

# ANALYSIS OF HOW THE EUROPEAN STOCK MARKETS PERCEIVE THE DYNAMICS OF MACROECONOMIC INDICATORS THROUGH THE SENTIMENT INDEX AND THE PURCHASING MANAGERS' INDEX

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## Abstract

In this article, we intend to analyse how the European stock markets perceive the dynamics of macroeconomic indicators in terms of the sentiment index and the purchasing managers' index. For this research, we focused on the countries of the European Union and applied an econometric event study, which consisted in the analysis of the evolution of the logarithmic returns of the stock indices for 27 countries of the European Union and for the euro area for the period January 2007 - November 2017. The results showed immediate reactions with a higher intensity in March 2015 for the SentiMent index and for March 2016 for the PMI. The frequency and amplitude of reactions are different from country to country; often, a high frequency of reactions in one country is not reflected in a very high amplitude response.

**Keywords:** capital markets, sentiment indices

**JEL Classification:** G19, G32

## 1. Short introduction

The specific features of stock markets provide us with very high frequency statistics, which allows the use of empirical methods to analyse the immediate impact of certain events on the evolution of stock indices.

For the purpose of this research, we have chosen the countries of the European Union as an area of interest, from an economical and financial point of view, the Romanian economy being

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linked to this area. The use of survey-based indices to capture how the economy operates as a whole or in certain sectors is more and more common in both practice and academia.

The two indices chosen to assess the impact of changes on stock markets have a wide coverage, both in terms of countries for which they are calculated and their use in practice and research, the indices being published monthly and intensely pursued by the economic press.

The methodology of calculating the indices differs, starting from the basic approach - "opinions" versus "facts", the choice of two variants of indicators for research being motivated by the desire to capture a reaction of the stock markets to indicators that represent in different ways the macroeconomic reality.

The advantage of choosing such indicators at the expense of classical macroeconomic indicators is access to calculated and published monthly indicators compared to the trimestral publication of some macroeconomic indicators, and thus a much higher frequency of the data series.

Another aspect worth mentioning is that once published, statistical data is no longer reviewed, as is the case of many macroeconomic indicators.

Baker and Wurgler (2007) published an investigation of sentiment indicators on stock markets, while Rakovska and Svoboda (2016) made an analysis of their application in financial research. Sibley et al. (2016) explore the information content of this kind of indexes. Bormann (2013) presents an interesting explanation on the sentiment of the indices and sentiment concept.

In previous research, using models from the GARCH family and a MIDAS methodology, Lupu et al. (2016) explored the linkage between sentiment indices and the volatility of stock market indices, concluding that the risk associated with benchmark indices is higher than those specific to sustainability related counterparts.

## **2. Description of indices**

### **2.1. Sentiment Index (SentiMent)**

The European Commission has been calculating the *sentiment index* since 1985. Surveys conducted by the European Commission provide monthly judgments and forecasts on various aspects of economic business in distinct sectors of the economy:

industry, services, construction, retail and consumers. On the basis of the obtained results, the Commission computes and publishes a composite index monthly (the last working day of each month for the current month) to reflect overall perceptions and industry expectations in a one-dimensional index for member countries and candidate countries (European Commission, 2017).

For calculating the composite index (used in this study), the above-mentioned sectors as components of this index are assigned some weightings:

- Industry sector: 40%;
- Services sector: 30%;
- Consumers sector: 20%;
- Construction sector: 5%;
- Retail sector: 5%.

Assigned weights were determined using two criteria: sector representativeness and performance tracking against the reference variable. Considering the composite index, the reference variable is GDP growth, which represents the change in the economy as a ensemble, used to test the performance of the composite index.

This indicator summarizes optimistic or pessimistic expectations regarding the economic developments, being very useful in monitoring and forecasting the business cycle. An index value above 100 represents a value of the economic sentiment above average, and according to the configuration, in 68% of the cases, the sentiment index will be between 90 and 110. The usefulness of the index is related to economic surveillance, the realization of short-term forecasts and in economic research.

## **2.2. Purchasing managers index (PMI)**

Markit Economics develops the Purchasing Managers Index, (PMI) based on monthly questionnaires addressed to companies. This index gives an overview of what is happening in the private environment of the economy by tracking variables such as production, new orders, stock levels, employment rates and prices in various sectors of the economy (industry, construction, trade and services).

According to the calculation methodology, PMI is calculated and published monthly, is based rather on facts than on opinions, and uses the same method in all countries, thus providing a comparable basis for assessing the production sector.

The index is widespread, with a large coverage in the press, and is used by corporate managers, economic analysts in financial institutions and central banks, the embedded information being useful for building monetary policy decisions.

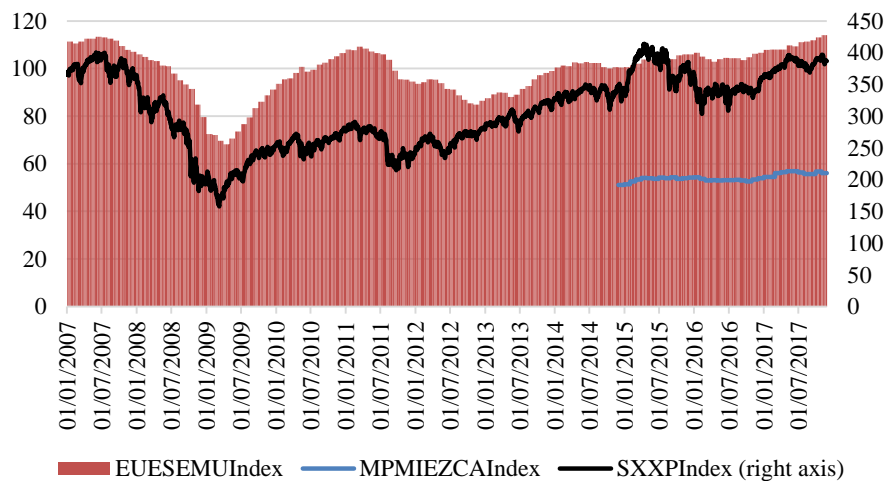
### 3. Description of data and methodology

The econometric event study consisted in the analysis of the evolution of the logarithmic returns of the stock indices for 27 countries of the European Union and for the euro area during January 2007 and November 2017.

The main purpose of this analysis was to capture the reaction of these returns to changes in the PMI published by Markit Economics, and to changes in SentiMent index values, calculated by the European Commission and that incorporates analysts' views regarding the economic policies in the countries of the European Union. For countries for which PMI is not calculated, the PMI calculated for the euro area was used.

