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AN EMPIRICAL INVESTIGATION ON THE RELATIONSHIP BETWEEN THE EUROZONE ZEW INDEX AND THE EUROZONE STOCK MARKETS

Nesrin Ceylan*
Izmir Kavram Vocational College, Finance, Banking and Insurance Department, İzmir, Turkey
E-mail: nesrinceylan001@gmail.com, ORCID:0000-0002-3193-010X

Turgay Münyas
Istanbul Okan University, Faculty of Business and Administrative Sciences, Istanbul, Turkey
E-mail: turgay.munyas@okan.edu.tr, ORCID:0000-0002-8558-2032

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Abstract: The aim of this study is to investigate the long and short term impact of the Euro ZEW index (ZEW) on the DAX (GDAXI) Germany, FTSE 100 (FTSE) the UK, CAC 40 (FCHI) France, OMXS30 Sweden and CROBEX (CRBEX) Croatia stock market indices using monthly data for the period between February 2008 and December 2020. The Euro ZEW Index was taken as the independent variable, and the index values of Eurozone stock markets were taken as the dependent variables. As a result of the study, the Euro ZEW index was found to have a positive (increasing) statistical significant effect on the DAX, FTSE, OMXS and CRBEX variables. Of the stock markets studied, Croatia CROBEX (CRBEX) index was the most affected index by the change in the Euro ZEW index. The least affected stock market was Germany DAX (GDAXI) index. The effect of the Euro ZEW Index on Euro stock markets was higher in the short-term, and gradually decreasing in the long term. The research findings are discussed in the conclusion section.

Keywords: Eurozone Stock Markets, Euro ZEW Index, ZEW Index, Cointegration

JEL Codes: G11, G15, G17

1. Introduction

Globalization in the financial markets necessitates the investors, investing in the international financial markets, to analyze the financial markets carefully. This

* Corresponding author: Nesrin Ceylan. *E-mail: nesrinceylan001@gmail.com*

necessity enables the investors to follow the data published by public institutions and Non-governmental organizations and to learn the impact of the data on the markets. The data represent inflation, growth, unemployment, and Confidence indexes. The EUROZONE ZEW index is one of them. The word ZEW is the acronym of the German phrase "Zentrum für Europäische Wirtschaftsforschung" (Almus & Nerlinger, 1999). This institution is a non-profit organization that conducts researches. The Index is a monthly-published indicator that measures the perception of the economy. This index is an indicator that helps to estimate the cycle of the European Zone economy. It is of utmost importance for the investors, investing in the international markets, as it measures the perception of the economy. Globalization in the financial markets has created an international risk for the investors. This globalization in the financial markets or the integration has made the investors follow the international indicators. It is seen in the literature review that there are studies related to the analysis of the ZEW Index and the macro-economic factors.
In the study, the aim is to find out whether the EUROZONE ZEW Index has an effect on the EUROZONE stock markets or not. The scope of the study has been extended to explore the effects of the EUROZONE ZEW Index on the Euro stock markets after the 2008 global crisis. The analysis of the study is performed by means of Bayer-Hanck cointegration test, (Fully Modified Ordinary Least Square: FMOLS), and (Vector Error Correction Model: VECM). The long and short-term impact of the Euro ZEW index (ZEW) on the DAX (GDAXI) Germany, FTSE 100 (FTSE) the UK, CAC 40 (FCHI) France, OMXS30 Sweden and CROBEX (CRBEX) Croatia stock market indices are also analyzed using monthly data for the period between February 2008 and December 2020.

2. Conceptual framework and literature review

Leibniz-Centre for European Economic Research (ZEW) is an Economic Research Institute and a system that reflects the investors' thoughts on a monthly basis (Brooks et al., 2017). In general, this system regularly reports the thoughts and shares of investors and thoughts to shareholders and their followers on a monthly basis (Daniel et al., 2002). System followers consider an optimistic meaning for a positive level, while a pessimistic level is considered a bad indication. Shareholders are informed depending on the time periods announced, expected and past. For example, on February 16th, 2020, the expectation was 59.6, while the ratio for the previous period was 61.8. When we look at the rate announced, it is seen as 71.2.
The word ZEW, which is the acronym for the German phrase "Zentrum für Europaische Wirtschaftsforschung", can be translated as the Center for European Economic Research, founded in 1990, and located in Mannheim, Germany. This

institution, which conducts researches on the performance of the European economy and institutions, receives support from the German government and various institutions (Ceylan, 2014).

