The Impact Of Macroeconomic Indicators On The Movement Of Crobex

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Abstract

Many research showed a high degree of correlation between the US and European capital markets, partly due to industrial-financial linkages of the United States and Europe, and partly due to the influence of psychological factors on the behavior of individuals, and the concept of behavioral finance. However, it can be assumed that the movement of the value of an observed index does not depend solely on the change of values of the S & P 500 index. Accordingly and in line with rational economic theory, this paper examines the link between changes in the value of selected macroeconomic indicators and the value of the main share Croatian capital market index CROBEX. The results indicate that of the nine initially observed variables, movement of CROBEX can be described and further explained by changes in the value of average wages, parity rate and dollar, the kuna and the euro and the kuna and the Swiss franc.

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1. Introduction

1.1 The issues discussed and the hypotheses

In several previous studies the impact of the US capital markets on global markets was investigated and proven. Change in the value of a particular US index, eg. S&P 500 index, can be treated as a kind of indicator of the direction of changes in the value of other equity indices secondary markets, and that on a global level. Thus, according to a recent survey (Tomic & et al., 2014), which analyzed the links between the European capital markets in relation to Dow JonesIndustrialAverage index - the DJIA, where was confirmed dependence found between the European capital markets in relation to leading the DJIA index. However, research has shown that the correlation between the CROBEX and the DJIA index is significantly lower compared to other observed indices. Given the high correlation with other global indices with DJIA index, it was concluded that CROBEX achieved a lower level of correlation with other EU countries indices. On the other hand, viewed as a potential investment, CROBEX achieved better returns on the investment period of the next two indices: the Italian FTSE MIB and the Spanish IBEX 35 index. According to the results, set the open questions were asked about the current state of the Croatian capital market factors affecting the change in value of CROBEX and questions about the level of treatment and the risk that investors take by investing their funds. As a continuation of the research mentioned in this paper we will seek to formally identify and quantify the factors that affect, or describe the change in the value of CROBEX, as leading indicator of the financial market in the Republic of Croatia.

In the first part of the paper were described the problems and are presented selected macroeconomic indicators. Also, it was presented a set of a different economic hypotheses with which to describe the reasons for selecting these indicators, ie. Their possible impact on the CROBEX. The hypotheses put forward in this paper are defined on a broader basis. This means that when creating that set of hypotheses the current state of the Croatian capital market, Croatian economy and some specifics related to same that affect or could affect the change in the value of the CROBEX was not taken in the account. In addition, there is consideration of previous similar studies and the results of these studies. After that, it will be briefly described the methodology by which to arrive at the results: multiple linear regression and multiple logistic regression model. The paper also presents the results of regression analysis model and the results of tests on multicollinearity, heteroskedasticity and autocorrelation. Based on the results of statisticaly significant indicators, a model was developed that describes how exactly is possible to estimate the change in CROBEX based on the movement of given macroeconomic indicators. For purposes of analysis, index CROBEX is assumed as a dependent binary variable which is defined to be the case of a positive monthly return express as 1, or in the case of negative monthly return express as 0, where in this way opens up the possibility of applying the model of binary logistic regression. In the context of the above, it will be examined the possibility of an accurate assessment of the probability that the CROBEX index takes the value of one or zero, ie. The possibility of an accurate assessment of the probability of growth or decline in value of the index on the basis of the given macroeconomic indicators. This will additionally determine the predictive power of selected macroeconomic indicators and their significance to try to answer the question of what factors affect the change in the CROBEX.

Nine of selected macroeconomic indicators and reasons for their selection, based on hypothesis interpretive below.

1. **Consumer Price Index (*cpi*)**– the most widely used measure of inflation. Given that CPI is the one of the major economic indicators, it can easily be linked to the financial market. His increasing is the percentage increase in total prices of goods and services, which means that the general purchasing power of citizens fall all other equal. Due to the falling purchasing power market reacts through reduced demand and consumption. The assumption is that if increased value of CPI negatively affect the CROBEX. The second reason is that higher inflation causes and the companies themselves to allocate more funds for the procurement of inputs required for the business. For this reason, companies are challanged to meet the targets, which indirectly affects the price of their shares on the secondary market.

2. **The weighted average interest rate on bank deposits (*depint*)** – in general, the interest rate on bank deposits are one of the most relevant indicators of conditions in financial markets. From the aspect of secondary capital market, it can be assumed that the increase in interest rates cause a drop in the value of CROBEX. The reason is that an increase in interest rates on deposits attract investors to save money in bank rather than invest it eslewhere. If the interest rate is increased sufficiently, it can be expected decline in CROBEX value because investors will sell shares and invest in deposits with an approximate yield assuming far less risk investments. On the other hand, the decline in interest rates on bank deposits has the opposite effect. Lower interest rates are not a sufficient attractive investment for investors. Investors will look for higher yields on their investments and allocate the funds to the capital market. The increased demand for shares will result in an increase in their value and will induce growth of CROBEX.