An example of the evolution of these three indicators (SentiMent, PMI and stock index) for the euro area and Europe is shown in Figure 1.

**Figure 1**  
Evolution of the SentiMent index, the PMI for the euro area and the STOXX 600 stock index for Europe (Jan. 2007 – Nov. 2017)



Source: Authors' processing using Bloomberg data

A first step of the analysis was to identify the moments in which the two indices (PMI and SentiMent) changed for each country in the sample. As a result of this research, different time points resulted for the analyzed countries, the frequency of searches for changes in index values being daily.

Therefore, the "event" was the change in the two categories of indices for each country. Correspondence of stock indices for each country with PMI and SentiMent indices is presented in the Table 1.

**Table 1**  
**Correspondence between stock indices, SentiMent indices and PMI for each country/area considered for analysis**

Country	Stock Market Index	SentiMent indices	PMI
<b>Austria</b>	ATXIndex	EUESATIndex	MPMIEZCAIndex
<b>Belgium</b>	BEL20Index	EUESBEIndex	MPMIEZCAIndex
<b>Bulgaria</b>	SOFIXIndex	EUESBGIndex	MPMIEZCAIndex
<b>Croatia</b>	CROIndex	EUESHRIndex	MPMIEZCAIndex
<b>Cyprus</b>	CYSMMAPAIndex	EUESCYIndex	MPMIEZCAIndex
<b>Czech Republic</b>	PXIndex	EUESCZIndex	MPMIEZCAIndex
<b>Denmark</b>	KAXIndex	EUESDKIndex	MPMIEZCAIndex
<b>Estonia</b>	TALSEIndex	EUESEEIndex	MPMIEZCAIndex
<b>Finland</b>	EUESFIIndex	HEXIndex	MPMIEZCAIndex
<b>France</b>	CACIndex	EUESFRIndex	MPMIFRCAIndex
<b>Germany</b>	DAXIndex	EUESDEIndex	MPMIDECAIndex
<b>Greece</b>	ASEIndex	EUESGRIndex	MPMIGRMAIndex
<b>Ireland</b>	ISEQIndex	EUESIEIndex	MPMIEZCAIndex
<b>Italy</b>	FTSEMIBIndex	EUESITIndex	MPMIITMAIndex
<b>Latvia</b>	RIGSEIndex	EUESLVIndex	MPMIEZCAIndex
<b>Lithuania</b>	VILSEIndex	EUESLTIndex	MPMIEZCAIndex
<b>Malta</b>	MALTEXIndex	EUESMTIndex	MPMIEZCAIndex
<b>UK</b>	UKXIndex	EUESUKIndex	MPMIEZCAIndex
<b>Netherlands</b>	AEXIndex	EUESNLIndex	MPMINLMAIndex
<b>Poland</b>	WIGIndex	EUESPLIndex	MPMIEZCAIndex
<b>Portugal</b>	BVLXIndex	EUESPTIndex	MPMIEZCAIndex
<b>Romania</b>	BET_XTIndex	EUESROIndex	MPMIEZCAIndex
<b>Slovakia</b>	DWSKIndex	EUESSKIndex	MPMIEZCAIndex

Country	Stock Market Index	SentiMent indices	PMI
<b>Slovenia</b>	SBITOPIndex	EUESSIIndex	MPMIEZCAIndex
<b>Spain</b>	IBEXIndex	EUESESIndex	MPMIEZCAIndex
<b>Sweden</b>	OMXIndex	EUE SSEIndex	MPMIEZCAIndex
<b>Hungary</b>	BUXIndex	EUESHUIndex	MPMIEZCAIndex
<b>The euro area</b>	SXXPIndex	EUESEMUIndex	MPMIEZCAIndex

*Source: Authors' processing using Bloomberg, European Commission and Markit Economics data*

For the event study (the event study methodology is presented in Lupu and Dumitrescu, 2010), the following analysis was performed for each change of the two categories of indices:

a) A sample of 700 transaction days was selected before the "event" date. For this data a simple GARCH (1,1) model was calibrated for the logarithmic returns of the stock index.

b) For each of the 10 days before the "event" the quadratic yields and the differences between them and the variance values estimated with the help of the GARCH model (1,1) were calculated. Quadratic yield reflects the variance value of that day. The difference between this and the model's estimated variance is the extent to which the model manages to explain the true stock market values in the immediate vicinity of the "event."

c) An average of these 10 differences has been calculated. This average is the extent to which the GARCH model (1.1) manages to explain on average the series of variants made during the 10 days before the "event".

d) For the "event" day and for each of the next 5 days, the GARCH (1.1) previously calibrated model was used to make variance forecasts. Thus, 6 variances were obtained, corresponding to each of the 6 days (the "event" day to which the next 5 days are added).

e) For these 6 days the quadratic returns were also used as measures of the actual variances that occurred during the period that followed the "event".

f) There were calculated 6 differences between quadratic yields and variances predicted by GARCH (1.1) and an analysis was made of the extent to which each of these differences was greater

than 2 times the average difference for the period before the "event", respectively the difference calculated under (c).

g) For each two-fold over-lapse of this average difference, a significant financial market reaction to the PMI or SentiMent indexes was considered.