The Economic Confidence Index of the Centre for European Economic Research (ZEW) rose by 6.8 percentage points to 61.8 points in January 2021, despite an increase in the number of cases in the Coronavirus outbreak in Germany. In the Eurozone, the index rose to 58.3 (Gedik Yatırım, 2021).

Looking at the definition made by FOREX, the EURO ZEW index is defined as a system in which a confidence index is announced on a monthly basis, giving an idea of the German economy. We can state that this system is actively or passively monitoring 350 trusted, European economic analysts' expectations from the German economy, as well as profitability and systemic transformation. In a general sense, this system mathematically contributes to the optimistic, pessimistic and neutral perspectives of analysts over the three dimensions perceived through the index. Looking at the studies and analyses so far, we can state that 45% was neutral, 20% was optimistic and the rest was pessimistic.

The migration phenomenon in recent years is known to cause problems in some European countries and the Eurozone. For this reason, we can state that analyst approaches also contain changes in terms of the ZEW index, and there are differences in interpretive approaches (Boswijk, 1994).

Another dimension is that the problem caused by the COVID-19 virus epidemic, which affected all countries of the world at the end of 2019, is an important problem that negatively affects many world economies and exchange rate differences, and increases the importance of causality (Bretschger et al., 2020).

There are reasons that affect the stock market and index system, especially the economy (Olweny & Kimani, 2011). These causes are grouped under two headings as internal and external factors (Bagaya & Song, 2016). Moreover, we can list many sub-factors, including unemployment, interest rates, country policies, global problems, economic fluctuations and purchasing power (Shahbaz et al., 2013). These factors affect stock market indices and have a negative or positive effect on them (Ali, 2014).

There are a large number of econometric analyses that are often used in the analysis in studies on the index. These vary according to the data and data sets that will be analyzed (Onwuegbuzie et al., 2009).

For the ZEW index, the differences between the Euro overnight interest rate and the ECB's policy interest rate were examined. Data for 2004 were evaluated in terms of time series and the relationship between the index and interest rates was determined by the correlation method. As a result of the study, it was concluded that the interest rate expectations between 2004 and 2006 had no effect on the index (Linzert & Schmidt, 2011).

According to the BIST100 and ZEW index, we can state that financial management and intersectoral relations affect the balance of interest; thus, index management and mobility are the factors affecting the formation of poor form performance (Korkmaz & Akman, 2010).

When we consider different index markets instead of ZEW INDEX, it is seen that the focus is on the significance of the fund risk and the market mobility. (Dooley & Hutchison, 2009; Yang et al., 2018; Akhtaruzzaman et al., 2020). Another study in the field has focused on the fact that market stability and mobility have caused a great impact on the stock markets and indexes. When we analyze the results of this study, we see that daily and long-term effects have resulted in the index mobility, differences in terms of cost and macroeconomic stability and it is also detected that they are important for international investors. (Zengin et al., 2018). When we consider Forex markets, the situation is the same with the ZEW Index and the number of daily operations is similar. We can say that investors are generally influenced by the daily and immediate events which lead to market mobility and changes in stock markets and indexes. (Angelovska, 2020). All in all, it is seen that Covid-19 has caused daily effects on the ZEW Index and other indexes and stock markets. This situation has also created some changes related to the perceptions of the investors and the followers. (Teresiene et al., 2021).

Financial management and reports are very significant for several investors for their future plans. When we analyze some studies on this issue, we see that the focus is on the significance of financial reporting. In addition to this, we can say that financial reporting and index mobility are similar. (Shkulipa, 2021). When we consider the index and stock market, we see that investors attach importance to casualty and correlation in the short and long-term investments and shape their investments in that direction, and a lot of studies on this topic support this situation. (Cosma et al., 2020). A study by Djurovic et al. in 2017 has been analyzed by Berde and Kuncz who have also focused on the significance of the data and index analysis in the studies of The European Union related to the aging index published every two years (Berde & Kuncz, 2019). It is seen that the above-mentioned three studies, in terms of contents, findings and results, support the methods and findings of our study. For this reason, it has been detected that different analysis techniques and statistical methods in index analyses will contribute to the field.

