content in the Singapore's economy, a stronger domestic currency lowers the cost of imported inputs and allows local producers to be more competitive internationally."

Based on the literature review we anticipate a positive sign for the relation between exchange rate and stock returns in an import dominant economy as ours. Also, with a high level of significance, as concluded by Menike (2006: 64) as being "…the most influential macroeconomic variable".

Empirically, in researches taken by Hamburger and Kochin (1972), Kraft and Kraft (1977), Flannery and Protopapadakis (2001), Maysami et al. (2004), Günsel and Çukur (2007), Hachicha and Chaabane (2007), Pilinkus (2009), Büyükşalvarcı (2010), also Savasa and Samiloglub (2010), a strong positive linkage between money supply and stock returns was found. In Maysami et al. (2004: 68) research this finding is explain by the fact that "…money demand is stimulated through increases in real activity, which in turn drive stock returns". Hachicha and Chaabane (2007) in their research said that they were not surprised with this result "…since a decrease in money supply can lead to lower inflation and lower returns."

Although, Cooper (1974), Nozar and Taylor (1988), Panetta (2001) and Menike (2006) found no relation between money supply and stock returns or Singh (2010) which found a negative relation between those two variables, a significant positive relation between them is the expected result for our research.

An overview of all the analyzed researches brought up the idea that the significance of each macroeconomic factor and his sign varies with the country (Rapach et al., 2004), industry (Günsel and Çukur, 2007) and lags (in a short- or long-term analysis) used to infer the relation between stock returns and state variables in terms of changes in the level of prices or in its volatility. As a summary of the literature review, Table 1, Table 2 and Table 3 are presented next;

Table 1: Research Overview: Variables and respective signal

Only six variables which our research is focus on, were analyzed (i.e. Inflation, Industrial Production, Interest rate, Exchange rate, GDP and Money Supply). Other variables were used in some of these researches but were omitted in order to reduce the table length and filter the relevant information to our research. Twenty researches were analyzed and summarized by authors, countries, macroeconomic variables and their findings. In the column "Observed Signal" a significant positive relation between the macroeconomic variable and the stock returns is represented with a "+", a significant negative relation between the macroeconomic variable and the stock returns is represented with a "-" and the existence of any significance between the variable and the stock returns is represented with a "0". The space in blank means that macroeconomic variable wasn't used by the author(s). Also, to simplify the table; Inflation (CPI), Industrial Production Index (IPI), Long-Term Interest Rate (LTR), Short-Term Interest Rate (STR), Risk Premium (RP), Term Structure (TS), Foreign Exchange Rate (FER) and Money Supply (M2).

Authors	**Macroeconomic Variables**							
	CPI	IPI	LTR	STR	RT	TS	FER	M2
Nantwi and Kuwornu (2011)	+			0			0	
Büyükşalvarcı (2010)	0	–		–				
Savasa and Samiloglub (2010)		+	0				–	+
Singh et al. (2010)	–						–	
Pilinkus (2009)	0						0	+
Mansor et al. (2009)	0	+					+	
Günsel and Çukur (2007)	0	–			+	+	0	+
Hachicha and Chaabane (2007)		+		–			+	+
Samitas and Kenourgios (2007)		+	+					
Shanken and Weinstein (2006)	0	+			0	0		
Menike (2006)	–			–			–	0
Floros (2004)	0							
Rapach et al. (2004)	–	0	–	–				
Maysami et al. (2004)	+	+	–	+			+	+
Panetta (2001)	+	+			–	+	+	0
Flannery and Protopapadakis (2001)	–	0						+
Bilson et al. (2000)	–	–					–	+
Kaminsky et al. (1996)							+	
Demirguc-Kunt et al. (1998)	–			–			+	
Chen et al. (1986)	–	+			+	–		

Table 2 :Researches Overview

This table synthesizes for each research the countries analyzed and de macroeconomic variables used in the same study. With this table we pretend to show the variety of countries and macroeconomic variables used in order to model the relation between both.

Research	Country Analyzed	Macroeconomic Variables
Chen et al. (1986)	US	Consumer Price Index (Inflation), Treasury-bill rate, Long-term government bonds, Industrial production, Low-grade bonds, Equally weighted equities, Value-weighted equities, Consumption and Oil price
Kaminsky et al. (1996)	Argentina, Bolivia, Brazil, Chile, Colombia, Denmark, Finland, Indonesia, Israel, Malaysia, Mexico, Norway, Peru, Philippines, Spain, Sweden, Thailand, Turkey, Uruguay and Venezuela	M2 multiplier, Domestic credit/GDP, Real interest rate, Lending-deposit rate ratio, Excess m1 balances, M2/reserves, Bank deposits, Exports, Terms of trade, Real exchange rate, Imports, Reserves, Real interest-rate differential and Deficit/GDP
Panetta (2001)	Italy	Industrial production, Inflation, Interest rates (Term structure and Risk premium), Exchange rates, Oil prices, Money growth (M2) and Consumption
Floros (2004)	Greece	Consumer price index and General price index
Rapach et al. (2004)	Belgium, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Sweden, UK and US	Relative money market rate, Relative 3-month Treasury bill rate, Relative long-term government bond yield, Term spread, Inflation rate, Industrial production growth, Narrow money growth, Broad money growth and Change in the unemployment rate
Menike (2006)	Sri Lankan	Exchange rate, inflation rate, money supply and interest rate
Hachicha and Chaabane (2007)	France, Spain, Portugal, Tunisia, and Egypt	U.S. 3-month Treasury-bill yield, MSCI world index, Industrial productivity, Nominal exchange rate, Money supply (M1) and Nominal interest rate
Samitas and Kenourgios (2007)	Czech Republic, France, Germany, Hungary, Italy, Poland, Slovakia, UK and US	Industrial production and Domestic interest rate
Mansor et al. (2009)	Australia, Hong Kong, Japan, Korea, Malaysia and Thailand	Inflation rates, Industrial production index and Foreign exchange rates
Singh et al. (2010)	Taiwan	Employment rate, Exchange rate, GDP, Inflation and Money supply
Savasa and Samiloglub (2010)	Turkey	Broad money supply (M0), Industrial production index, Real effective exchange rate index, Long-term domestic interest rates and US Federal funds rates
Owusu-Nantwi and Kuwornu (2011)	Ghana	Consumer price index, Crude oil price and Exchange rate and 91 day Treasury bill rate

Table 3: Count of Observed Signals

This table indicates how many times these specific macroeconomic variables (i.e. Inflation, Industrial Production, Interest rate, Exchange rate and Money Supply) were used in a total of *twenty one* analyzed researches and which sign has the biggest frequency, thus the signal that is more expected to be found in our research. The highlighted numbers (i.e. the ones in **bold**) represent the expected signal for the relation between the macroeconomic variable and the stock returns.

	Observed Signal			
Macroeconomic Variables	0	–	+	**Grand Total**
Inflation	6	**7**	3	16
Industrial Production	2	3	**8**	13
Long-Term Interest rate	1	**2**	1	4
Short-Term Interest rate	1	**5**	1	7
Risk Premium (Interest rate)	1	1	**2**	4
Term Structure (Interest rate)	1	1	**2**	4
Foreign Exchange rate	3	4	**6**	13
Money Supply	2	0	**7**	9
Grand Total	17	23	30	70

3. Methodology

Different methods have been used to test the relations between macroeconomic variables and stock prices. Proceeding with this research topic, this study analyses the effects of macroeconomic variables on PSI 20 index and its companies by using a multiple linear regression model. This model is useful and suitable for this research purpose which consists in examining the contemporaneous relation between changes in macroeconomic variables and their impact in stock returns.

Based on both theoretical and empirical literature reviewed (Chen et al., 1986; Floros, 2004; Büyükşalvarcı, 2010; Singh et al., 2010), this study hypothesize the relation between PSI 20 index (PSI20) and six macroeconomic variables, namely consumer price index (CPI), industrial production index (IPI), long-term interest rate (LTR), short-term interest rate (STR), foreign exchange rate (FER) and money supply (M2). The hypothesized relation is represented as follows:

$$\text{PSI20} = f\left(\text{CPI, IPI, LTR, STR, FER, M2}\right)$$

In order to see whether the above identified macroeconomic factors could explain the variation on PSI 20 index returns, the multiple linear regression model is formed:

$$\text{PSI20}_t = \beta_0 + \beta_1\,\text{CPI}_t + \beta_2\,\text{IPI}_t + \beta_3\,\text{LTR}_t + \beta_4\,\text{STR}_t + \beta_5\,\text{FER}_t + \beta_6\,\text{M2}_t + \varepsilon_t \qquad (1)$$

Where β_0 is the intercept and β_i (where i = 1, 2, 3, 4, 5, 6) represents the coefficient for each of the variables while ε_t is the error term of the regression.