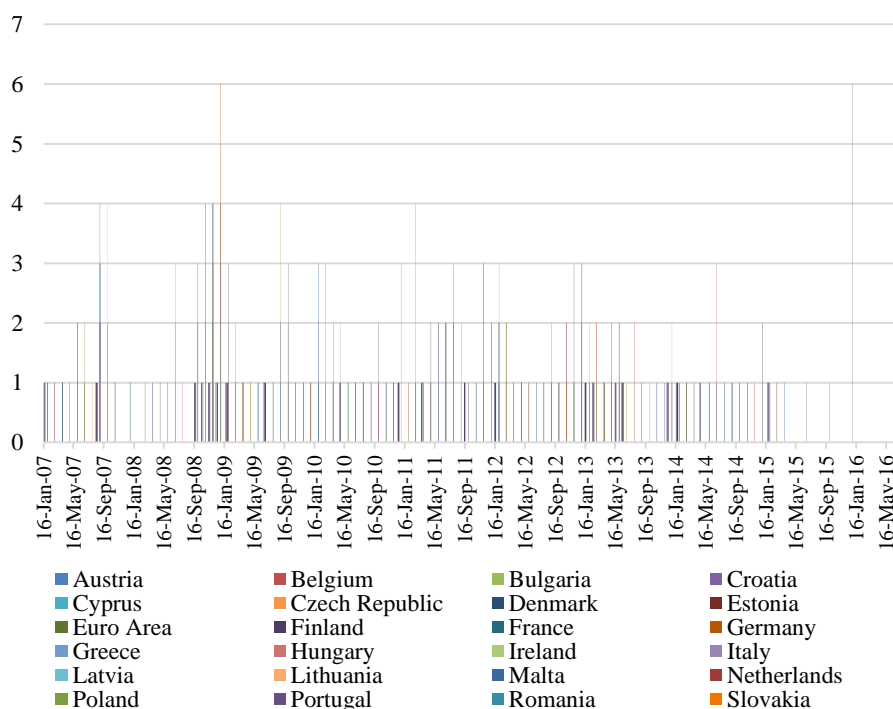
In order to synthesize the results of the analysis, we have calculated all the situations in which significant financial market reactions were recorded for each of the days when the two indices (PMI and SentiMent) have changed. At the same time, we calculated the averages for each of market reaction situations. These averages reflect the overall amplitude of market changes because of a particular event.

#### **4. Obtained results**

##### **4.1. Results for the Sentiment Index (SentiMent)**

The following graph (Figure 2) is more difficult to follow being populated with a lot of data, but it is useful for an overview, from which it can be deduced the general impact of the SentiMent index changes on the stock markets, namely the frequency and duration of significant changes (the number of days). It can be noticed that for all six days following the event significant changes took place in Germany and Croatia for changes in the SentiMent index of 31 December 2008 and 31 December 2015 respectively. Significant changes for longer periods (4 days) were in Austria, Sweden, Denmark, UK, Bulgaria and Cyprus. The impact of the SentiMent index changes on stock markets was more intense by the beginning of 2015, after which the frequency decreased.

**Figure 2**  
**The Reaction of European stock markets to changes in the European Commission's Sentiment Index (Jan. 2007 – July 2016)**



Source: Authors' processing using Bloomberg and European Commission data

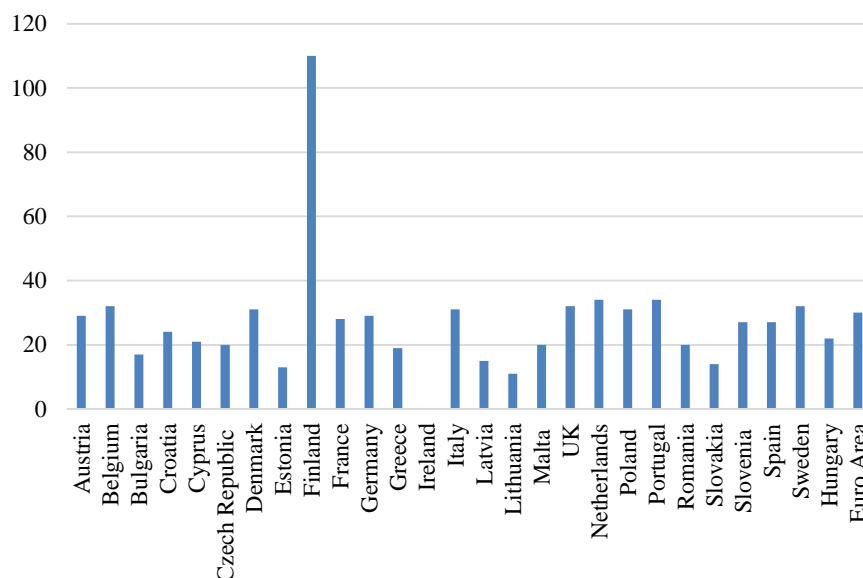
Depending on the total number of days for which European stock markets responded significantly to changes in the Sentiment index (Figure 3), we note that Finland is ranked first with 110 days in total for the period under review (all stock market reactions are short-lived, all of them for one day), followed by the Netherlands with 34 days in total, Portugal with 34 days, Belgium, UK and Sweden with 32 days, Denmark, Italy and Poland with 31 days and the euro zone with 30 days.

For Romania, the total number of days in which reactions were recorded is 20, the longest significant response being recorded for three days at a change in the Sentiment index of August 31, 2017.



**Figure 3**

**Total number of days for which European stock markets responded significantly to changes in the SentiMent index for each analysed country (January 2007 - July 2016)**



Source: Authors' processing using Bloomberg and European Commission data

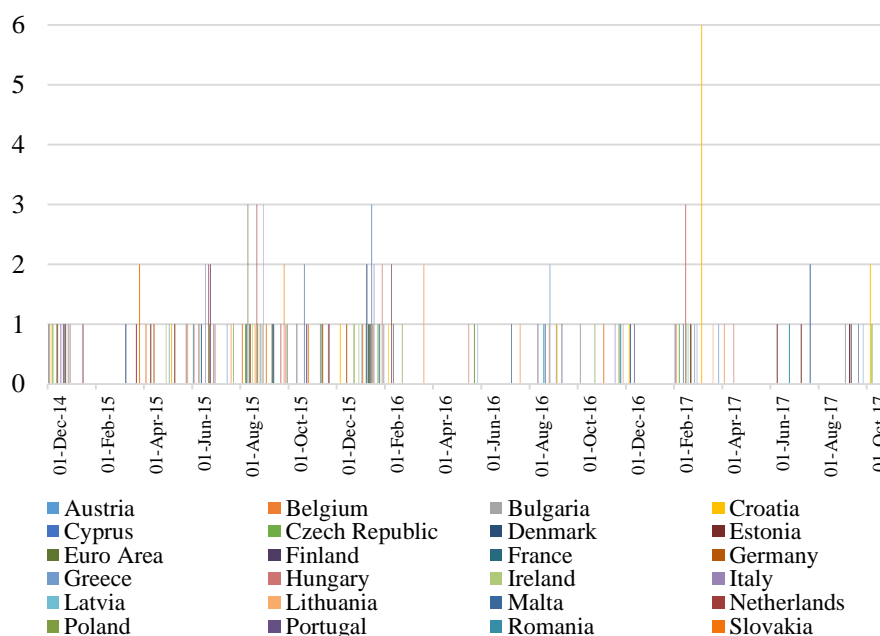
The magnitude of these changes (measured by multiple from the standard deviation resulting from the model calibration) is presented for each country in the graphs in Annex 1. The largest changes in the amplitude were recorded in Cyprus (164.00), Latvia (34.16), Lithuania (30.69), Greece (29.49), Croatia (29.06), Finland (22.46), Spain (18.92), the Czech Republic (17.57), Portugal (15.12), Poland (4.99), Slovakia (14.96), Romania (14.23). Ireland is the only country where there has been no change during the period under review.