3. **Weighted average interest rate on long-term corporate loans (*ltint)*** – increase in lending rates on long-term corporate loans will cause a drop in the value of CROBEX. High interest rates on long-term loans, hinder business companies through several aspects. For example, if the company has adopted a development strategy which includes capital borrowing, borrowing at high interest rates leads to the harder realization of their project or even the cancelation. In other words, high interest rates lead to putting on hold the realization of capital investments which jeopardizes their future expansion. As expected, the decline in long-term interest rates on loans can be expected to increase the value of CROBEX. In this case, the expected increase in the borrowing of the company and their business expansion which indirectly affects positive change in CROBEX value.

4. **Weighted average interest rate on short-term corporate loans (*stint*)** – to the interest rate on short-term loans can be set the same assumption as to the interest rate on long-term loans.

5. **Average net wages (*wage*)** – is a important macroeconomic indicator that is easily associated with the general state of the economy of the country. Given that the economy is closely linked to financial markets, the following assumptions can be set. It is expected that by increasing the average monthly salary will positively affect to the value of CROBEX.

6. **Parity of euro and kuna (*eur*)** – in general, increase in value of one currency in terms of another opens more economic issues. Looking from the aspect of domestic enterprises, the depreciation of the domestic currency could cause problems in day to day operations for the reason that a lot of companies importing goods as initial inputs for their products, also depreciation could increase export sales. Also, if the company has debt in euro, and

has not the implemented strategies to protect against currency risk, the question of growth in borrowing costs is raised. Also, here you can set up a reverse hypothesis that due to the depreciation of the kuna assumed revenue growth of export-oriented enterprises, for joint stock companies means an increase in the value of their shares. However, given the current monetary strategy of the central bank[1], it is unlikely to see large fluctuations of the kuna against the euro. For this reason, the increase in value of the euro against the kuna, the Croatian capital market is becoming more attractive to foreign investors to allocate their capital. Finally, the assumption is that increased investment, ie. Increasing demand for shares, should result in growth of indices and that level of parity attracts foreign investors with greater purchasing power.

7. **Parity of the Swiss franc and the kuna (*chf*)** – the recent fall in the euro against the US dollar, caused by the economic crisis in the euro area, increased the demand of investors for the Swiss franc as a safe currency which caused his appreciation. It can be said that in this period was established a pattern of behavior of parity of the euro and the Swiss franc. The reason for this is the reverse process between the euro and the Swiss franc. Increase in value of one currency means the drop in value of other. Following the assumption 6., in case of increase in the value of the Swiss franc, it is assumed decline in CROBEX, and vice versa. Furthermore, companies whom borrow in the Swiss franc together with uncontrolled growth in interest rates can affect the profitability and competitiveness of the company, which indirectly affects the company's stock price.

8. **Parity of US dollar and kuna (*usd*)** – drop in the value of the dollar in relation to the kuna should cause an increase in the value of CROBEX, and vice versa. The assumption is that the US capital market reacted positively to the fall of the dollar on world level. The reasons for this is that the weaker dollar makes the US capital market more attractive for foreign investors. In addition, a lot of US companies operating outside the borders of the United States and thus generate revenue in foreign currencies. The increase in the value of foreign currencies against the dollar means higher revenues generated in US dollars. Given the existing correlation between the American and the Croatian capital market, and the impact of the US capital markets in the world, it is assumed that the Croatian CROBEX follow the above change of the value of US indices.

9. **Occupancy rate of beds in the hotel or similar accommodation (zimmer)** – In general, capital markets respond positively to good economic news. For this reason, it is assumed that the growth in the occupancy of beds positive effect on the value of the index for the reason that investors are optimistic on the positive results of the tourist season. By contrast, the decline in occupancy rates beds causes a drop in the value of CROBEX.