The historical data related to the EURO ZEW index is shown in figure 1. The years in which the Index is at the lowest level are 2008, 2011 and 2020. These three years are the European crisis years in which the index is at the lowest level. The index on 15/07/2008 was -63,7 and at the lowest level. The basic reason for the lowest level of the index on 15/07/2008 was the 2008 global economic crisis. The Index shows that the 2008 crisis affects the world's economy as well as the European economy. The year in which the index is at the lowest level is 2011. The index on 15/11/2011 is – 59,1 at the second-lowest level. In this process, the reason that the index is at the lowest level is the debt crisis of the European economy. Another historical process that the index is at the lowest level is on 17/03/2020 with -49,5. The reason that the Index, on 17/03/2020 with- 49,5 is that Covid 19 Pandemic has affected the whole world's economy. Apart from the crisis years, it is seen that the index has a rising tendency and has exceeded the 50 band. As seen in the figure, the index has been below zero only in crisis years.

Figure 1 EURO ZEW index
Source: Author's computation

The scope of the study has been extended to explore the effects of the EUROZONE ZEW Index on the EUROZONE stock markets after the 2008 global crisis. The analysis of the study has been performed by the use of monthly data as the ZEW index is published monthly.

3. Research methodology

3.1. Method

In the study, the analyses were made with the help of Eviews version 10.0 and STATA 15.0. In addition, the Bayer-Hanck cointegration test, Fully Modified Ordinary Least Square (FMOLS) and Vector Error Correction Model (VECM) were used in the ADF and PP unit root analysis.

3.2. Aim

The study aims to investigate the long- and short-term effect of the Euro ZEW index (ZEW) on the stock market indices of DAX (GDAXI) Germany, FTSE

2008.02 (FTSE) the UK, CAC 2020.12 (FCHI) France, OMXS30 Sweden and CROBEX (CRBEX) Croatia for monthly data for the period between February 2008 and December 2020.

3.3. Scope

Within the scope of the study, the Euro ZEW Index was taken as the independent variable, and the index values of Eurozone stock markets were taken as the dependent variables. The Euro ZEW index (ZEW), DAX (GDAXI) Germany, FTSE 100 (FTSE) UK, CAC 40 (FCHI) France, OMXS30 Sweden and CROBEX (CRBEX) Croatia stock market indices for the monthly data for the period between February 2008 and December 2020 were addressed in this study.

4. Econometric analysis

For the analysis, the study covers the long- and short-term relationship of the impact of the Euro ZEW index (ZEW) on the DAX, FTSE, CAC40, OMXS and CRBEX indices for monthly data including the period between February 2008 and December 2020. The data were obtained from https://tr.investing.com/indices data bank. The analyses were made with the help of Eviews version 10.0 and STATA 15.0. The variables in the model are presented in Table 1.
The graphs about the course of the variables over time are as follows.
The descriptive information about the data is presented in Table 2.
Econometric analysis covers the long- and short-term relationship of the impact of the Euro ZEW index (ZEW) on the DAX, FTSE, CAC40, OMXS and CRBEX indices. For this purpose, 5 different models were analyzed.
Model 1: DAX=f(ZEW)
Model 2: FTSE=f(ZEW)
Model 3: CAC40=f(ZEW)
Model 4: OMXS=f(ZEW)
Model 5: CRBEX=f(ZEW)

Table 1 Introduction of the variables used in the analysis

Variable	Notation	Definition
EURO ZEW INDEX	ZEW	Independent variable
DAX (GDAXI)_Germany	DAX	Dependent variable
FTSE 100 (FTSE)_UK	FTSE	Dependent variable
CAC 40 (FCHI)_France	CAC40	Dependent variable
OMXS30_Sweden	OMXS	Dependent variable
CROBEX (CRBEX)_Croatia	CRBEX	Dependent variable