#### **4.2. Results for the Purchasing Managers' Index (PMI)**

As in the previous case, although the next chart (Figure 4) is more difficult to follow, it can outline the overall impact of changes to the PMI on stock markets, namely the frequency and duration of significant changes (the number of days). It can be noticed that the

only significant change for all six days pursued took place in Croatia for a change in PMI on 31 March 2017. Significant changes for longer periods were in the euro area, the Netherlands, the UK, Greece and Hungary (for three days) and in Slovakia (twice), Italy (twice), Portugal, Malta (twice), Denmark, Spain, Estonia, Lithuania, Slovenia and Croatia. The impact of PMI changes on stock markets was more intense until April 2016, after which the frequency decreased.

**Figure 4**  
**The Reaction of European stock markets to PMI changes**  
**(November 2014 - November 2017)**



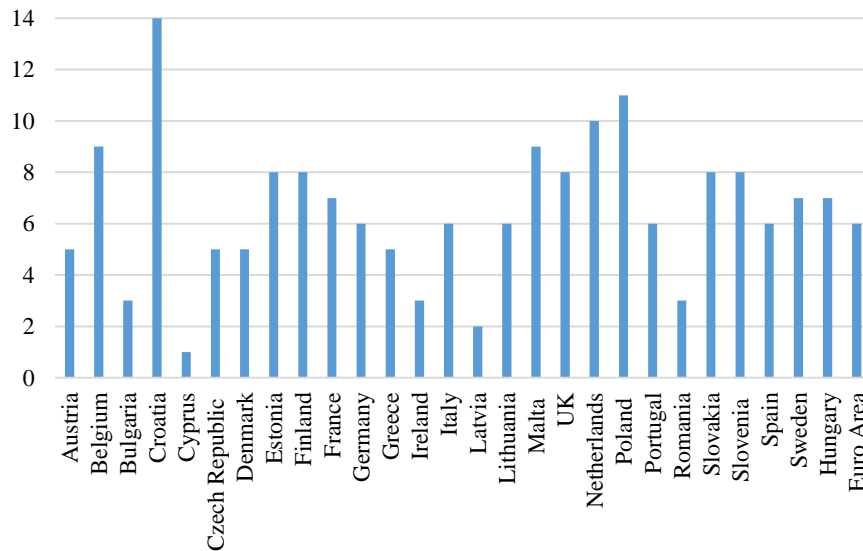
Source: Authors' processing using Bloomberg and Markit Economics data

Depending on the total number of days for which the European stock markets reacted significantly to PMI changes (Figure 5), we notice that the first position is Croatia with 14 days in total for the analysed period (one of the reactions had a duration of six days), followed by Poland with 11 days, the Netherlands with 10 days, Belgium and Malta with 9 days.

It should be noted that all countries have registered at least one significant reaction (Cyprus is the one-country country for a

single day). This impact is also important given that only the Netherlands has a PMI calculated specifically for this country, with the other responding to the change in PMI for the euro area, with no specific PMI.

**Figure 5**  
**Total number of days for which European stock markets reacted significantly to PMI changes for each analysed country (November 2014 - November 2017)**



Source: Authors' processing using Bloomberg and Markit Economics data

The magnitude of these changes (measured by multiple from the standard deviation resulting from the model calibration) is presented for each country in the graphs, in Annex 2. Although Croatia has a long-term response, its amplitude is reduced, with the standard deviation of only 5.99 higher. The biggest changes in the amplitude were recorded in Latvia (29.65), Greece (29.50), Bulgaria (16.47), Ireland (15.97), Finland (15.36), Slovakia (14,17), Romania (11,22, seventh place), Denmark (10,16), Hungary (10,06), Cyprus (8,36).

## **5. Final considerations**

The global financial crisis has re-launched debates on the role of financial markets in spreading macroeconomic fluctuations. In this study, we attempted to identify the European stock markets' reactions to changes in sentiment indices and purchasing managers' indices, these indices being a mean of measuring macroeconomic status and evolution, different from the classic macroeconomic approach. The results showed immediate reactions, with a higher intensity by March 2015 for the SentiMent index and by March 2016 for PMI. Frequency and amplitude of reactions vary from country to country; often the high frequency of reactions in one country is not accompanied by a very high amplitude response.

For future research, a more complex, network-wide example, including multiple elements and their connections, could lead to early identification of vulnerabilities and the implementation of preventive measures. An interesting research would be to restore the analysis for various sectors of activity, but also to correlate with the economic and/or financial cycle.