For the remaining dependent variables (i.e. the twenty PSI 20 companies) the regression model is composed by the same explanatory variables (i.e. CPI, IPI, LTR, STR, FER and M2), the only difference is on the dependent variable (i.e. the returns for each company).

The ordinary least squares (OLS) method is used to estimate the parameters of the regression model stated above and all estimations have been performed by using the packages *EViews*, *Gretl* and *SPSS*, whereas other auxiliary calculations were made in *Excel*.

Methodology scheme:

1. Descriptive Statistics: Observations, Mean, Median, Maximum, Minimum, Std. Dev., Skewness, Kurtosis, Jarque-Bera test statistic and p-Value;

2. Stationarity variables in order to test whether a time series variable is stationary or not. The tests applied are *ADF* (Augmented Dickey-Fuller) and *KPSS* (Kwiatkowski-Phillips-Schmidt-Shin) tests;

3. Estimation of the multiple linear regression model;

4. Model assumptions tests:
    - Multicollinearity (i.e., Tolerance and Variance Inflation Factor procedure);
    - Normality of the error term (i.e., Jarque-Bera test);
    - Autocorrelation of the error term (i.e., Durbin-Watsons test and Breusch-Godfrey test);
    - Homoscedasticity of the error term (i.e., White test).

5. Dealing with:
    - Multicollinearity (i.e., Change the initial model composition and test again for Multicollinearity);
    - Non-Normality of the error term (This is not a problem for inference as we have big samples, $n > 30$);
    - Autocorrelation of the error term(i.e., Cochrane-Orcutt procedure);
    - Heteroscedasticity of the error term (i.e., White HC standard errors);
    - Autocorrelation and Heteroscedasticity of the error term (i.e., Newey-West test HAC standard errors).

4. Empirical Study

4.1. Data

This section describes the state variables that are used in the empirical analysis. Six macroeconomic variables were chosen in order to establish the relation between the stock returns of the twenty companies which compose the PSI 20 Index and the index itself, with macroeconomic variables. The choice was made based in the most used macroeconomic factors by the authors of the analyzed researches. Therefore, six macroeconomic variables were selected, namely: Inflation, Industrial Production, Long and Short-term Interest Rates, Foreign Exchange Rate and Money Supply.

The Macroeconomic data were extracted from *Banco de Portugal statistics* while the PSI 20 INDEX and its companies price values were extracted from *Yahoo!Finance* and crosschecked with the *EURONEXT DataStream*. We are using monthly data and the number of observations varies depending on the financial instrument (Table 4 shows the time period for each financial instrument and the number of corresponding observations). Note that the sample acquired for the dependent variables are monthly adjusted closing price (i.e., adjusted for dividends and splits).

Moreover, the logarithm was applied to the initial data in order to work with stationary series. Based in the empirical results, for the variables which remain non-stationary after applying the logarithm, they were converted to a monthly continuous rate by taking the first differences of the logarithmic series (Maysami et al., 2004):

$$DL(Vj) = \ln(Vj)_{t} - \ln(Vj)_{t-1} \tag{2}$$

Where DL(Vj) is the first differences of the logarithmic (continuous growth rate) of variable j month t. $(Vj)\ t$ and $(Vj)\ t-1$ are the level of variable i for month t and $t - 1$ respectively.

Dependent Variables

4.1.1. PSI 20 Companies and PSI 20 INDEX

Based on financial theory (Fama, 1981; Chen et al., 1986) coupled with the results of previous studies, this article hypothesizes certain relations between consumer price index, industrial production, long-term interest rates, short-term interest rates, foreign exchange rate, and money supply with the PSI 20 index and its companies, namely;

Table 4: Acronyms and Time Period

This table shows the acronyms used for each dependent variable and its time period in our empirical study as well as the number of observations of the logarithm of prices. These acronyms account for the logarithm of prices and for the first differences of the logarithmic of the dependent variables.

Instrument's Name	Acronyms		# of Observations	Time Period	
	Log of Prices	Returns		Beginning	End
PSI 20 INDEX	LPSI20	DLPSI20	155	31-01-1999	30-11-2011
ALTRI, SGPS	LALTR	DLALTR	81	31-03-2005	30-11-2011
BANCO BPI	LBPI	DLBPI	107	31-01-2003	30-11-2011
BANCO COMERCIAL PORTUGUÊS	LBCP	DLBCP	107	31-01-2003	30-11-2011
BANCO ESPIRITO SANTO	LBES	DLBES	143	31-01-2000	30-11-2011
BRISA	LBRI	DLBRI	107	31-01-2003	30-11-2011
CIMPOR, SGPS	LCPR	DLCPR	107	31-01-2003	30-11-2011
EDP	LEDP	DLEDP	107	31-01-2003	30-11-2011
EDP RENOVAVEIS	LEDPR	DLEDPR	42	30-06-2008	30-11-2011
ESPIRITO SANTO FINANCIAL	LESF	DLESF	98	31-10-2003	30-11-2011
GALP ENERGIA-NOM	LGALP	DLGALP	62	31-10-2006	30-11-2011
JERÓNIMO MARTINS, SGPS	LJMT	DLJMT	107	31-01-2003	30-11-2011
MOTA ENGIL	LEGL	DLEGL	107	31-01-2003	30-11-2011
PORTUCEL	LPTI	DLPTI	107	31-01-2003	30-11-2011
PORTUGAL TELECOM	LPT	DLPT	155	31-01-1999	30-11-2011
REN	LRENE	DLRENE	52	31-07-2007	30-11-2011
SEMAPA	LSEM	DLSEM	107	31-01-2003	30-11-2011
SONAE INDÚSTRIA SGPS	LSONI	DLSONI	72	30-12-2005	30-11-2011
SONAE	LSON	DLSON	143	31-01-2000	30-11-2011
SONAECOM, SGPS	LSNC	DLSNC	137	30-06-2000	30-11-2011
ZON MULTIMEDIA	LZON	DLZON	107	31-01-2003	30-11-2011

Explanatory Variables and Hypotheses

4.1.2. Consumer Price Index (CPI)

Consumer Price Index is used as a proxy of inflation rate. CPI is chosen as it is a broad base measure to calculate average change in retail prices for a fixed market basket of goods and services. The CPI data is compiled from a sample of prices for food, shelter, clothing, fuel, transportation and medical services that people purchase on daily basis. Inflation is ultimately translated into nominal interest rate and an increase in nominal interest rates increase discount rate which results in reduction of present value of cash flows so theoretically, an increase in inflation has a negatively impact in equity prices. Empirical studies by Chen et al. (1986), Bilson et al. (2000), Rapach et al. (2004), Menike (2006) and Singh et al. (2010) concluded that inflation has negative effects on the stock market.

4.1.3. Industrial Production Index (IPI)

Industrial Production Index is used as proxy to measure the growth rate in real sector. Industrial production consists of the total output of a nation's plants, utilities, and mines. From a fundamental point of view, it is an important economic indicator that reflects the strength of the economy, and by extrapolation, the strength of a specific currency. Therefore, industrial production presents a measure of overall economic activity in the economy and affects stock prices through its influence on expected future cash flows. Chen et al. (1986), Panetta (2001), Maysami et al. (2004), Shanken and Weinstein (2006) and Savasa and Samiloglub (2010) found a positive sign. Thus, it is expected that an increase in industrial production index is positively related to stock returns.

4.1.4. Interest Rate (LTR and STR)

A ten-year interest rate and a three-month time deposit rate (i.e. Rate of return on fixed-rate Treasury bonds - 10 years and EURIBOR – 3 months) are used as a proxy for long-term and short-term interest rates, respectively. The intuition regarding the relation between interest rates and stock prices is well established, suggesting that investors anticipate that increased investment and spending will boost the companies listed on the stock exchange when the interest rate drops. Thus, a change in nominal interest rates should move asset prices in the opposite direction as corroborated by Maysami et al. (2004), Rapach et al. (2004), Menike (2006), Hachicha and Chaabane (2007) and Büyükşalvarcı (2010) while finding a negative sign for the relation between interest rates and stock returns. In addiction an interest rate is typically not subjected to revision and are available immediately, that said, interest rates are likely to be relevant in real time investment decisions (Rapach, 2004: 23).

4.1.5. Foreign Exchange Rate (FER)

The proxy which has been used to capture the effect of unexpected changes in exchange rates on stock returns is the rate of change in the US dollar/EUR exchange rate which is an important factor to determine the international competitiveness. Portugal is mainly an import country. For an import dominated country currency depreciation will have an unfavorable impact on a domestic stock market. As the European Union currency depreciates against the U.S. dollar, products imported become more expensive. However, some imports are essential for production or cannot be made in Portugal and have an inelastic demand and inevitably we and up spending more on these when the exchange rate falls in value, which in turn causes lower cash flows, profits and the stock price of the domestic companies. Demirguc-Kunt et al. (1998), Panetta (2001), Maysami et al. (2004) and Mansor et al. (2009) found a positive sign. Thus, a positive relation is expected between foreign exchange rate and stock returns.