Source: Author's view

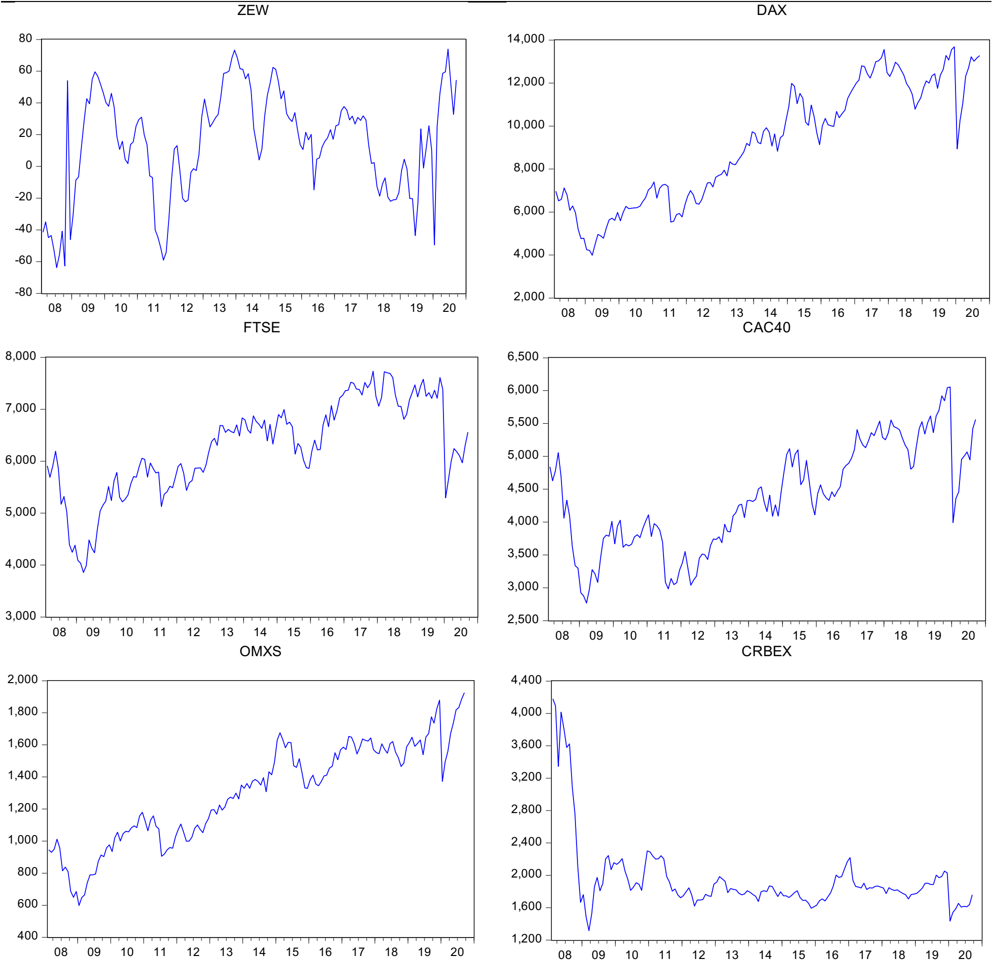

Figure 2 The course of the variables over time
Source: Author's computation

Table 2 Definitions about the data

Statistics	ZEW	DAX	FTSE	CAC40	OMXS	CRBEX
Mean	14.38882	9163.191	6267.803	4369.133	1297.694	1948.946
Median	18.45000	9349.540	6318.205	4331.750	1347.275	1825.080
Maximum	73.90000	13681.19	7731.830	6056.820	1925.500	4180.880
Minimum	-63.70000	3987.770	3857.100	2767.280	597.7600	1315.480
Std.Deviation	33.13348	2752.171	911.0235	801.0227	311.8296	465.9631

Source: Author's computation

4.1. Econometric method

Augmented Dickey-Fuller (ADF) (1981) and Phillips-Perron (PP) (1988) tests were performed for stationarity tests. There are frequently used criteria in the literature for determining the common lag length for variables involved in the equations. These criteria are the Final Prediction Error (FPE), Hannan-Quinn (HQ), Schwarz (SW), Likelihood Ratio (LR) and Akaike Information Criteria (AIC). The lag length was determined according to these criteria. The Bayer-Hanck (2013) Cointegration Analysis was used for investigating the long-term relationship. An error correction model was applied for short-term relationships.