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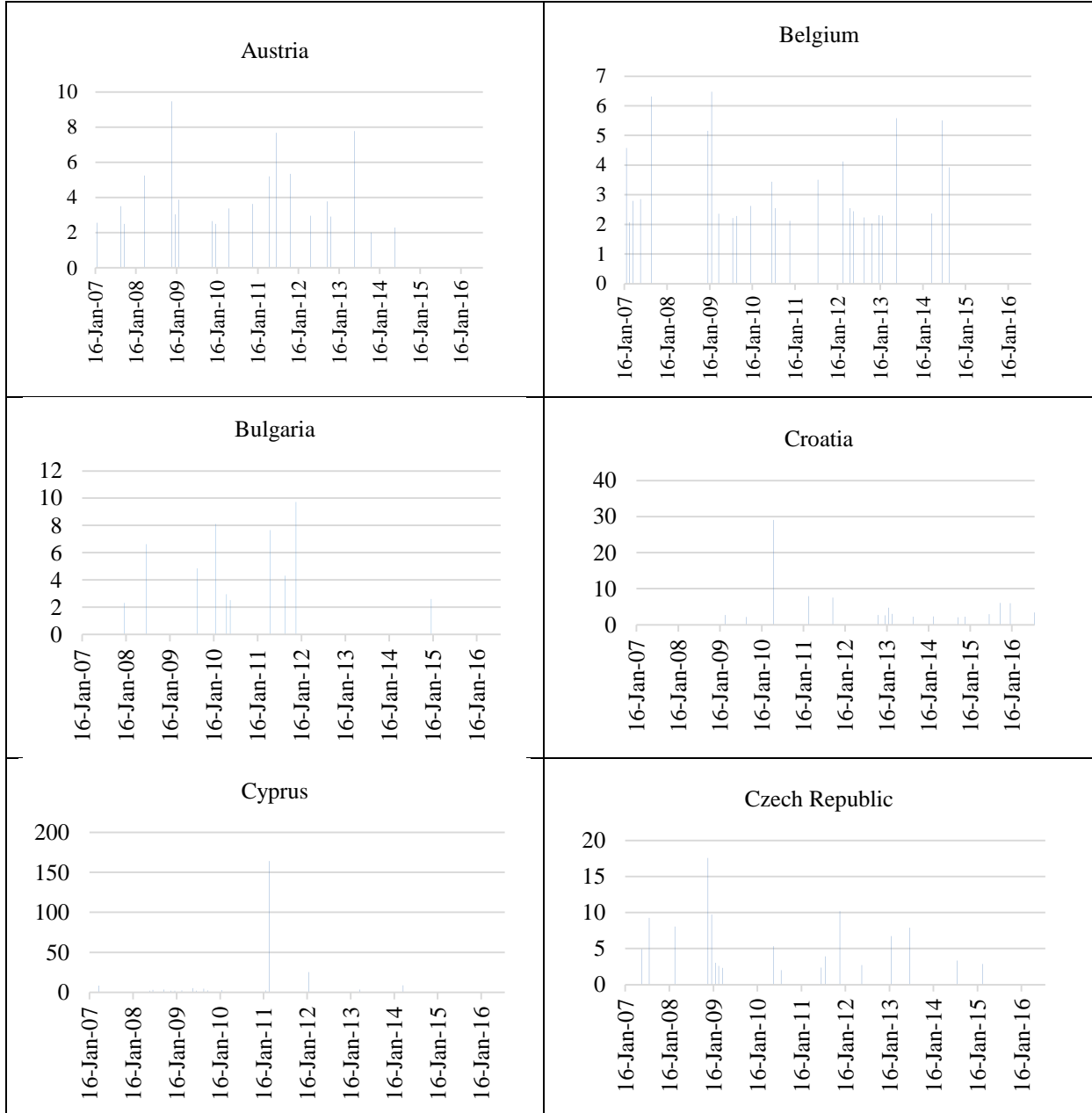
#### **Electronic resources**