4.1.6. Money Supply (M2)

Broad Money (M2) is used as a proxy of money supply. The money supply is basically defined as the quantity of money (money stock) held by money holders (general corporations, individuals and local governments). M2 is a category of the money supply that includes all coins, currency and demand deposits (that is, checking accounts and *NOW* accounts) and all time deposits, savings deposits and non-institutional money-market funds. Therefore, an increase in money supply leads to increase in liquidity that ultimately results in upward movement of nominal equity prices. Flannery and Protopapadakis (2001), Bilson et al. (2000), Maysami et al. (2004), Hachicha and Chaabane (2007) and Pilinkus (2009) found a positive sign. Thus, a positive relation is expected between money supply and stock returns.

4.1.7. Gross Domestic Product (GDP)

GDP is the total value of final goods and services produced within a country's borders in a year. It is one of the measures of national income and output. It may be used as one indicator of the standard of living in a country. If a country or a region of the world has a high economic growth prospects, investors will find them attractive places to invest therefore, GDP growth is expected to have a positive impact on the stock returns. Even so, we will not use this variable in our model based in;

1. The methodology used by us to choose the macroeconomic variables was the realization of the most commonly ones used by all the studies that were analyzed and GDP was rarely used;
2. GDP data is only possible to arrange in a quarterly basis, while the others macroeconomic variables are in a monthly basis and thus make better use of data of returns by not using GDP as an explanatory variable in our model;
3. GDP as an explanatory variable is automatically linked to others macroeconomic variables which reduces its explanatory power, i.e. interest rate and exchange rate where:
   - Higher exports (an injection into the circular flow) and falling imports leads to rising GDP levels;
   - A lower exchange rate accompanied by lower interest rates will stimulate consumer spending and general economic recovery (i.e. GDP levels will increase).

Therefore, GDP will not be integrated in our model as an explanatory variable.

In conclusion, the expect signals for each macroeconomic variable in our multiple linear regression model based on the findings of the reviewed literature and the theoretical relation that each macroeconomic variable has with stock returns are as follows:

Table 5: Acronyms and Expected Signals for the Dependent Variables

This table summarizes the expected signals for each macroeconomic variable coefficient in relation to the PSI20 and its company's returns. These expected signals will be the standard signals to be compared to the ones we found in our study.

Macroeconomic Variable	Acronyms		Expected Signal
	Logarithmic series	Returns	
Inflation	LCPI	DLCPI	–
Industrial Production	LIPI	DLIPI	+
Long-Term Interest rate	LLTR	DLLTR	–
Short-Term Interest rate	LSTR	DLSTR	–
Foreign Exchange rate	LFER	DLFER	+
Money Supply	LM2	DLM2	+

4.2. Estimation Results

In this section we will apply the proposed methodology. The descriptive statistics are presented for the first differences of the logarithm of prices for each company and PSI 20 index in table 6 and for the first differences of the logarithm of each macroeconomic variables presented in table 7 as well as the normality test (Jarque-Bera test) shown in table 8 and 9. The Unit Root Tests (i.e. ADF and KPSS tests) are presented in table 10 and 11. Then, the multiple linear regression models will be defined for each dependent variable. Moreover, OLS assumptions will be tested and corrective measures, if needed, will be considered. In conclusion, the coefficients' estimates and their statistical significance will be presented as well as the model used for each dependent variable. As we will see, the number of observations per regression is not the same therefore the number of observations used for each macroeconomic variable will change per regression which will change the values presented of the descriptive statistics, normality test and unit root tests.

4.2.1. Descriptive Statistics

The relevant descriptive statistics for the compounding rates of change are presented below in table 6 and table 7, respectively. The means are mainly negative, but all close to zero. The returns appear to be somewhat asymmetric, as reflected by the negative skewness estimates: the dependent variables seem to have more observations in the left-hand (negative skewness) tail than in the right-hand tail while the independent variables seem to have more observations in the right-hand (positive skewness) tail than in the left-hand. The kurtosis varies in most cases from 2 to 8, being always different from the standard Gaussian distribution which is 3: DLSON, DLESF, DLJMT and DLCPR are the ones which kurtosis standout in comparison to the other variables for theirs high values. Moreover, the Jarque-Bera (J-B) test was included in the descriptive statistics being the normality hypothesis rejected in almost every case as shown below in table 8 and table 9 for the dependent and independent variables, respectively.

Table 6: Summary statistics for the dependent variables returns

This table presents the main descriptive statistics estimated for each dependent variable.

Returns	# Obs.	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
DLALTR	80	0,02658	0,00000	0,63488	-0,63653	0,16152	0,09759	7,59414
DLBCP	106	-0,023009	-0,00249	0,21963	-0,32992	0,10908	-0,28929	2,78076
DLBES	142	-0,019067	-0,00444	0,23852	-0,35889	0,09434	-1,18186	5,42348
DLBPI	106	-0,009742	0,00000	0,25974	-0,47810	0,10013	-1,00341	7,93105
DLBRI	106	-0,002805	0,00554	0,13947	-0,26189	0,06823	-1,03960	5,02359
DLCPR	106	-0,00686	0,00982	0,23730	-1,59857	0,17386	-7,33258	67,75497
DLEDP	106	0,007993	0,01274	0,11683	-0,20133	0,05553	-0,81484	4,49725
DLEDPR	41	-0,013075	-0,01379	0,18848	-0,32226	0,10160	-0,30411	4,22249
DLEGL	106	0,000181	0,00948	0,26826	-0,28838	0,09643	-0,56467	4,04167
DLESF	97	-0,010429	0,00000	0,13103	-0,77171	0,10084	-4,65220	34,90497
DLGALP	61	0,011968	0,02595	0,28566	-0,48245	0,12004	-1,13012	6,39050
DLJMT	106	0,041291	0,02703	1,66991	-0,40368	0,17774	7,17990	68,23480
DLPSI20	154	-0,004812	-0,00182	0,16752	-0,23348	0,05620	-0,65585	5,02014
DLPT	154	0,002699	0,00608	0,23009	-0,42549	0,09108	-0,98651	6,20491
DLPTI	106	0,00719	0,00448	0,19612	-0,14689	0,06657	0,19631	3,16705
DLRENE	52	-0,008241	-0,00707	0,12516	-0,11544	0,05263	-0,20659	2,86706
DLSEM	106	0,007655	0,00496	0,16227	-0,16661	0,06783	0,04614	2,72810
DLSNC	137	-0,01529	-0,00766	0,46304	-0,36115	0,12612	-0,04109	4,57476
DLSON	142	-0,031492	0,00000	0,27088	-3,24168	0,29442	-9,21726	101,04140
DLSONI	71	-0,031992	-0,03213	0,43235	-0,37863	0,12515	-0,01274	5,32422
DLZON	106	-0,007031	-0,00461	0,27774	-0,28117	0,08791	-0,16680	5,01104

Table 7: Summary statistics for the compounding rates of change of independent variables

This table presents the main descriptive statistics estimated for each independent variable.

Returns	# Obs.	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
DLCPI	154	0,002140	0,001872	0,015986	-0,007067	0,004122	0,542656	3,705645
DLFER	154	0,001007	0,002325	0.065471	-0.075726	0,025726	0,000468	2,968563
DLIPI	154	-0,000467	0,005931	0,288002	-0,362083	0,129587	-0,368833	4,007666
DLLTR	154	0,007238	0,001855	0,163992	-0,105818	0,047001	0,538722	3,308697
DLM2	154	0,003096	0,002232	0,032475	-0,031855	0,012005	0,061621	3,046884
DLSTR	154	-0,004846	0,002638	0,213489	-0,292858	0,066445	-1,332055	7,840224

Table 8: Normality tests for dependent variables

This table presents the statistics and p-values of the Jarque-Bera test. The J-B normality hypothesis is rejected in almost all series and pointed with **red** colour.

Returns:	Jarque-Bera	Probability
DLALTR	70,48083	0,00000
DLBCP	1,69081	0,42938
DLBES	67,80755	0,00000
DLBPI	125,17990	0,00000
DLBRI	37,17930	0,00000
DLCPR	19469,87	0,00000
DLEDP	21,63122	0,00002
DLEDPR	3,18503	0,20341
DLEGL	10,42545	0,00545
DLESF	4464,017	0,00000
DLGALP	42,20226	0,00000
DLJMT	19706,21	0,00000
DLPSI20	37,22641	0,00000
DLPT	90,88723	0,00000
DLPTI	0,80407	0,66896
DLRENE	0,40816	0,81540
DLSEM	0,36412	0,83355
DLSNC	14,19438	0,00083
DLSON	58882,33	0,00000
DLSONI	15,98277	0,00034
DLZON	18,35382	0,00010

Table 9: Normality tests for independent variables

This table presents the statistics and p-values of the Jarque-Bera test. The J-B normality hypothesis is rejected in almost all series and pointed with **red** colour.