Given the fact that certain data or indicators can impact movement of CROBEX in the future period, LAGs have been created to better describe this phenomenon. So, for example, variable weighted average interest rate on long-term corporate loans (ltint) in the context of the LAG is shown as "ltintlag1" where, as such, represents a shift data for one time period before the CROBEX. The current situation in the secondary market in Croatia points to certain problems. It can be said that the domestic capital market is narrow and imperfect, and even with questionable information efficiency. Accordingly, the observed data can be taken as an indicator of a business activity of companies in the coming period. The reason for this is because it is assumed that the level of interest rates on long-term loans - in accordance with the assumption, may affect the

[1] Price stability and stability of the banking system, which indirectly affects the relatively stable exchange rate.

company's activities in the coming time. Low interest rates on long-term loans will encourage new capital projects or business expansion. On the other hand, the time required for the realization of a new project company from the time of changes in interest rates, can be significant. Moving independent variables one period before is eliminating the time gap and the calculation determines the actual effect on the progress of the index - if it exists at all. For the same reason "ltintlag2" was created, which represents a shift for two periods compared to CROBEX. For independent variables two LAGs were created so number of initially observed variables was 27.

1.2 Previous researches

In the broader economic literature there is no common view on the direction and intensity of the relationship between macroeconomic variables and variables that represent the financial market. Various studies gave conflicting results because of the specifics of a particular market, because of the different specifications of the model and the selection of variables in the model. Cheung and Ng (1998) considered that the conflicting results of similar studies in different countries are due to differences in the perceptions of investors on the monetary policy of a country. Furthermore, Ramasamy and Yeung (2005) as the reason for conflicting results cited broader economic factors, such as level of development and changes in the structure of the economic system of a country, including the capital market. In line with these results, and considering the different social systems, an important factor in the analysis represents the time period in which the analysis is performed. Due to the large number of studies, in the sequel the results of relevant studies will be described, as the considerations of recent date studies that served as an indicator for selection of independent variables in the analysis.

So it's worth considering the first study of relationship between macroeconomic factors and the equity markets, such as Fama (1981), Fama and French (1989), Ferson and Harvey (1991). In principle, it can be concluded that in all of the study was demonstrated a significant relationship between the capital markets and certain macroeconomic indicators, such as industrial production, inflation, interest rates, yield curves and the risk premium.

Research carried out by Masuduzzaman later date (2012) for Germany and the United Kingdom which analyzes the correlation of macroeconomic factors (consumer price index, interest rates, currency exchange rates, money supply and industrial production) and return on shares in the period from 1999 to 2011. By using Johansen's cointegration approach, author determines that there is a relationship between share prices and selected macroeconomic indicators, in the long and in the short term and that there is cointegration between the variables in the territory of both countries.

In the India, Singh (2010) examined the relationship between the stock market and the three key macroeconomic variables (consumer price index, exchange rate policy the Indian rupee against the dollar and the index of industrial production), using a time horizon of 1995 to 2009. Research indicates that industrial consumption can only be correlated with the change in value of the stock market.

Analysis on a longer time horizon - over 40 years, from 1965 to 2005, on the impact of selected macroeconomic indicators to the change in the value of stock markets in Japan and the US, was conducted by Humpe and Macmillan (2009). The results indicate that in United States, stock prices are positively correlated with industrial production, and negatively with inflation and

long-term interest rates. On the other hand, a study conducted in the Japan suggests a positive correlation between the stock market and industrial production, but a negative relationship between the stock market and money supply.
Nasseh and Strauss (2000), using quarterly data for the period from 1962 to 1995, examined the effect of macro factors on the equity markets of several European countries, such as Germany, UK, Netherlands, France, Italy and Switzerland. The results of their research were leading to a positive correlation of consumer price index and the index of industrial production to the capital market. On the other hand, they have determined that in the long term interest rates are negatively associated with changes in the value of the stock market indices. As expected, proving the positive correlation between the German capital market and the value of other selected European indices.

In the Great Britain, during the period from 1967 to 1995, Morelli (2002), using the ARCH and GARCH models, re-examines the connection between the volatility of macroeconomic indicators (industrial production, money supply, exchange rates, inflation and retail) and volatility equity market. Results of this study indicate that the variability of selected macroeconomic variables does not affect the variability of the stock market.

Research conducted in Croatia (Barbić and Čondić-Jurkić, 2011) in which was tested the presence of information inefficiencies in the capital markets of Central and Eastern Europe (CEE), analyzing the relationship between equity indices and selected macroeconomic variables (inflation, monetary weight, interest rate money market and foreign exchange reserves), indicating that there is no long-term connection between macroeconomic indicators and stock indices in Croatia.

On the other hand, another research conducted (Jaksic, 2008) in which was analyzed the direction and intensity of the impact of selected macroeconomic variables (M4 and interest rates) on the CROBEX suggest a connection between these variables. The study analyzed the relationship between variables in the short and long run. The results indicate that money supply has a positive effect on stock prices in the short, but not in the long run.