4.2. Findings and evaluation

In the first phase, stationarity tests of the data were analyzed. For each test, the "stationary" and "stationary+trend" options were used. The Hodrick-Prescott filter included in Eviews 10.0 was used to eliminate seasonality. Since the ZEW data have a negative value in some periods (decline), no logarithm could be obtained to eliminate seasonality. Although various methods have been developed for the decomposition of time series free from seasonal effects into Trend and Cycle components, the most commonly used technique is the filter developed by Hodrick-Prescott (1980). The Hodrick-Prescott (HP) filter selects the trend and cycle motion components in a time series to minimize them as follows:

$$\sum_{t=1}^{T}(y_t-\tau_t)^2+\lambda\sum_{t=2}^{T-1}[(\tau_{t+1}-\tau_t)-(\tau_t-\tau_{t-1})]^2 \tag{1}$$

In this equation, the variable τ_t shows the trend component, and λ shows the "smoothing parameter", which smooths the volatility in the trend. The λ parameter refers to the ratio of the volatility observed in the circuit motion component to its volatility measured by the second difference of the trend component, and represents the noise/signal ratio observed in the data. The value λ must be determined before applying the filter. A zero λ parameter, which can take values in the range [0, infinite], indicates that there is no cyclical movement in the data, and a plus infinite value indicates that there is a trend component in the series that follows a linear movement over time (Hodrick & Prescott, 1980). In this study, λ=1600 was used for daily data, as recommended by theorists to practitioners.

Although there were no negative values in other data, it was preferred to use filters in all series to ensure homogeneity. After the seasonality elimination process, unit root tests were applied to determine the trend effects.

Table 3 ADF and PP unit root test results of variables

Variables	ADF		PP	
	Constant	**Stationary+trend**	**Constant**	**Stationary+trend**
ZEW	-1.832(0.246)	-2.160(0.283)	-1.904(0.223)	-2.303(0.143)
DAX	-1.671(0.380)	-1.913(0.391)	-1.882(0.417)	-2.047(0.129)
FTSE	-1.488(0.211)	-1.617(0.277)	-1.749(0.315)	-1.912(0.142)
CAC40	-2.056(0.284)	-2.219(0.301)	-2.151(0.296)	-2.310(0.246)
OMXS	-0.987(0.231)	-1.325(0.244)	-1.314(0.314)	-1.553(0.360)
CRBEX	-0.805(0.118)	-1.113(0.209)	-1.202(0.246)	-1.472(0.285)
Δ*ZEW*	-5.902(0.000)*	-6.205(0.002)*	-5.873(0.000)*	-6.127(0.002)*
Δ*DAX*	-5.731(0.000)*	-5.997(0.000)*	-4.982(0.014)*	-5.168(0.005)*
Δ*FTSE*	-6.247(0.017)*	-6.813 (0.009)*	-6.344(0.007)*	-6.901(0.000)*
Δ*CAC40*	-5.380(0.004)*	-5.771(0.000)*	-5.811(0.001)*	-6.017(0.000)*
Δ*OMXS*	-6.113(0.000)*	-6.505(0.003)*	-6.216(0.000)*	-6.592(0.000)*
Δ*CRBEX*	-5.802(0.001)*	-6.047(0.000)*	-5.321(0.000)*	-5.707(0.015)*

* Stationary variable for a level of significance of 0.05,
Note: *values in parentheses are values (p), and the Δ representation indicates a first-order difference.*
Source: Author's computation

According to the results in Table 3, all variables have unit roots at the ground level. Variables were found to be stationary for the first-order difference, there is stationarity at level I(1). Lag lengths were determined for cointegration analysis.

Table 4 Results for determining lag length

	LR	**FPE**	**AIC**	**SC**	**HQ**
Model 1	2 lags	2 lags	3 lags	2 lags	2 lags
Model 2	3 lags	2 lags	3 lags	3 lags	3 lags
Model 3	2 lags	2 lags	2 lags	1 lag	2 lags
Model 4	1 lag	1 lag	2 lags	1 lag	2 lags
Model 5	2 lags	2 lags	2 lags	2 lags	2 lags

Final Prediction Error (FPE), Hannan-Quinn (HQ), Schwarz (SW), Likelihood Ratio (LR), Akaike Information Criteria (AIC)
Source: Author's computation

As shown in Table 4, "2" lags for the Model 1, "3" lags for the Model 2, "2" lags for the Model 3, "1" lag for the Model 4, and "2" lags for the Model 5 were used. The value given by the majority of lag length criteria was accepted as appropriate.