Returns:	Jarque-Bera	Probability
DLCPI	10,75330	0,004623
DLFER	0,006347	0,996831
DLIPI	10,00706	0,006714
DLLTR	8,06049	0,017770
DLM2	0,11157	0,945745
DLSTR	195,87040	0,000000

4.2.2. Stationarity Test

In order to test for variables stationarity the ADF and KPSS tests were computed for the dependent (i.e., LALTR, LBCP, LBES, LBPI, LBRI, LCPR, LEDP, LEDPR, LEGL, LESF, LGALP, LJMT, LPSI20, LPT, LPTI, LRENE, LSEM, LSNC, LSON, LSONI and LZON) and independent (i.e., LCPI, LIPI, LLTR, LSTR, LFER and LM2) variables. For ADF test, the null hypothesis is that the series is non-stationary (i.e., presence of a unit root), and the alternative hypothesis is that the series is stationary (i.e., absence of a unit root) while the KPSS test admits the stationarity in the null. The optimal lag number of each series was selected automatically by *EViews* package based in the Schwarz Info Criterion value for a maximum of 12 lags.

Table 10 ADF and KPSS Results for the Dependent Variables

This table shows the results for the ADF and KPSS tests applied to the logarithm of prices as the levels and to the first differences of the logarithmic series. The values pointed in **red** indicate the existence of unit root problems.

	ADF		KPSS		ADF		KPSS
Log of Prices:	Statistic	Lag	Statistic	Returns:	Statistic	Lag	Statistic
LALTR	-3,066277 **b	0	0,208763 **a	DLALTR	-7,673674 *a	0	0,127050 ***a
LBCP	-0,086976 a	1	0,284618 *a	DLBCP	-7,687950 *a	0	0,077007 a
LBES	1,429657 b	0	0,291620 *a	DLBES	-11,391450 *a	0	0,389787 ***b
LBPI	-0,450181 a	0	0,273447 *a	DLBPI	-8,417251 *a	0	0,060687 a
LBRI	-0,211368 a	0	0,292283 b	DLBRI	-9,602633 *a	0	0,053992 a
LCPR	-5,327320 a	0	0,207379 a	DLCPR	-10,538910 *c	0	0,178599 b
LEDP	-2,676666 ***b	0	0,275691 *a	DLEDP	-10,478870 *a	0	0,062914 a
LEDPR	-1,038082 c	0	0,091035 a	DLEDPR	-6,691550 *c	0	0,073730 b
LEGL	-0,192023 a	0	0,306212 *a	DLEGL	-8,853361 ***a	0	0,066126 a
LESF	-1,017153 c	1	0,174111 **a	DLESF	-3,541573 *c	0	0,086505 a
LGALP	-2,617135 ***b	0	0,079769 a	DLGALP	-8,332210 *c	0	0,177285 b
LJMT	-2,194170 a	0	0,108533 a	DLJMT	-10,092680 *b	0	0,067902 b
LPSI20	-1,095253 c	0	0,146246 **a	DLPSI20	-9,988304 *c	0	0,099656 b
LPT	0,008859 c	0	0,138839 ***a	DLPT	-12,064100 *c	0	0,074404 b
LPTI	-1,982820 b	0	0,149035 **a	DLPTI	-9,663036 *c	0	0,141933 b
LRENE	-1,311079 c	0	0,104165 a	DLRENE	-7,433504 *c	0	0,145834 b
LSEM	-1,979407 b	1	0,265457 *a	DLSEM	-8,208269 *c	0	0,061559 a
LSNC	-2,315458 **c	0	0,150270 **a	DLSNC	-9,788117 *c	0	0,135942 b
LSON	-5,673939 *b	1	0,133613 ***a	DLSON	-11,662910 *c	0	0,326638 b
LSONI	-1,411452 a	0	0,081236 a	DLSONI	-6,983789 *c	0	0,257856 c
LZON	-2,105781 a	0	0,263029 *a	DLZON	-12,057980 *a	0	0,067546 a

ADF and KPSS statistic critical values at: 1% level (*), 5% level (**) and 10% level (***); Trend and Intercept (a), Intercept (b) and None (c)

The results of the unit root tests for the independent variables are presented in table 10. In an overall, the ADF unit root hypothesis is not rejected for the logarithm of prices (except for LALTR, LEDP, LGALP, LSNC and LSON) and the KPSS stationarity hypothesis is rejected in the majority of the series of logarithm of prices (except for LBRI, LCPR, LEDPR, LGALP, LJMT, LRENE and LSONI). On the other hand, for the first differences of the logs the ADF null hypothesis of a unit root is strongly reject and the KPSS null of stationarity in not reject for almost every series. Thus, we conclude that our dependent variables are stationary in first differences.

Table 11: ADF and KPSS Results for the Independent Variables

This table shows the results for the ADF and KPSS tests applied to the logarithm of the independent variables as the level and to the first differences of the logarithmic. The values pointed in **red** indicate the existence of unit root problems.

Log of Prices:	ADF Statistic		Lag	KPSS Statistic		Returns:	ADF Statistic		Lag	KPSS Statistic	
LCPI	-3,244657	***a	12	0,321517	*a	DLCPI	-0,544204	c	11	0,243856	b
LFER	-2,644824	a	1	0,144168	***a	DLFER	-9,074023	*c	0	0,149232	b
LIPI	-1,003294	c	13	0,258067	*a	DLIPI	-3,299799	*c	12	0,047912	b
LLTR	-1,772345	***	0	0,267530	*a	DLLTR	-10,275690	*c	0	0,190096	**a
LM2	-1,970160	b	0	0,104326	a	DLM2	-13,363330	*b	0	0,264741	b
LSTR	0,185822	c	1	0,115864	a	DLSTR	-5,130903	*c	0	0,072278	b

ADF and KPSS statistic critical values at: 1% level (*), 5% level (**) and 10% level (***); Trend and Intercept (a), Intercept (b) and None (c)

The results of the unit root tests for the independent variables are presented in table 11. In an overall, the ADF unit root hypothesis is not rejected for the logarithm of prices (except for LCPI and LLTR) and the KPSS stationarity hypothesis is rejected for the series of logarithm of prices (except for LM2 and LSTR). On the other hand, for the compounding rates of change (i.e., first Differences) the ADF null hypothesis of a unit root is rejected (except for DLCPI) and the KPSS null of stationarity in not reject for almost every series (except for DLLTR). Thus, we conclude that ours independent variables are stationary in first differences in exception for the CPI compounding rates of change which were considered as non-stationary by the ADF test and for the LTR compounding rates of change by the KPSS test. In order to have comparable series in each multiple linear regression model, we decided to work with the first differences of the logarithmic series which constitute the compounding rates of change of the original variables which have financial/economic interpretation.

In conclusion, the multiple linear regression models used in our study and based in the previous results will follows the structure of equation (1) but composed by first differences of the logarithmic series. A change in the models may occur depending in which or all OLS model assumptions aren't met.

4.2.3. Multicollinearity

When the independent variables are strongly correlated among themselves – condition known as multicollinearity – the analysis of the adjusted regression model can lead to some confusion and non-sense. Thus, this condition is one of the first assumptions to validate during the linear regression.

"In practical context, the correlation between explanatory variables will be non-zero, although this will generally be relatively benign in the sense that a small degree of association between explanatory variables will almost always occur but will not cause too much loss of precision" (Chris Brooks 2008: 170).

There are several signs that suggest the existence of multicollinearity among the variables. For instance, the R-square being too big or the partial coefficients being too low is a sign of a possible existence of strong correlation between independent variables; the t-tests for each of the individual slopes are non-significant (sig > 0.05), but the overall F-test for testing all of the slopes are simultaneously 0 which makes it significant (sig < 0.05); and the correlations among pairs of predictor variables are large.

To check if multicollinearity exists in each model we used the Variance Inflation Factor (VIF) to conclude whether multicollinearity between explanatory variables exists.

The VIF is a measure of how much the variance of the estimated regression coefficient βj is "inflated" by the existence of correlation among the explanatory variables in the model. For the purpose of testing the existence of Multicollinearity, VIF values were computed for each multiple linear regression model. Note that the values of Tolerance and VIF are related as shown in the equation (3) therefore we will only present the VIF values. If the values of VIF are bigger than 10 we are facing a problem of multicollinearity.

$$\text{VIF}_j = \frac{1}{\text{Tolerance}} = \frac{1}{1-R_j^2} \quad (3)$$

Where R_j^2 is the R^2-value obtained by regressing the j^{th} variable on the remaining explanatory variables.