Benazić (2008), analyzes the connection between stock prices and foreign exchange rates in the Republic of Croatia with the Vector Error Correction - VEC model. The paper analyzes the short-term and long-term structure models. Analysis of the long-run indicates that an increase in stock prices led to the appreciation of the exchange rate, while in the short-run changes in share prices are almost insignificant.

Already on the basis of three different studies conducted in the Republic of Croatia, one may confirm the presence of conflicting results on the impact of various macroeconomic factors on the change in value of the stock index which emphasizes the importance of empirical research.

2. Methodology

Given that in this study will be analyzed the impact of macroeconomic variables on change of the value of CROBEX, a linear relationship can be written as an expression 1.

$$y_i = \alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_j x_{ij} + \cdots + \beta_k x_{ik} + e_i\,, \qquad i = 1, 2, \ldots, n \tag{1}$$

Where: y_i - the value of the dependent variable (CROBEX), α - regression intercept - a constant member in the multiple regression, often with no meaningful economic interpretation, β_j - regression coefficient on the j-th independent variable, j = 1,2, ..., k (change regression values of the dependent variable for a unit increase in the independent variable x_{ij}, assuming that the other independent variables are held constant), x_{ij} - the value of j-th independent variable, e_i - deviation from the functional relationship (error-haul), n - number of values of the variables (sample size).

The problem with the time series analysis may represent the existence of a trend. Differentiating the initial values of all variables to their percentage change, trend or seasonality can be removed. To verify whether the data is stationary, Dickey-Fuller's test was conducted, which confirmed stationarity of time series. Furthermore, the value of equity index is changing every second, so it is assumed that the value changes continuously. Accordingly, the percentage change in the index is calculated according to the expression 2.

$$r_{it} = ln \frac{P_{it}}{P_{it-1}} \tag{2}$$

Where: r_{it}- yield in the period of investment, ln - natural logarithm, P_{it}-value of index i at time t, P_{it-1} −index value in time t-1.

2.1 Logistic regression

Unlike linear regression, where the variable is continuous, the logistic regression model is suitable for the evaluation of categorical variables, or for situations where the dependent variable is usually only takes two forms, with the independent variables can be continuous, categorical, or a combination thereof. In the same way can be accessed and estimated the expected value of an equity index or financial instrument. The logistic regression model with one independent variable has a linear form of the logit probability function and is listed as expression 3.

$$logit[\pi(x)] = log\left(\frac{\pi(x)}{1-\pi(x)}\right) = a + \beta \tag{3}$$

Logistic Regression Results are expressed in logit form. For easier interpretation, results should be expressed in terms of probability π. The model used in this work is listed in expression 4.