4.2.1. Bayer-Hanck (2013) cointegration analysis

The Engle-Granger (1987) cointegration test, which is estimated based on the long-term regression model residue values, can reveal the long-term relationship between the series, without making series with unit roots stationary series.

However, the Engle-Granger cointegration test is considered weak in models with multiple explanatory variables (Govindaraju & Tang, 2013:314). The Johansen (1991) cointegration test, which was developed later is extremely sensitive to lag length (Kızılgöl, 2006:58). In later years, Boswijk (1994) introduced a new cointegration test based on the error correction model and applied it with F statistics. Banerjee et al. (1998) test, on the other hand, has an error correction model and is based on t statistics. None of the above-mentioned cointegration tests are perfect or completely powerful. Based on the fact that cointegration tests in the literature give contradictory results, Bayer and Hanck (2013) have developed a new test that evaluates the cointegration tests by Engle and Granger (1987), Johansen (1991), Boswijk (1994), and Banerjee et al. (1998) together. By combining the probability values (significance levels) of these tests to achieve a more powerful cointegration test, Bayer and Hanck (2013) have used the probability values of the univariate test of Engle-Granger (1987), multivariate test of Johansen (1991), error-correction based test of Boswijk (1994) and the test by Banerjee et al. (1998) (Shahbaz, et al., 2013:10, Aktürk, et al., 2014:122). The cointegration test by Bayer-Hanck (2013) combined individual probability values by using Fisher's chi-square distribution equation (Arı, 2016:61).

$$EG-JOH = -2[In\,(P_{EG}) + In\,(P_{JOH})] \quad (2)$$
$$EG-JOH-BO-BDM = -2\,[In\,(P_{EG}) + In\,(P_{JOH}) + In\,(P_{BO}) + In\,(P_{BDM})] \quad (3)$$

PEG, PJOH, PBO, and PBDM in the Equation (2) and (3) refer to the probability values of Engle-Granger (1987), Johansen (1991), Boswijk (1994) and Banerjee et al. (1998) cointegration tests. If the calculated test statistic is greater than the critical value found by Bayer-Hanck (2013), the basic hypothesis that there is no cointegration relationship is rejected and it is decided that a cointegration relationship exists between the series. Bayer-Hanck cointegration test results are presented in Table 5.

Table 5 Bayer-Hanck (2013) cointegration test results

Models	EG-JOH	EG-JOH-BO-BDM	Cointegration
Model 1: FDAX=f(FZEW)	16.842*	28.215**	Yes
Model 2: FFTSE=f(FZEW)	18.554**	30.531**	Yes
Model 3: FCAC40=f(FZEW)	11.393	15.647	No
Model 4: FOMXS=f(FZEW)	18.214**	29.807**	Yes
Model 5: FCRBEX=f(FZEW)	17.911**	31.418**	Yes

*Note:** and **notation indicate a presence of cointegration by 1% and 5% level of significance, respectively the" F " notation shows the first-order difference.

Source: Author's computation

Looking at the Bayer and Hanck (2013) cointegration test results, the values of the two Fisher Test statistics calculated were found to be smaller than the critical values for Model 3, and it was determined that there was no cointegration relationship. In this case, CAC40 has no long-term relationship with the ZEW variable. A cointegration was found for the other models, except this one. The ZEW variable has a long-term relationship with the DAX, FTSE, OMXS and CRBEX indices.

Long-term cointegration coefficient estimates for 4 models, in which their cointegration relationships were determined, were performed using the Fully Modified Ordinary Least Square method (FMOLS).

Table 6 FMOLS long-term cointegration coefficient estimates

Models	F(ZEW) coefficient
Model 1: FDAX=f(FZEW)	0.251*
Model 2: FFTSE=f(FZEW)	0.176*
Model 4: FOMXS=f(FZEW)	0.325*
Model 5: FCRBEX=f(FZEW)	0.383*

* statistical significance at 0.05 level; The autocorrelation and heteroscedasticity problems in the estimates were corrected by the Newey-West method.