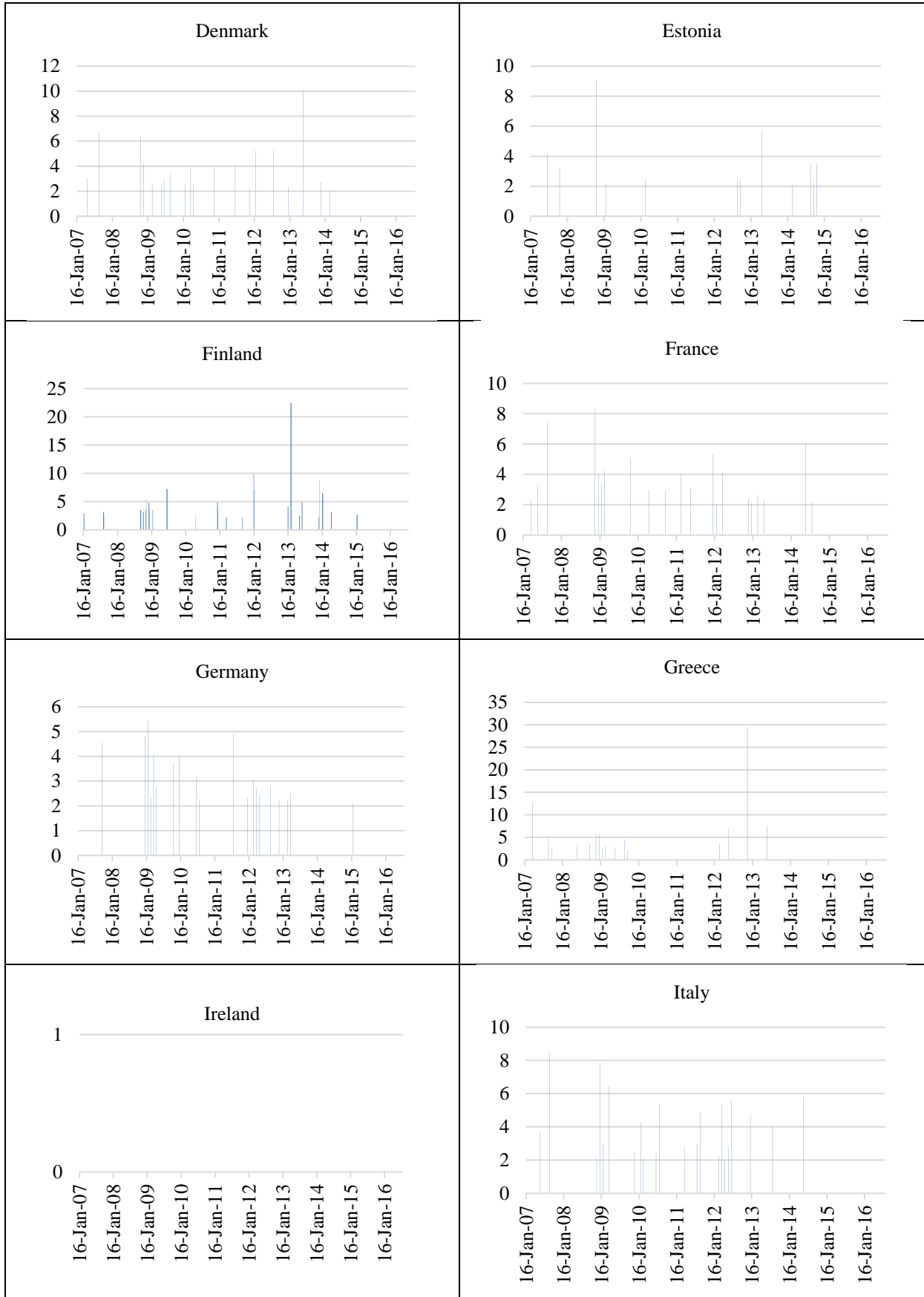
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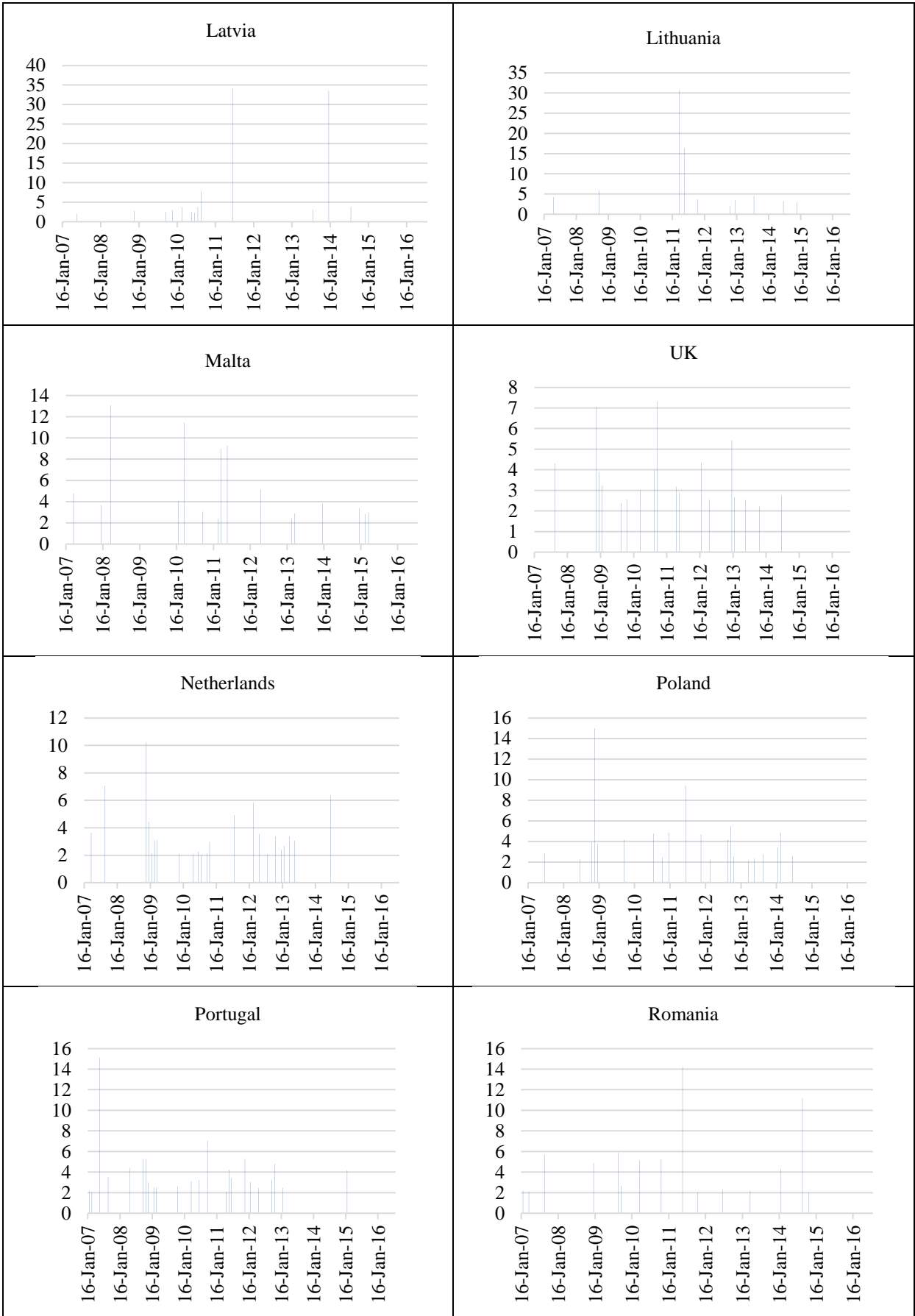
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