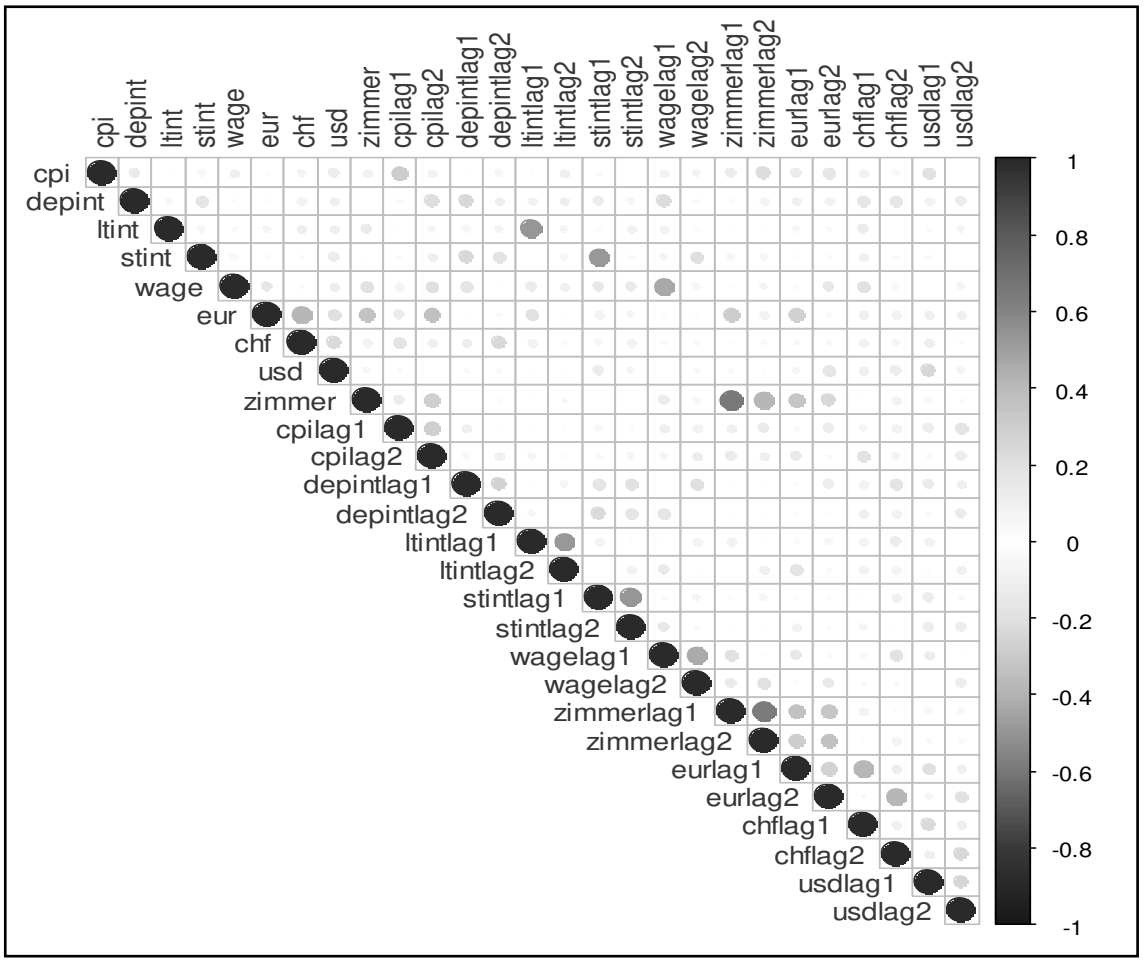
$$\pi = P\big(Y = 1 \big| X_1 = x_1, X_2 = x_2, \ldots, X_p = x_p\big) = \frac{e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p}}{1 + e^{\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p}} \tag{4}$$

3. Results

Before specifying a statistical model, it is necessary to explore the simple relationships between variables in order to eliminate variables that potentially damaging the model. In order to visually inspect joint dynamics of selected indicators and determine potential multicollinearity between variables, it is necessary to create a correlation matrix of macroeconomic data, in accordance with Figure 1. Certain patterns of joint movement can be observed looking at the correlation matrix. It is well known that during the tourist season, due to the increased inflow of foreign currency - the euro weakens in respect of kuna. Accordingly, the existing correlation between variables zimmer and eur is reversed. Increased number of nights during the season suggests a new inflow of foreign currency and the euro is depreciating. The same rule applies to couples of their LAG variables.

Furthermore, the lower positive correlation can be seen between the variables eur and chf. This dynamic correlation is contrary with the expectations of the allegations assumption (hypotheses) 7, which says that the change in the value of the euro and the Swiss franc is reverse process. However, due to fixation of the domestic currency against the euro and in the case of depreciation of euro in respect to chf, expected depreciation of the Croatian kuna is justified. For this reason, the correlation between the parity of chf and the kuna and the parity of the euro and the kuna is in a positive dynamics. In other words, if the exchange rate is fixed to the currency of another currency, the correlation would be in accordance with the premise. It is noteworthy that here a great role has given to US dollar as the reference currency.

Figure 1. *Correlation matrix of selected macroeconomic variables*



In addition, a negative correlation is present between variables ltint and ltintlag1 and between variables stint and stintlag1. Displayed dynamics of interest rates can be explained by opposite movements in interest rates on a monthly basis. Due to the creation of their LAGs, the variables have a negative correlation. A serious problem of positive correlation are perceived between variables zimmer and zimmerlag1 and zimmer and zimerlag2. Since it is a bed occupancy rate throughout the year, here is a problem of seasonality which failed to be removed by differencing variables.

3.1 The test results on the multicollinearity

Displayed correlation matrix provides visual insight into the existence of correlation between the independent variables. In order to formally prove the existence of multicollinearity, factor inflation variance (Variance Inflation Factor -VIF) test was conducted. VIF indicator points to the scale of variation of one of the independent variables described variations to other independent variables in the model whereby its value, in the case of multicollinearity, expected to be in the range 4 < VIF. The test results are shown in Table 1.