Source: Author's computation

During the analyses by FMOLS method, the autocorrelation and heteroscedasticity problems in the estimates were corrected by the Newey-West method. As a result of assumption tests, no assumption deviation occurred. For the 4 models considered, the ZEW variable significantly affects DAX, FTSE, OMXS and CRBEX variables in a positive (incremental) direction. According to Table 6, the ZEW variable increased the DAX index by 25.1%, the FTSE index by 17.6%, the OMXS index by 32.5%, and the CRBX index by 38.3%. As is seen, the effect on CRBEX is the greatest according to the coefficient values, followed by OMXS and DAX. The lowest effect was achieved for FTSE.

In order to investigate the short-term dynamics of variables moving together in the long term, the Vector Error Correction Model (VECM) was used. The information obtained as a result of this estimation is presented in Table 7.

Statistically significant results were obtained for 4 models presented in Table 7. The error correction coefficient in all models is negative and statistically significant. In other words, the error correction mechanism of the models works. Of the short-run deviations, occurred between the long-run series, 34.5% for the Model 1, 38.7% for the Model 2, 41.3% for the Model 4, and 42.6% for the Model 5 disappear and the series converge again to the equilibrium value in the long-term. In other words, short-term deviations disappear and the variables converge to the equilibrium value in the long term. In the short term, the coefficients had higher values than in the long term. In the short term, the biggest effect belongs to CRBEX, and the lowest effect is obtained for FTSE.

Table 7 Short-term error correction model prediction results

Model 1: Dependent Variable: ΔDAX_t	**Coefficient**	**Diagnostic tests**
ΔZEW_t	0.295*	*R*² =0.583, *Adj. R*² =0.580, *F(p)*=0.000*, ***Breusch-Godfrey LM Test*** *(p)*= 0.108*, ***White Test*** *(p)*=0.114*, ***Ramsey RESET Test (p)***= 0.135* , **JB test** (p)=0.266
ECT_{t-1}	-0.348*	
Constant	0.854*	
Model 2: Dependent Variable: $\Delta FTSE_t$	**Coefficient**	**Diagnostic tests**
ΔZEW_t	0.204*	*R*² =0.575, *Adj. R*² =0.572, *F(p)*=0.000*, ***Breusch-Godfrey LM Test*** *(p)*= 0.114*, ***White Test*** *(p)*=0.127*, ***Ramsey RESET Test (p)***= 0.142* , **JB test** (p)=0.273
ECT_{t-1}	-0.387*	
Constant	0.672*	
Model 4: Dependent Variable: $\Delta OMXS_t$	**Coefficient**	**Diagnostic tests**
ΔZEW_t	0.385*	*R*² =0.591, *Adj. R*² =0.590, *F(p)*=0.000*, ***Breusch-Godfrey LM Test*** *(p)*= 0.131*, ***White Test*** *(p)*=0.139*, ***Ramsey RESET Test (p)***= 0.156* , **JB test** (p)=0.280
ECT_{t-1}	-0.413*	
Constant	0.761*	
Model 5: Dependent Variable: $\Delta CRBEX_t$	**Coefficient**	**Diagnostic tests**
ΔZEW_t	0.403*	*R*² =0.599, *Adj. R*² =0.596, *F(p)*=0.000*, ***Breusch-Godfrey LM Test*** *(p)*= 0.145*, ***White Test*** *(p)*=0.148*, ***Ramsey RESET Test (p)***= 0.167* , **JB test** (p)=0.312
ECT_{t-1}	-0.426*	
Constant	0.803*	

Note: *denotes statistical significance at 5% level, JB; is Jarque-Bera normality test probability value. The autocorrelation and heteroscedasticity problems in the estimates were attempted to be corrected with the Newey-West method.

Source: Author's computation

There is a medium-level correlation between the ZEW Index approach to determine stock market indexes and it describes the ZEW Index as a determiner of stock market indexes. In other words, the expected ZEW index can affect the stock market indexes. The Constant effect model assumes that the ZEW Index is related to stock market indexes peculiar to the country. Although the coefficient of determination is (R2) low as %57 the stated models are statistically meaningful.