Table 12 Collinearity Statistic – VIF

In this table is presented the VIF values. VIF values will change between regressions because of the difference in the number of observations used in each one. Therefore, in order to condense the data the VIF values for each independent variable was grouped by number of observations used in each regression. Thus, group 1 (i.e., DLBCP, DLBPI, DLBRI, DLCPR, DLEDP, DLEGL, DLJMT, DLPTI, DLSEM and DLZON), group 2 (i.e., DLBES and DLSON) and group 3 (i.e., DLPSI20 and DLPT) were created.

Returns:	DLCPI	DLFER	DLIPI	DLLTR	DLM2	DLSTR
DLALTR	1,34681	1,05692	1,16299	1,12624	1,02527	1,22333
DLEDPR	1,46391	1,02897	1,30960	1,28630	1,07191	1,33179
DLESF	1,30935	1,06867	1,12871	1,13735	1,03825	1,19895
DLGALP	1,41790	1,09440	1,23197	1,21592	1,04065	1,28185
DLRENE	1,50049	1,07317	1,29368	1,25132	1,04460	1,32110
DLSNC	1,18136	1,03905	1,07644	1,12304	1,03507	1,19652
DLSONI	1,40153	1,08961	1,20258	1,18113	1,03035	1,23292
GROUP 1	1,28955	1,09690	1,10561	1,15735	1,02872	1,20222
GROUP 2	1,19269	1,06001	1,06878	1,10894	1,04064	1,20860
GROUP 3	1,16318	1,05542	1,06798	1,10328	1,04738	1,18742

GROUP 1 = [DLBCP, DLBPI, DLBRI, DLCPR, DLEDP, DLEGL, DLJMT, DLPTI, DLSEM, DLZON]; GROUP 2 = [BES, SON]; GROUP 3 = [DLPSI20, DLPT]

Due the fact that all the regressions incorporate the same independent variables, VIF values will change between regressions with different number of observations. Therefore, in order to reduce the number of outputs of the VIF values for each independent variable was grouped by number of observations used in each regression. Thus, group 1 (i.e., DLBCP, DLBPI, DLBRI, DLCPR, DLEDP, DLEGL, DLJMT, DLPTI, DLSEM and DLZON), group 2 (i.e., DLBES and DLSON) and group 3 (i.e., DLPSI20 and DLPT) were created as you can see in the table above. The results for the VIF statistic show that the values were never bigger than 10, therefore the multicollinearity problem doesn't exist between independent variables.

4.2.4. Normality of the error term

Recall that the normality assumption [$u_t \sim N(0, \sigma 2)$] is required in order to conduct single or joint hypothesis tests about the model parameters. One of the most commonly applied tests for normality is the Jarque-Bera test. A normal distribution is not skewed and is defined to have a coefficient of kurtosis of 3, in other words, symmetric and said to be mesokurtic. The J-B null hypothesis of normally distributed errors is rejected when p-value is < 0, 05.

Table 13: Normality of the error term (Jarque-Bera test)

This table presents the results for the Jarque-Bera test on the residuals which were estimated by regressing the compounding rates of change of the PSI 20 index and its companies on macroeconomic variables. We also add the skewness and kurtosis to compare with the J-B results. The p-values pointed in **red** show when the J-B normality of the error terms hypothesis is rejected.

Residual:	Skewness	Kurtosis	Jarque-Bera	Probability
DLALTR	0,064286	7,180106	58,29938	0,000000
DLBCP	-0,357874	3,055563	2,276274	0,320415
DLBES	-0,932702	5,317088	52,35440	0,000000
DLBPI	-1,358123	10,41132	275,1832	0,000000
DLBRI	-1,009708	4,577480	29,00199	0,000001
DLCPR	-6,883698	62,78780	16.624,87	0,000000
DLEDP	-0,746162	4,150207	15,67919	0,000394
DLEDPR	0,461382	3,221172	1,538204	0,463429
DLEGL	-0,132857	3,623175	2,027031	0,362941
DLESF	-4,765403	3,597170	4.760,959	0,000000
DLGALP	-0,915468	4,945602	18,14164	0,000115
DLJMT	7,294615	68,61072	19.952,79	0,000000
DLPSI20	-0,504530	4,809951	27,55398	0,000001
DLPT	-0,684485	5,300928	45,99693	0,000000
DLPTI	0,329778	3,393802	2,606246	0,271682
DLRENE	-0,478668	2,557089	2,410772	0,299576
DLSEM	0,100263	2,877955	0,243385	0,885421
DLSNC	-0,200140	4,617682	15,85273	0,000361
DLSON	-8,942568	97,037820	54.214,36	0,000000
DLSONI	-0,028299	5,275565	15,32831	0,000469
DLZON	0,044765	4,116213	5,538263	0,062716

In this case, the residuals are mainly negatively skewed and are leptokurtic. Hence the null hypothesis for residuals normality is rejected very strongly (the p-value for the J-B test is zero to six decimal places), implying that the inferences we make about the coefficient estimates could be wrong, although the sample is probably just about large enough that we don't need to be concerned as we would if we were working with a small sample. The non-normality in this case appears to have been caused by a small number of very large negative and positive residuals representing high monthly shocks.

4.2.5. Autocorrelation of the error term

No autocorrelation is also one of the assumptions under the Gauss-Markov theorem and relates to the error terms. In more detail, no autocorrelation assumes that the error terms of each independent variable are uncorrelated. Therefore, if the errors are not uncorrelated with one another, it would be stated that they are 'autocorrelated' or that they are 'serially correlated'. A test of this assumption is therefore required. Therefore, we will compute two tests, the Durbin-Watson and the Breusch-Godfrey.

Durbin-Watson (DW) is a test for first order autocorrelation (i.e., it tests only for a relation between an error and its immediately previous value):

$$u_t = \rho u_{t-1} + v_t \qquad (4)$$

Where $v_t \sim N(0, \sigma_v^2)$. Thus, under the null hypothesis, the errors at time t and t − 1 are independent of one another (H0: ρ = 0) and if this null were rejected (H1: ρ ≠ 0), it would be concluded that there was evidence of a relation between consecutive errors.

In order to see the levels of significance of the D-W stat we should take into account the following logic: If the value of the statistic is around 2, we conclude that there isn't autocorrelation. If it is between dl and du or 4-dl and 4-du, we cannot conclude anything about the nature of the errors' autocorrelation and finally if they are over the previous limits we are assuming that there is autocorrelation (if near 4 – negatively autocorrelated, if near 1 – positively autocorrelated). In our case and taking into account a dL and dU critical values, the Durbin-Watson statistic for our models falls mainly on region III were the null hypothesis isn't rejected. The fact that some error terms autocorrelation were given as inconclusive (i.e., DLALTR, DLBPI, DLEDPR, DLGALP, DLRENE and DLZON multiple linear regression model error terms) show the limitations of this test and we cannot conclude anything about autocorrelation in these regressions. Autocorrelation of the error terms were found for DLBCP, DLESF, DLPSI20 and DLSEM regressions' error term, as shown in the table 14.

We are now going for another autocorrelation test, namely, Breush-Godfrey (BG) which is a more general test for autocorrelation up to the rth order. In its null is assumed no autocorrelation of r order (i.e., H0: $\rho_1 = \rho_2 = \ldots = \rho_r = 0$). Three error terms were considered autocorrelated by the BG test, namely, DLBCP, DLBPI and DLGALP while DLESF, DLPSI20 and DLSEM error terms which were considered autocorrelated by DW statistic is now no autocorrelated with a p-value close to 0,05 of significance (i.e., 0,0649 and 0,1052 respectively).

Table 14: Autocorrelation of the error terms

This table presents the Durbin-Watson (DW) test and Breusch-Godfrey (BG) test results for the error term of each multiple linear regression model. For the DW test we consider k = 6 and n = # of Observations, at 5 % of significance points of dL and dU. For the BG test we considered 12 as the number of lags due the fact that we are using monthly data. The values pointed in **red** indicate the existence autocorrelation in the error terms.