Table 1. Results of VIF indicators

No.	Variable	*VIF*	Variable	*VIF*	Variable	*VIF*
1.	*cpi*	1.416136	*cpilag1*	1.481000	*wagelag2*	1.972697
2.	*depint*	1.445372	*cpilag2*	1.766743	*zimmerlag1*	***3.800769***
3.	*ltinit*	1.620458	*depintlag1*	1.521632	*zimmerlag2*	***2.669744***
4.	*stint*	1.904291	*depintlag2*	1.389874	*eurlag1*	1.980497
5.	*wage*	2.032679	*ltintlag1*	2.248835	*eurlag2*	1.675614
6.	*eur*	2.024683	*ltintlag2*	1.661840	*chflag1*	1.533338
7.	*chf*	1.527748	*stintlag1*	2.465737	*chflag2*	1.536391
8.	*usd*	1.329467	*stintlag2*	1.826163	*usdlag1*	1.610621
9.	*zimmer*	***2.708765***	*wagelag1*	***2.536495***	*usdlag2*	1.457837

The results are consistent with the analysis of the correlation matrix. The value of all indicators is within the allowed value. It may be noted that variables with the largest VIF values are zimmer, zimmerlag1 and zimmerlag2. Variables: wagelag1, stintlag1, ltintlag1, wage and euro have increased VIF indicator, but their value is within the allowable range. In order to minimize error in parameter estimation with regression analysis, or to remove the problem of seasonality, variables: zimmer, zimmerlag1 and zimmerlag2 are not subject to further consideration of this model.

3.2 Results of multiple linear regression

After reviewing individual correlation relationship of macroeconomic variables and exclusion of variables related to the occupancy rate of beds, number of variables included in the model is 24. Below is formed first model with regression analysis - MODEL 1. Table 2 shows the results of regression.

Table 2. Results of regression analysis - MODEL 1.

No.	Coefficients	Estimate	Std. Error	t-value	Pr(>|t|)
/	(Intercept)	0.017741	0.009263	1.915	0.05854
1.	*cpi*	-1.270.218	1.589.607	-0.799	0.42628
2.	*depint*	0.254639	0.136649	1.863	0.06555
3.	*ltinit*	-0.047930	0.161342	-0.297	0.76707
4.	*stint*	-0.146568	0.158225	-0.926	0.35668
5.	*wage*	-0.910741	0.400007	-2.277	0.02509
6.	*eur*	0.506756	1.580.955	0.321	0.74928
7.	*chf*	-0.698780	0.508775	-1.373	0.17291
8	*usd*	-0.886309	0.322466	-2.749	0.00719
9.	*cpilag1*	-0.245769	1.642.738	-0.150	0.88140
10.	*cpilag2*	-1.239.438	1.682.222	-0.737	0.46311
11.	*depintlag1*	0.046318	0.150522	0.308	0.75899
12.	*depintlag2*	0.031292	0.144129	0.217	0.82860
13.	*ltintlag1*	0.074757	0.178504	0.419	0.67633
14.	*ltintlag2*	0.132440	0.151595	0.874	0.38456
15.	*stintlag1*	-0.159718	0.178345	-0.896	0.37280
16.	*stintlag2*	-0.207912	0.155858	-1.334	0.18547
17.	*wagelag1*	-0.612122	0.451299	-1.356	0.17827
18.	*wagelag2*	0.254937	0.384391	0.663	0.50883
19.	*eurlag1*	2.587.069	1.590.492	1.627	0.10721
20.	*eurlag2*	1.717.254	1.459.949	1.176	0.24250
21.	*chflag1*	-1.188.991	0.514147	-2.313	0.02295
22.	*chflag2*	-0.336696	0.515785	-0.653	0.51551
23.	*usdlag1*	-0.511631	0.354651	-1.443	0.15248
24.	*usdlag2*	-0.222400	0.335536	-0.663	0.50909
Residual standard error: 0.0743 on 93 degrees of freedom					
Multiple R-squared: 0.33					
Adjusted R-squared: 0.16					
F-statistic: 1.925 on 24 and 93 DF					
p-value: 0.01391					

The rules for exclusion of variables from the model are based on a combination of economic theory supporting the model, and the statistical indicators presented. After examining the results displayed in MODEL 1, there has been a large number of variables that do not satisfy the hypothesis of regression. The method used to eliminate the number of independent variables in the model is the Backward Stepwise method. After removing the statistically insignificant variables, MODEL 11 was occurred, in which each variable satisfies the condition given interval of statistical significance of $a = 0.05$. The regression results are shown in Table 3.