5. Conclusion and recommendations

All the variables analyzed have unit roots at the ground level. Variables were found to be stationary for the first-order difference, there is stationarity at level I(1). It was determined that the first-order difference of variables can be used in regression analysis.

Lag lengths were determined for cointegration analysis. In the study, "2" lags for the Model 1, "3" lags for the Model 2, "2" lags for the Model 3, "1" lag for the Model 4, and "2" lags for the Model 5 were used. The value given by the majority of lag length criteria was accepted as appropriate. According to these models, CAC40 has no long-term relationship with the ZEW variable. A cointegration was found for the other models, except this one. The ZEW variable has a long-term relationship with the DAX, FTSE, OMXS and CRBEX indices.

For the 4 models considered, the ZEW variable significantly affects DAX, FTSE, OMXS and CRBEX variables in a positive (incremental) direction. The ZEW index increases DAX index by 25.1%, the FTSE index by 17.6%, the OMXS index by 32.5%, and the CRBX index by 38.3%. As is seen, the effect on CRBEX is the greatest according to the coefficient values, followed by OMXS and DAX. The lowest effect is obtained for FTSE.

Statistically significant results were obtained for 4 models. Of the short-run deviations, occurred between the long-run series, 34.5% for the Model 1, 38.7% for the Model 2, 41.3% for the Model 4, and 42.6% for the Model 5 disappear and the series converge again to the equilibrium value in the long-term. In other words, short-term deviations disappear and the variables converge to the equilibrium value in the long term. In the short term, the coefficients had higher values than in the long term. Apart from CAC40 variable H0 hypothesis has been rejected for the cointegration analysis. DAX, FTSE, OMXS VE CRBEX and ZEW long-term relationship has been determined. Thus, CAC40 and ZEW do not have a long-term relation. H0 has been accepted. The Index, has focused on the European countries' economies having the world's strongest economies. The Index reflects the expectations related to the general structure of the European countries' economies. This Index is an indicator which helps to estimate the direction of the cycle of the European countries' economies. The investors increase their financial property in order to minimize the risks they face in financial markets within the frame of modern portfolio administration.

Globalization in the financial markets has created international risks for the investors. This globalization or integration, has obliged the investors to follow international indicators. One of these indicators is the EUROZONE ZEW Index.

The findings of the study show that the ZEW Index has been effective on German, England, Sweden, and Croatia stock markets. Another result is that the German stock market is affected by the other stock markets less than other stock markets. It is because of the fact that the German economy is one of the most significant countries of industry and one of the most significant economies in the European economies. Finally, it is very significant for the investors, who are going to invest in Eurozone stock markets, to follow the EUROZONE ZEW Index carefully with reference to the above-mentioned results.

Table 8 Causality test for 2008 -2020

Sample: 2008M02 2020M12
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
1- DAX does not Granger Cause ZEW	155	1.34303	0.2726
2- ZEW does not Granger Cause DAX		1.39710	0.0091
3- FTSE 100 does not Granger Cause ZEW	155	1.00735	0.3743
4- ZEW does not Granger Cause FTSE 100		3.42575	0.0423
5- CAC 40 does not Granger Cause ZEW	155	1.69222	0.1970
6- ZEW does not Granger Cause CAC 40		4.18972	0.0223
7- OMXS30 does not Granger Cause ZEW	155	1.89340	0.1465
8- ZEW does not Granger Cause OMXS30		4.76568	0.0203
9- CROBEX does not Granger Cause ZEW	155	1.22244	0.2460
10- ZEW does not Granger Cause CROBEX		4.19762	0.0345

Table 8 shows that, DAX, FTSE, CAC, OMXS, CROBEX are not the reasons of the ZEW variable. However, the hypothesis and Granger casualty test results show the opposite results. In line with these expectations, it is seen that from the ZEW variable, there is a one-way casualty to DAX, FTSE, CAC, OMXS, CROBEX. However, the result for the relation between DAX, FTSE, CAC, OMXS, CROBEX and ZEW shows that there is no casualty between the variables.

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Author contributions

TM conceived the study and was responsible for the data curation, methodology, formal analysis, and discussion of the results. NC was responsible for the introduction, literature review and conclusion.

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