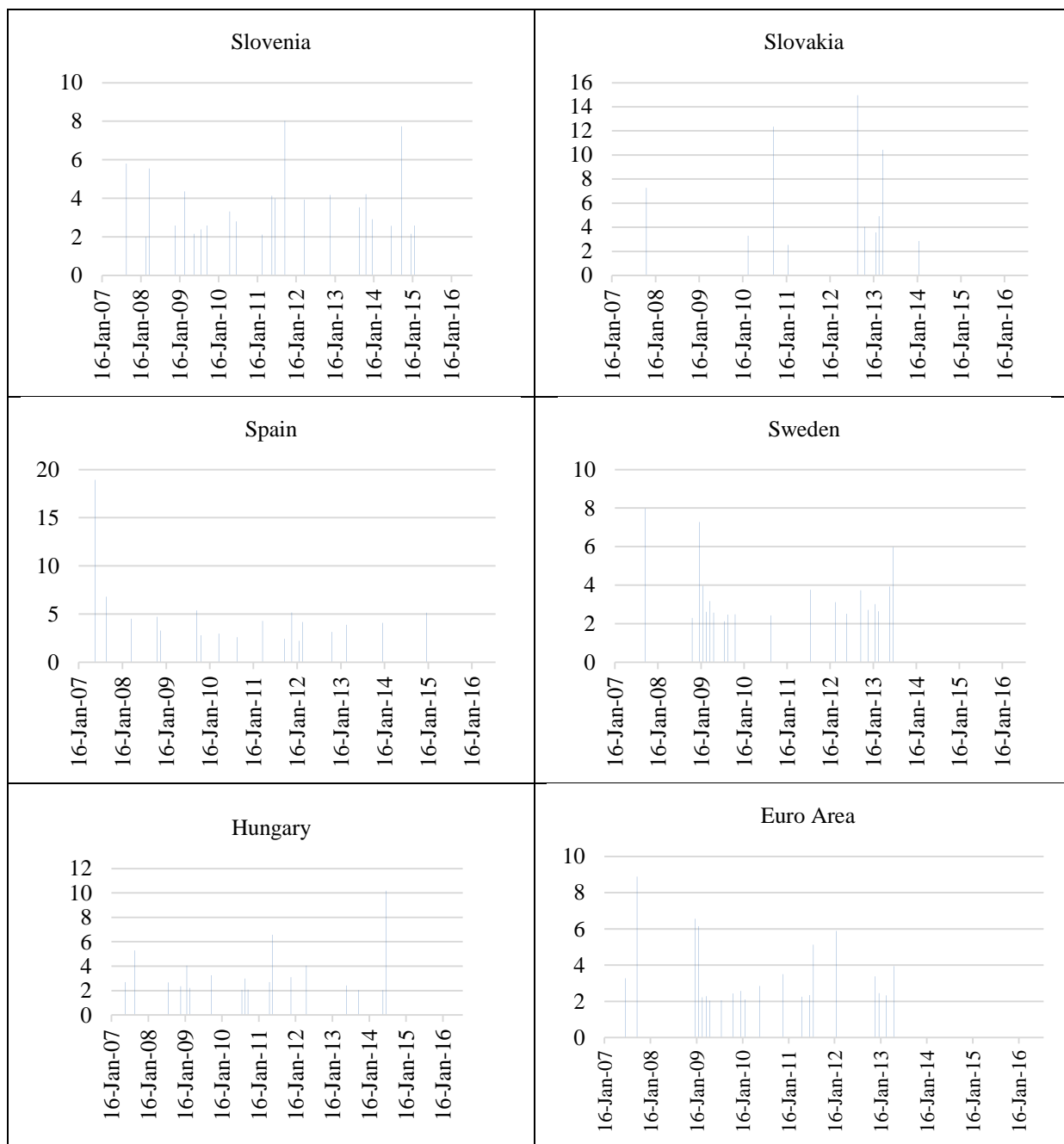
**Frequency and Amplitude of Significant Changes in European Stock Markets to Changes in the Sentiment**