Residuals:	# of Observations	dL	dU	Durbin-Watson statistics	Prob. Chi-Square(12)
DLALTR	80	1,4800	1,8008	1,59661371 [b]	0,12219839
DLBCP	106	1,5660	1,8044	1,32235313 a	0,03081476
DLBES	142	1,6388	1,8146	1,99412002 [c]	0,66466723
DLBPI	106	1,5660	1,8044	1,61247547 [b]	0,01533321
DLBRI	106	1,5660	1,8044	1,85279348 [c]	0,23135629
DLCPR	106	1,5660	1,8044	1,97669259 [c]	1,00000000
DLEDP	106	1,5660	1,8044	2,04810728 [c]	0,21968387
DLEDPR	41	1,1891	1,8493	2,73129253 [b]	0,14729238
DLEGL	106	1,5660	1,8044	1,86969944 [c]	0,43631562
DLESF	97	1,5407	1,8025	1,10743759 [a]	0,51394485
DLGALP	61	1,3787	1,8073	2,35099493 [b]	0,03440522
DLJMT	106	1,5660	1,8044	1,99083484 [c]	0,95447501
DLPSI20	154	1,6565	1,8181	1,57315356 [a]	0,42868496
DLPT	154	1,6565	1,8181	1,97029519 [c]	0,45058577
DLPTI	106	1,5660	1,8044	2,01247528 [c]	0,63460379
DLRENE	52	1,3090	1,8183	2,36980681 [b]	0,13439316
DLSEM	106	1,5660	1,8044	1,55817660 [a]	0,12512190
DLSNC	137	1,6306	1,8131	1,79126458 [b]	0,54883329
DLSON	142	1,6388	1,8146	2,03048888 [c]	0,99217548
DLSONI	71	1,4379	1,8021	1,88001882 [c]	0,50449033
DLZON	106	1,5660	1,8044	2,33487385 [b]	0,44215844

Regions for DW test: Positive autocorrelation (a); Inconclusive (b), No autocorrelation (c)

In conclusion, based on the results the existence of autocorrelation in DLBCP, DLBPI and DLGALP error terms is confirmed. Later on we will deal with this problem accordingly by applying the Cochrane-Orcutt procedure.

4.2.6. Homoscedasticity of the error term

It has been assumed thus far that the variance of the errors is constant, σ^2 - this is known as the assumption of homoscedasticity. If the errors do not have a constant variance, they are said to be heteroscedastic. A further popular test is White's (1980) general test for heteroscedasticity. The test is particularly useful because it makes few assumptions about the likely form of the heteroscedasticity. The test results are presented in table 15.

Table 15: Homoscedasticity of error terms

This table presents the White test results for the error term of each multiple linear regression model. The letters in **red** indicate the existence of heteroscedasticity in the error terms.

Residuals:	Prob. Chi-Square(6)
DLALTR	0,992523
DLBCP	0,514552
DLBES	0,027525
DLBPI	0,783240
DLBRI	0,076081
DLCPR	0,919913
DLEDP	0,982401
DLEDPR	0,178229
DLEGL	0,887667
DLESF	0,927653
DLGALP	0,001993
DLJMT	0,968583
DLPSI20	0,311244
DLPT	0,035633
DLPTI	0,762296
DLRENE	0,385727
DLSEM	0,560584
DLSNC	0,954152
DLSON	0,767092
DLSONI	0,679235
DLZON	0,562996

Looking to the White Test results, we don't reject the null because the significance associated to this test is > 0, 05. This means that the residual are homoskedastic. The null was only rejected in three cases (i.e., DLBES, DLGALP and DLPT) which bring up the heteroscedasticity problem.

4.2.7. Dealing with OLS assumptions problems

As already stated, in order to make inferences based on the estimated coefficients generated by the OLS regression model, four assumptions must hold, no perfect collinearity among the explanatory variables, normality, no autocorrelation and homoscedasticity of the error terms. For some regressions these assumptions are not verified, namely:

1. **Autocorrelation of the error terms:** DLBCP and DLBPI;
2. **Heteroscedasticity of the error terms:** DLBES and DLPT;
3. **Autocorrelation and Heteroscedasticity of the error terms:** DLGALP.

Therefore, we now present the methods used to deal with these problems.

1. Dealing with autocorrelation of the error terms:

In order to solve this problem, we used the Cochrane-Orcutt procedure in *Gretl* package and we were able to remove the existence of autocorrelation in the multiple linear regression models which DLBCP and DLBPI are dependent variables. As we can see in table below, DW statistic is now in region III. Therefore, and based on the residuals, there is no first order autocorrelation in the error terms of each regression model.

Table 16: Cochrane-Orcutt Procedure statistics

This table presents the outcome from using the Cochrane-Orcutt procedure to eliminate the autocorrelation of the error term in the regressions where DLBCP and DLBPI are the dependent variables. To analyze the Durbin-Watson statistics we considered k = 6 and n = # of observations.

	Iterations	ρ	# of Observations	dL	dU	DW
DLBCP	4	0,34051	105	1,56340	1,8042	2,049463 [c]
DLBPI	4	0,23136	105	1,56340	1,8042	1,981755 [c]

Regions for DW test: Positive autocorrelation (a); Inconclusive (b), No autocorrelation (c)

2. Dealing with heteroscedasticity of the error terms:

"Using heteroscedasticity-consistent standard error estimates. Most standard econometrics software packages have an option (usually called something like 'robust') that allows the user to employ standard error estimates that have been modified to account for the heteroscedasticity following White (1980). The effect of using the correction is that, if the variance of the errors is positively related to the square of an explanatory variable, the standard errors for the slope coefficients are increased relative to the usual OLS standard errors, which would make hypothesis testing more 'conservative', so that more evidence would be required against the null hypothesis before it would be rejected." (Chris Brooks, 2008:138). After estimating the regression with heteroscedasticity-robust standard errors the probabilities of the t-statistics were lower as expected by dealing with the heteroscedasticity of the error terms in the multiple linear regression models with DLPT and DLBES as dependent variables. Moreover, we show the change in the standard error estimates by considering the heteroscedasticity-robustness in our models as presented in table 17.

Table 17: Solving Heteroscedasticity Problem (White)

This table shows the standard error estimates that have been modified to account for the heteroscedasticity following White (1980), comparing them to its previous estimation. These estimations relate to the multiple linear regression models which dependent variables are DLBES and DLPT.

	DLBES		DLPT	
	Before	After	Before	After
Independent variables:				
DLCPI	1,9669	2,1826	0,8006	1,8508
DLFER	0,3050	0,2461	0,0000	0,3781
DLIPI	0,0612	0,0436	0,5938	0,0651
DLLTR	0,1736	0,1741	0,6674	0,1679
DLM2	0,6421	0,6660	0,3286	0,5312
DLSTR	0,1266	0,1902	0,4472	0,1058
C	0,0090	0,0082	0,8746	0,0095

3. Dealing with autocorrelation and heteroscedasticity of the error terms

As observed above, we are facing heteroscedasticity and autocorrelation problems in the model where DLGALP is the dependent variable. To try to solve this, we will use the Newey-West procedure which will work on the standard errors solving the problems in hand for this model. The change in the coefficients standard errors is as follows:

Table 18: Solving Autocorrelation and Heteroscedasticity Problem (HAC)

This table shows the standard error estimates that have been modified to account for the autocorrelation and heteroscedasticity problem based on the HAC (Newey-West) and compare them to its previous estimation.

	DLCPI	DLFER	DLIPI	DLLTR	DLM2	DLSTR	C
BEFORE	3,784960	0,588879	0,153387	0,300364	1,207953	0,196693	0,018509
AFTER	2,833774	0,689280	0,166339	0,318915	0,940921	0,155039	0,020259

4.2.8. Multiple linear regression model results

In order to establish the statistical relationship between stock returns and macroeconomic variables have been defined, tested and estimated, twenty one multiple linear regression models whose main estimation results are presented next:

Table 19: Estimated Coefficients

This table shows the estimated values for the coefficients and their significance (sig) for each independent variable in each multiple linear regression model. The values were organized by dependent variables and the coefficients which are not significant are pointed in **red**.