Table 3. Results of regression analysis - MODEL 11

No.	Coefficients	Estimate	Std. Error	t-value	Pr(>|t|)
/	(Intercept)	0.009337	0.006912	1.351	0.179434
1.	*wage*	-0.876332	0.302417	-2.898	0.004515
2.	*usd*	-0.962665	0.279274	-3.447	0.000797
3.	*eurlag1*	3.068836	1.278381	2.401	0.018003
4.	*chflag1*	-1.582495	0.462162	-3.424	0.000860
Residual standard error: 0.07334 on 113degrees of freedom					
Multiple R-squared – R^2: 0.21					
Adjusted R-squared – $\bar{R}^2$: 0.18					
F-statistic: 7.471on 4 and 113 DF					
p-value: 0.00002					

In accordance with the results of the regression coefficients, the estimated regression equation is as follows:

$$lnCROBEX = 0.009337 - 0.876332wage - 0.962665usd + 3.068836eurlag1 - 1.582495chflag1$$

Quantitatively, this model can be interpreted as follows. For a given unit of measurement, every macroeconomic indicator affects the change in CROBEX in accordance with its regression coefficient, provided that the other three indicators are unchanged. Consequently, the dynamics of changes in the CROBEX describes an example of application of change the value of macroeconomic indicators for a single unit of measurement, provided ceteris paribus[2].

a) The increase in the value of the average monthly net salary (wage) for a single unit causes a drop in CROBEX for $e^{-0.876332\%.}$
b) Increase the value of the US dollar in relation to kuna for a single unit, on average, will reduce the value of CROBEX for $e^{-0.962665\%}$.
c) Increase the value of the euro against the kuna in the previous period (eurlag1) by one unit causes an increase in CROBEX for $e^{3.068836\%}$.
d) The increase in the value of the parity of the Swiss franc against the kuna in the previous period (chflag1) for one unit reduces the on average value of CROBEX for $e^{-1.582495\%.}$

In addition to quantitative, results should be considered and qualitatively. It may be noted that macroeconomic indicator wage is not in accordance with the described economic theory. The theoretical assumption that explains the impact of the average net salary (wage) has not been confirmed. We assume that the variable wage is positively correlated with the change in value of the index, ie capital market follows the dynamics of the amount of average net salary. In order to explain the movement contrary to expectations, it will be needed taken into consideration the variable consumer price index in accordance with assumption 1 (hypothesis 1). For variable cpi is assumed to have a negative impact on the change in CROBEX, ie. That high inflation has a negative impact on the activities of investors. Furthermore, the correlation coefficient, calculated on the "raw" data (data that have not been differentiated) between the variables cpi and wage is high ($\rho = 0.96$). Thus, the negative impact of average net wages on the CROBEX, can be explained by a high correlation with the consumer price index. In other words, the increase in average wages, follows inflation on average, and inflation has a negative impact on the change in value of CROBEX.

[2] All other held equal (unchanged).

Parity of the kuna against the US dollar, is in line with the described economic assumption. Increasing the value of the US dollar relative to the kuna, is implying decline in value of CROBEX. Here was confirmed the already proven positive correlation between the Croatian and US capital markets. Specifically, the US capital markets react negatively to the appreciation of the dollar. In accordance with the existing correlation, it is expected that the Croatian capital market will track the value of the US market.

In addition, statistically significant and in line with these assumptions, are variables eurlag1 and chflag1. Although the presented results could imply that the Croatian capital market is inefficient - it is not the case. It is hard to believe that a change in the value of the euro against the kuna could influence changes in CROBEX in the detachment of a few days. For this reason, it can be said that these results may suggest another - the aforementioned problem, the problem of market depth[3]. However, the goal of this work is not analysis of the depth of the Croatian capital market, se it will not be more words on this matter.

The value of the coefficient of determination is 0.21, and the value of the corrected coefficient of determination is 0.18. Due to the lower value of coefficients, it can be concluded that the selected variables explain less variability of CROBEX. Thus, the regression results suggest that selected macroeconomic indicators are describing the change in CROBEX, but do not control the intensity of changing values, which is to be expected. For example, changes in the value of the dollar against the kuna of 1% may be the trigger for the reaction in the capital market, but cannot be expected that the capital market change by 1%, even more because the model includes several macroeconomic variables whose regression coefficients are of opposite sign, so the change in the value of CROBEX is canceled. Finally, only 18% of the total change in value of CROBEX, can be explained by changing the values of selected macroeconomic indicators.

3.3 Results of tests on heteroskedasticity

Inspection of dispersion diagrams of squared error versus the estimated value of the dependent variable, ie inspection of individual diagrams squared error versus the values of the independent variables was concluded that there is no systematic pattern of residuals. Although the residuals move without dynamic trend, it is necessary to conduct a formal test for the presence of heteroscedasticity in order to confirm the conclusion. Results Breusch-Pagan - BP test are given in Table 4.