	DLCPI		DLFER		DLIPI		DLLTR		DLM2		DLSTR	
Returns:	Coef.	Sig	Coef.	Sig	Coef.	Sig	Coef.	Sig	Coef.	Sig	Coef.	Sig
DLALTR	1,417	0,754	1,018	0,160	-0,024	0,882	-0,336	0,350	-1,666	0,250	0,109	0,661
DLBCP	0,775	0,761	0,643	0,124	-0,036	0,587	-0,403	0,045	0,884	0,227	0,010	0,958
DLBES	0,042	0,985	0,849	0,001	0,006	0,889	-0,376	0,033	-0,558	0,404	0,254	0,184
DLBPI	-0,537	0,826	1,058	0,009	0,018	0,788	-0,172	0,374	-0,055	0,939	-0,019	0,908
DLBRI	1,576	0,331	0,403	0,119	0,083	0,126	-0,384	0,004	-0,455	0,375	-0,012	0,901
DLCPR	-4,535	0,302	0,590	0,398	0,094	0,517	-0,199	0,578	1,799	0,197	0,013	0,961
DLEDP	0,612	0,654	0,512	0,020	0,024	0,591	-0,145	0,193	-0,209	0,628	-0,007	0,932
DLEDPR	6,356	0,087	0,834	0,093	-0,206	0,155	0,133	0,601	0,135	0,916	-0,464	0,007
DLEGL	1,591	0,489	0,998	0,007	-0,065	0,392	-0,338	0,074	-0,452	0,535	-0,101	0,460
DLESF	-0,977	0,714	0,636	0,137	-0,005	0,961	0,003	0,991	-0,188	0,822	0,011	0,943
DLGALP	3,313	0,248	0,591	0,395	-0,179	0,286	0,038	0,905	0,688	0,468	-0,154	0,326
DLJMT	-0,907	0,840	1,076	0,134	0,130	0,382	0,199	0,587	-1,253	0,379	0,128	0,631
DLPSI20	0,206	0,861	0,467	0,011	-0,018	0,610	-0,029	0,781	-0,196	0,608	-0,005	0,945
DLPT	0,459	0,804	1,262	0,001	-0,030	0,648	0,068	0,684	-0,580	0,276	-0,087	0,414
DLPTI	1,976	0,234	0,430	0,105	-0,061	0,264	-0,112	0,406	-0,267	0,610	0,000	0,999
DLRENE	1,799	0,293	0,375	0,126	-0,178	0,009	0,077	0,540	0,130	0,826	-0,191	0,023
DLSEM	0,951	0,580	0,091	0,738	-0,044	0,442	-0,192	0,173	-0,308	0,571	0,042	0,677
DLSNC	1,144	0,680	0,992	0,023	0,038	0,650	0,324	0,180	-1,869	0,036	-0,216	0,224
DLSON	-1,519	0,815	-0,62	0,540	0,028	0,888	0,361	0,528	-2,002	0,344	-0,411	0,324
DLSONI	2,268	0,532	0,697	0,237	-0,148	0,296	-0,226	0,449	-1,546	0,193	-0,061	0,752
DLZON	-0,359	0,867	0,922	0,008	0,003	0,967	-0,256	0,144	-0,498	0,463	0,018	0,887

We can conclude, after analyzing table 19, that most of the estimated coefficients don't have a statistically significant impact in the variation of stock returns. Even thus, we can still conclude about the impact that these macroeconomic variables (i.e., CPI, FER, IPI, LTR, M2 and STR) have in the variation of stock returns.

Table 20: Regression Model's F test and Adjusted R^2

This table shows the values of the F-statistic, its probability and adjusted R-squared for each regression model. The values were organized by dependent variables and the regressions which don't have significant explanatory properties are pointed in **red**.

Returns:	F-statistic	Prob(F-statistic)	Adjusted R^2
DLPSI20	1,37328	0,22908	0,01443
DLALTR	0,80986	0,56563	-0,01465
DLBCP	1,76835	0,11348	0,16196
DLBES	3,00316	0,00871	0,07855
DLBPI	1,63654	0,14512	0,11102
DLBRI	2,99320	0,00993	0,10225
DLCPR	0,71080	0,64167	-0,01680
DLEDP	1,67485	0,13505	0,03713
DLEDPR	2,09720	0,07933	0,14132
DLEGL	2,75908	0,01600	0,09134
DLESF	0,39862	0,87813	-0,03905
DLGALP	0,60426	0,72570	-0,04121
DLJMT	0,66162	0,68073	-0,01972
DLPT	3,84307	0,00137	0,10031
DLPTI	1,22334	0,30081	0,01260
DLRENE	2,24003	0,05633	0,12731
DLSEM	0,59679	0,73224	-0,02358
DLSNC	1,91012	0,08384	0,03860
DLSON	0,52664	0,78731	-0,02056
DLSONI	0,96102	0,45873	-0,00335
DLZON	2,02695	0,06904	0,05543

F test is an overall significance test of the regression model and as presented in the table above only four models which have as dependent variables DLBES, DLBRI, DLEGL and DLPT, were able to capture some of the variations in the stock returns, in other words, the models demonstrate to have some significance. Also, the adjusted R^2 appear to be predominantly low, even taking negative values which shows lack of power from our regressors (jointly) to explain the variations in stock returns.

Table 21: Analysis of the coefficients

This table indicates how many times a specific macroeconomic variable (i.e. Inflation, Foreign Exchange rate, Industrial Production, Interest rates and Money Supply) had a positive or negative effect in the PSI 20 index and its companies. In a total of twenty one analyzed regressions we pointed out the signs with biggest absolute frequency, in other words, the expected sign for our macroeconomic variables. The highlighted numbers (i.e. the ones in **bold**) represent the expected signal for the relation between the macroeconomic variable and the stock returns estimated by our regression models. The numbers followed by "*" indicate the sign obtained for the PSI20 relationship with macroeconomic variables. Therefore, if the number in **bold** is followed by an "*" it means that the majority of the companies and the PSI20 have the same relation with the macroeconomic variables. If "*" appears close to a number which isn't in **bold**, means that the nature of the relation that macroeconomic variable has with the PSI20 is not equal to the most observed signal between its companies.

Number of:	DLCPI	DLFER	DLIPI	DLLTR	DLM2	DLSTR
Positive signs	**15** *	**20** *	9	8	5	8
Negative signs	6	1	**12** *	**13** *	**16** *	**13** *
Significant coeficientes	0	7	1	3	1	2
Including PSI20 (*)						

As an overall, the expected signals for our explanatory variables are as presented above in table 21 which is so interesting due the fact that it shows, by the numbers in **bold**, which is the most common outcome for the relation between the macroeconomic variables that we have chosen with the variation of stock returns.

Therefore, the compounded rate of change of the inflation and foreign exchange rate are expected to have a positive impact in the variation of sock returns while the remaining dependent variables are expected to have a negative relation with them. Also, it's possible to denote that the most frequent signal for each independent variable match the signals obtained for the relation with the returns of the PSI 20 index (see the "*" and the numbers pointed in **bold** which are an exact match, see table 21). If there is a match between them, it means that macroeconomic variables affect the PSI20 and the majority of its companies in the same way.

Also, by comparing our results with the ones obtained by the analysed papers we found some discrepancies in the impact of DLCPI, DLIPI and DLM2 on the stock returns. The relation between consumer price index and stock returns variations seems to be positive which weren't expected (we were expecting a negative relationship between them). Industrial production index and money supply, which were expected to have a positive relation with stock returns, appear to have a negative one. This is unexpected, principally for the M2 which were never found to have a negative relation with stock returns in the analysed researches. Fabio Panetta (2001: 27) explains this fact by saying that "…during a recession, an unexpected rise in economic activity would likely cause an increase of stock prices, while during an expansion it could be interpreted negatively, generating inflationary fears and a fall in share prices." On the other hand, both interest rates and foreign exchange rate match our expectations. Interest rates (LTR and STR) appear to have a negative correlation while foreign exchange rate denote a positive relation with the variation of stock returns.

In conclusion, significant relation between the variation of stock returns and the compound rate of change of macroeconomic variables were hardly found. Even so, DLFER seems to be the most significant macroeconomic variable (i.e., comparing to the other variables, it was the one that was more times statistically significant), followed by DLLTR, DLSTR, DLIPI and DLM2 (i.e., DLCPI was never significant). Also, only three of the selected macroeconomic variables were consistent to our initial expectations, namely; DLFER, DLLTR and DLSTR.

Also, the instability of the relation between stock returns and macroeconomic factors can lead to severe bias to the regression model results (spurious relations) even if it's apparent that all economic variables are endogenous in some ultimate sense.

5. Conclusion

Many studies have been conducted to explore the variation of financial markets to macroeconomic variables theoretically and empirically. Some of these studies have focused on the relation between stock market prices and fundamental economic indicators. The outcome of these studies varies greatly regarding the effect of changes of macroeconomic variables in stock prices. The conclusions raised by the analysed papers were that changes in macroeconomic variables lead the changes in stock markets and that stock prices can be predicted by means of publicly available information such as time series data on financial and macroeconomic variables. With this paper we tried to extend the empirical results by exploring a set of economic state variables as systematic influences on stock market returns. As a drawback, we rarely found any significant empirical proof of the endogenous relation between stock returns and macroeconomic variables. Nevertheless, elations about the nature of their relation could be done and it points to a positive correlation of the compounded rate of change of consumer price index (DLCPI) and foreign exchange rate (DLFER) while industrial production (DLIPI), interest rates (DLLTR and DLSTR) and money supply (DLM2) appear to have a negative impact on the variations of stock returns. Also, it’s possible to conclude that the state variables affect the market stock exchange index and its companies the same way for the great majority of them.