Table 4. *Results Breusch-Pagan test*

Mark	value
Breusch-Pagan test	2.19
p-value	0.70
df	4

[3] The depth of financial markets indicates the number and financial potential buyers and sellers entering the market with the intention to trade financial assets and instruments, if their value rises or falls in relation to the present. The depth of the market is one of the basic prerequisites for a well-functioning market.

Given that in the model are 4 variables and statistical significance $a = 0.05$, the critical value of the chi-square table for the BP test interval is: $\chi^2{}_{4,0.05} = 9.49$. Accordingly, the value in the table is greater than the result of BP test so result confirms the absence of heteroscedasticity.

3.4 The test results on the autocorrelation

In addition to testing the residuals to the problem of heteroscedasticity, below are described the results of the Durbin Watson - DW test of residuals on the problem of autocorrelation. Results DW test are given in Table 5.

Table 5. *Results of Durbin Watson test*

Mark	Value
D-W Statistic	2.00
Autocorrelation - ρ	0.00
p-value	0.89
lag	1

Since DW test result exceeds the upper limit, it can be concluded that there is no positive autocorrelation: $DW > d_U \rightarrow H_0$.

3.5 Creating a model that estimates the direction of change of CROBEX

The following shows the dynamics of CROBEX in binary form, and in a way that in case of a positive monthly return it is approximated with number 1, or in the case of negative monthly returns with 0. For a better overview display, Table 6 shows only the total movement of CROBEX in binary form. The used sample data is the same as the previous sample data used in multiple linear regression.

Table 6. Binary movement of CROBEX in the period from 2004 to 2013.

Increase in value	Decrease in value	Total
1	*0*	*/*
62	56	118

Furthermore, although logistic regression provides insight into the statistical significance of a certain parameter, selection of a statistically significant macroeconomic indicators included in the model are based on previous results of multiple linear regression[4]. With this approach goal was to determine how well certain macroeconomic indicators can describe the initial changes in CROBEX.

[4] It is important to point out that it was possible to estimate the value of CROBEX based on variables that have proven to be statistically significant based on the logistic regression. However, the resulting model showed worse results than the predictions of the probability model that uses variables are significant according to multiple linear regression.

3.6 Testing the model and interpretation of results

Results of logistic regression equations are presented in logit form. In order to facilitate their interpretation, dependent variable should be represented in the form of probability π with outcome 1. Setting the level of probability of outcome 1 to 0.5, a model was obtained that gives the best results. The results of this model are shown in Table 7.

Table 7. *LOGMODEL 1.* Classification of outcome 1 with probability = 0.5

	Predicted 0	Predicted 1	Total	Percentage of accuracy
0	29	27	56	51.78% (29/56)
1	18	44	62	70.97% (44/62)
Total accuracy of model: **62%** (73 od 118)				

The individual results of Table 7 can be interpreted as follows. From a total of 118 observations of CROBEX index in the period from 2004 to 2013, the change in index value was 56 times negative, and 62 times positive. Furthermore, of the 56 shift down in CROBEX value, the model predicted 29 times correctly when CROBEX will fall, which makes the percentage of accuracy of 51.78%. On the other hand, of the 62 shifts upward in CROBEX value, the model predicted 44 times the when CROBEX will grow, which is the percentage of accuracy of 70.97%. Finally, of the total 118 of index values, the model is accurately predicted 73 times movement of the CROBEX, which gives accuracy of 62%.

4. CONCLUSION

Analyzing dependence of the change in value of the CROBEX relative to the selected macroeconomic indicators is the primary focus of this paper. In the present study a variety of problems were encountered, both in the definition of rational economic theory - which are presented in this paper in the form of assumptions, and in the selection and measurement of different determinants that define a particular theory.

Model results indicate that multiple regression can to some extent describe the initial CROBEX change based on the movement of the value of certain macroeconomic indicators. From the initial 24 variables that were included in the model, statistically significant proved to be four variables that are a combination of variables without displacement in relation to CROBEX and variables with displacement (LAG variables). Furthermore, including logistic regression, additional analysis was conducted to corroborate the results obtained. The total accuracy of the logistic regression model was 62%, which suggests that there is a link between the change in the value of selected macroeconomic data and changes in value of the CROBEX.

As an incentive for further academic debate, it is proposed to analyze dependencies of CROBEX index in relation to created LAGs of certain macroeconomic indicators. Specifically, in addition to the indicators in their original form, some LAG variables are proven to be statistically significant. Based on these results, there is the ability to predict changes in CROBEX value for the next month. In addition, the time horizon used in this study is ten years and the data is reported on a monthly basis.

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