This difference in results between studies only shows the difficulty in modelling stock returns using macroeconomic variables and the necessity to strengthen the efforts to shorten the length in the existing gap between the theoretical and empirical significance of systematic state variables risk. It is apparent that all economic variables are endogenous in some ultimate sense. But still, there is much to be done in order to model equity variations as function of macro variables compounding rates of change. We encourage researchers to dig deeper in this matter and test multivariate approaches in order to extend the conclusions of this study to other sectors and to other markets which is a goal worth pursuing.

References

Owusu-Nantwi, Victor and John K. M. Kuwornu 19 September, 2011, "Analyzing the effect of macroeconomic variables on stock market returns: Evidence from Ghana". *Journal of Economics and International Finance* Vol. 3(11), pp. 605-615, 7 October, 2011.

Andrés Solimano, June 2010. "IMF Research on Macro-Financial Linkages: Context, Relevance, and Diversity of Approaches".

Ahmet Büyükşalvarcı, "The Effects of Macroeconomics Variables on Stock Returns: Evidence from Turkey". *European Journal of Social Sciences* - Volume 14, Number 3 (2010).

Antonello D'Agostino, Luca Gambetti and Domenico Giannone, "Macroeconomic Forecasting And Structural Change". Working Paper Series Nº 1167 / April 2010.

Bilal Savasa, Famil Samiloglub, "The Impact Of Macroeconomic Variables On Stock Returns In Turkey: An ARDL Bounds Testing Approach". *University of Aksaray* (Afyon Kocatepe Üniversitesi, İ.İ.B.F. Dergisi (C.X II,S I, 2010).

Tarika Singh, Seema Mehta and M. S. Varsha 12 November, 2010. "Macroeconomic factors and stock returns: Evidence from Taiwan". *Journal of Economics and International Finance* Vol. 2(4), pp.217-227, April 2011.

Donatas Pilinkus, "Stock Market and Macroeconomic Variables: Evidences from Lithuania". *Economics & Management*: 2009. 14. ISSN 1822-6515.

Deepinder Kaur, May, 2009. "Correlation and Causality between Stock Market and Macro Economic Variables in India: An Empirical Study". *School Of Management And Social Sciences*, Thapar University.

Wan Mansor Wan Mahmood, Nazihah Mohd Dinniah, "Stock Returns and Macroeconomics Variables: Evidence from the Six Asian-Pacific Countries". *International Research Journal of Finance and Economics*. ISSN 1450-2887 Issue 30 (2009).

"Introductory Econometrics for Finance, SECOND EDITION" by Chris Brooks. *The ICMA Centre, University of Reading*.

"Practical Applications of Post-Modern Portfolio Theory", Vern Sumnicht, MBA, CFP 2008.

Ahmed Hachicha and Abdelkader Chaabane (2007). "Macroeconomic volatility and stock returns: Evidence from Mediterranean markets". *International Review of Business Research Papers* Vol. 3 No. 3 August 2007 Pp. 125-143.

Aristeidis G. Samitas and Dimitris F. Kenourgios (2007) "Macroeconomic factors' influence on 'New' European countries' stock returns: the case of four transition economies". *Int. J. Financial Services Management*, Vol. 2, Nos. 1/2, pp. 34-49.

Jorge Carrera and Luis N. Lanteri (2007). Banco Central de la República Argentina, working paper 2007/17: "Macroeconomic Shocks and Financial Vulnerability".

Nil Günsel, Sadõk Çukur, "The Effects of Macroeconomic Factors on the London Stock Returns: A Sectoral Approach". *International Research Journal of Finance and Economics*. ISSN 1450-2887, Issue 10 (2007).

William J. Coaker II (2006), "The Volatility of Correlation: Important Implications for the Asset Allocation Decision", *Journal of Financial Planning*.

Jay Shanken and Mark I. Weinstein, "Economic forces and the stock market revisited". *Journal of Empirical Finance* 13 (2006) 129–144.

L.M.C.S. Menike, 2006. "The Effect of Macroeconomic Variables on Stock Prices in Emerging Sri Lankan Stock Market". *Sabaragamuwa University Journal*, vol 6, no. 1, pp 50-67.

Menachem Brenner, Paolo Pasquariello, and Marti Subrahmanyam, December 12, 2006. "Financial Markets and the Macro Economy".

Post-Modern Portfolio Theory, by Pete Swisher, and Gregory W. Kasten, *FPA Journal*, September of 2005.

Floros, Christos. "Stock Returns and Inflation in Greece". *University of Portsmouth*, UK. *Applied Econometrics and International Development*. AEEADE. Vol. 4-2 (2004).

David E. Rapach, Mark E. Wohar, Jesper Rangvid May 7, 2004, "Macro Variables and International Stock Return Predictability". *International Journal of Forecasting*.

Ramin Cooper Maysami, and Lee , Chuin Howe and Mohamad Atkin Hamzah, (2004) "Relation between macroeconomic variables and stock market indices cointegration evidence from stock exchange of Singapore's all-S sector indices". *Jurnal Pengurusan*, 24. pp. 47-77. ISSN 0127-2713.

John Boyd, Jian Hu and Ravi Jagannathan (2002). "The Stock Market's Reaction to Unemployment News: "Why Bad News Is Usually Good For Stocks"".

Fabio Panetta February 2001. "The stability of the relation between the stock market and macroeconomic forces". *Banca d'Italia*, Research Department, number 393.

Mark J. Flannery, Aris A. Protopapadakis, January 22, 2001. "Macroeconomic Factors Do Influence Aggregate Stock Returns". *Review of Financial Studies*.

Chris Bilson, Tim Brailsford and Vince Hooper (2000). "Selecting Macroeconomic Variables as Explanatory Factors of Emerging Stock Market Returns" Department of Commerce, Australian National University Canberra 0200 AUSTRALIA.

John Y. Campbell and John H. Cochrane, "Explaining the Poor Performance of Consumption-based Asset Pricing Models". *The Journal of Finance*. Volume 55, Issue 6, pages 2863–2878, December 2000.

Demirguc-Kunt, Asli & Detragiache, Enrica, 1998. "Financial liberalization and financial fragility," Policy Research Working Paper Series 1917, The World Bank.

Frank A. Sortino and Robert van der Meer, "Downside risk". *The Journal of Portfolio Management*, summer 1991, Vol. 17, No. 4: pp. 27-31.

Graciela L. Kaminsky and Carmen M. Reinhart (1996). "The Twin Crises: The Causes of Banking and Balance-Of-Payments Problems". *The American Economic Review*, Vol. 89, No. 3 (Jun., 1999), 473-500.

Nozar, H. & Taylor, P. 1988. “Stock prices, money supply and interest rates: the question of causality”. *Applied Economics* 20(12): 1603-1611.

Chen, N., Roll, R., Ross, S., 1986. “Economic forces and the stock market”. *Journal of Business* 59:383-403.

Cox, John; Ingersoll, Jonathan; and Ross, Stephen A. 1985. “An intertemporal general equilibrium model of asset prices”. *Econometrica* 53:363-84.

Pearce, Douglas K. and V. Vance Roley. "Stock Prices and Economic News." *Journal of Business*, Vol. 58, No. 1, (January 1985), pp. 49-67.

Robert Geske, Richard Roll, Mar. 1983, “The Fiscal and Monetary linkage between Stock Returns and Inflation”. *The Journal of Finance,* Volume 38, Isuue 1, 1-33.

Fama, E. F. & Gibbons, M. R. 1982. “Inflation, real returns and capital investment”. *Journal of Monetary Economics* 9: 297-323.

Eugene F. Fama, "Stock Returns, Real Activity, Inflation, and Money". *American Economic Review*, Vol. 71, No. 4 (Sep., 1981), pp. 545-565.

Roll, R., and Ross, S. 1980. “An empirical investigation of the arbitrage pricing theory”. *Journal of Finance* 35:1073-1103.

Breeden, Douglas T. 1979. "An intertemporal asset pricing model with stochastic consumption and investment opportunities." *Journal of Financial Economics* 7(3):265-296.

Kraft, J. & Kraft, A. 1977. “Determinants of common stock prices: a time series analysis”. *Journal of Finance* 32(2): 417-425.

Ross, Stephen A. 1976. “The arbitrage theory of capital asset pricing”. *Journal of Economic Theory* 13:341-60.

Cooper, R. 1974. “Efficient capital markets and the quantity theory of money”. *Journal of Finance* 29(3): 887-908.

Merton, Robert C. 1973. “An intertemporal capital asset pricing model”. *Econometrica* 41:867-87.

Hamburger, M. J. & Kochin, L. A. 1972. “Money and stock prices: the channels of influence”. *Journal of Finance* 27(2): 231-249.

William F. Sharpe, “Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk”. *The Journal of Finance*, Vol. 19, No. 3. (Sep., 1964), pp. 425-442.

Harry M. Markowitz, “Portfolio Selection”. New Haven, CT: *Yale University Press*, 1959.