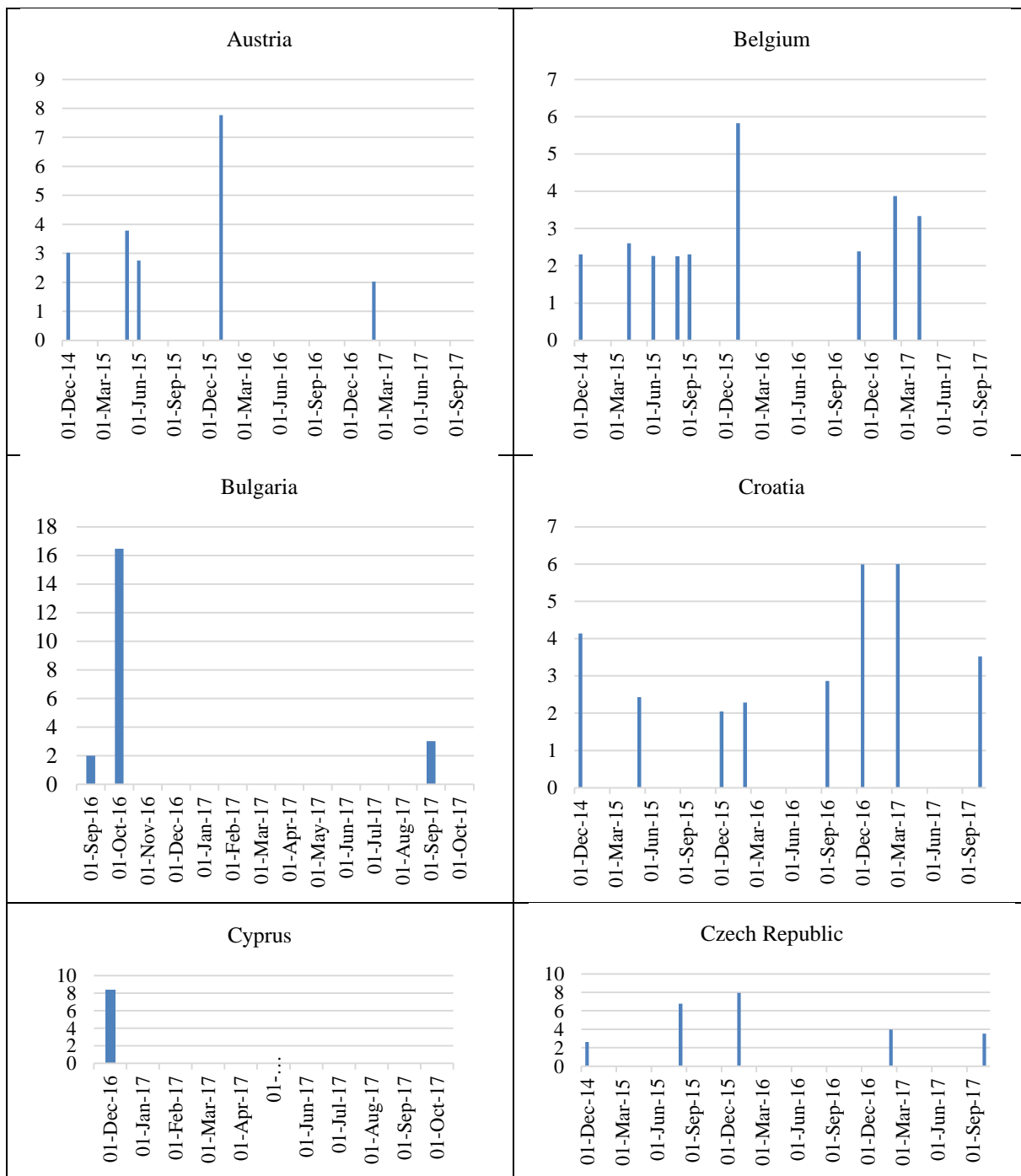


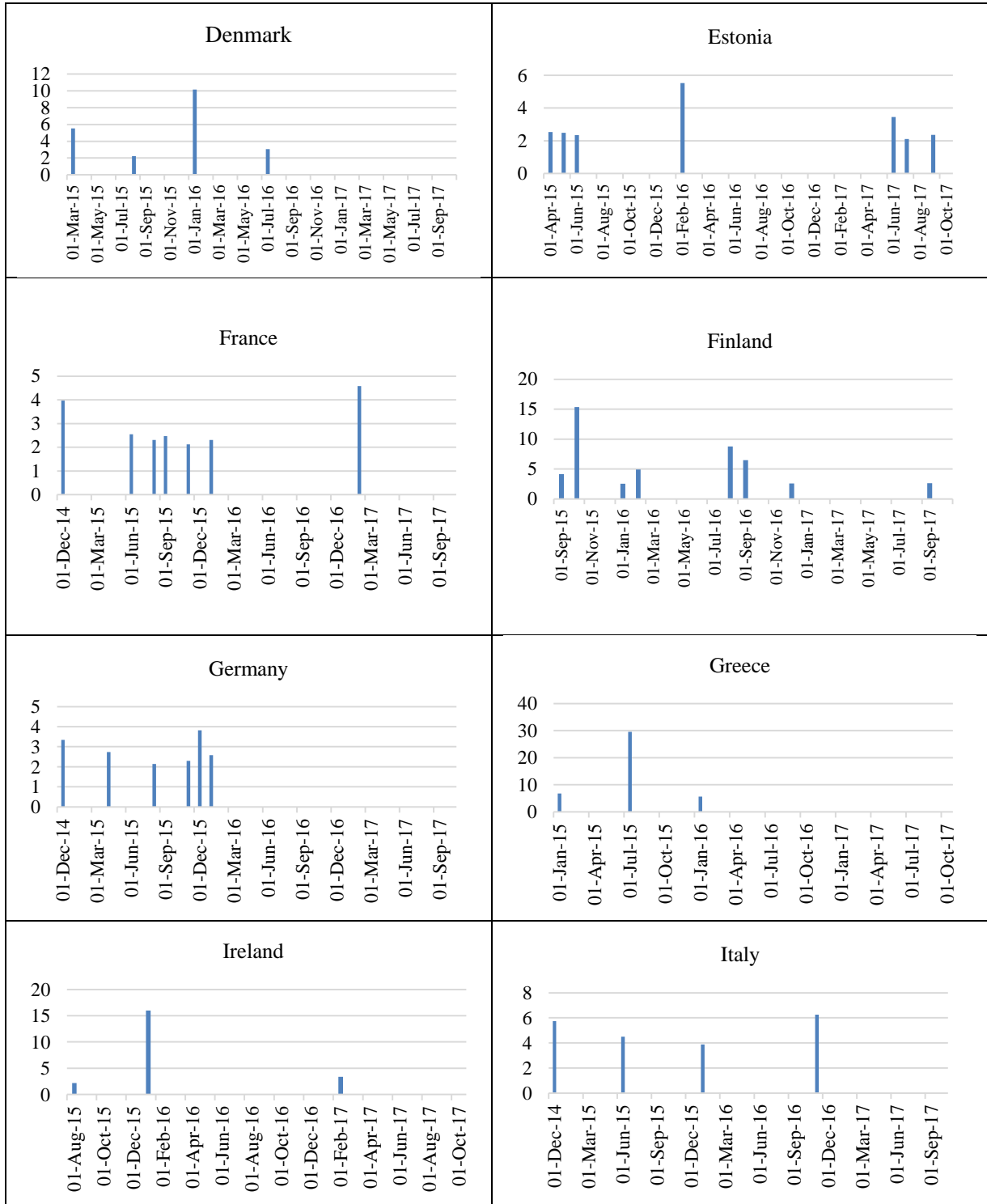


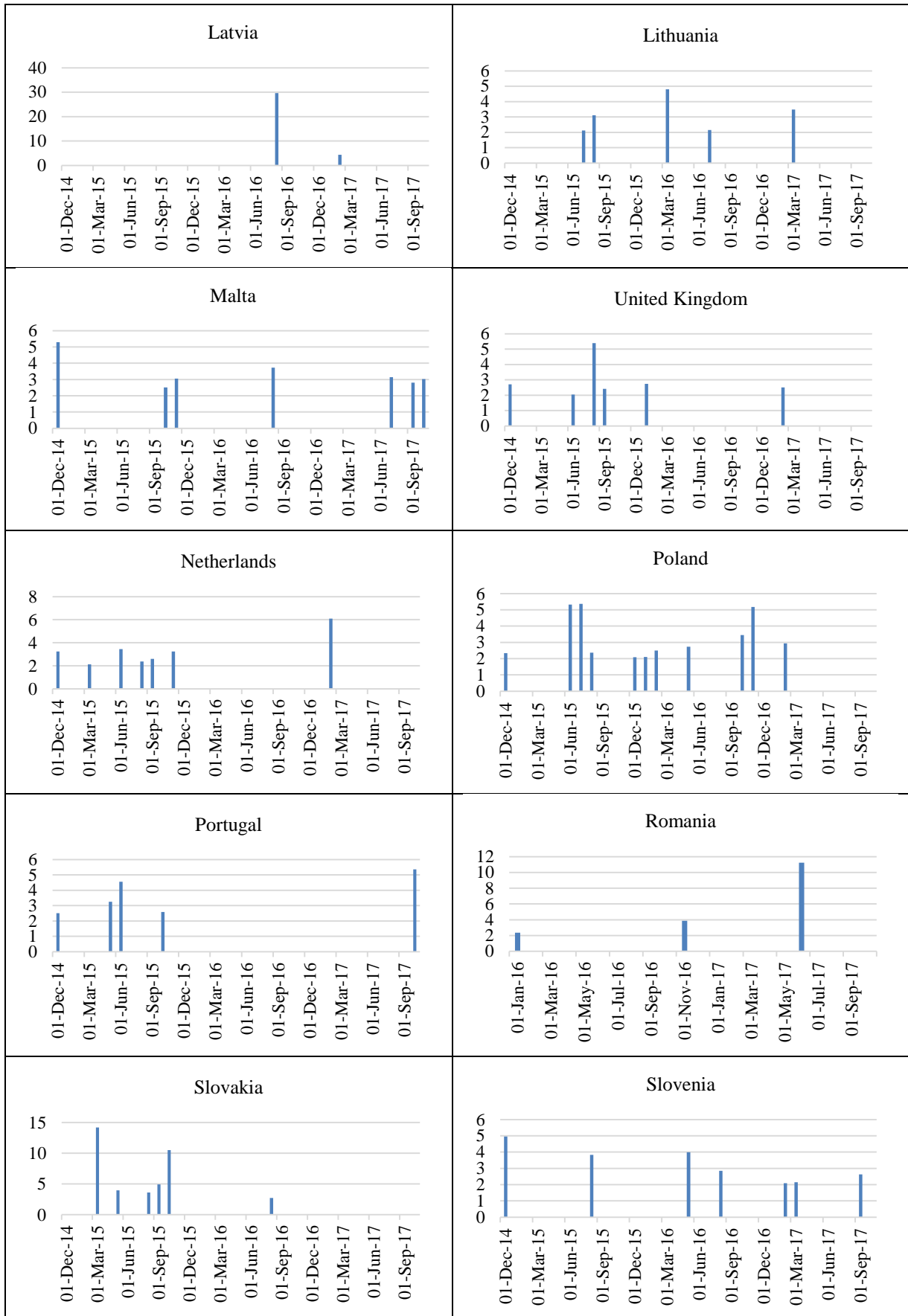


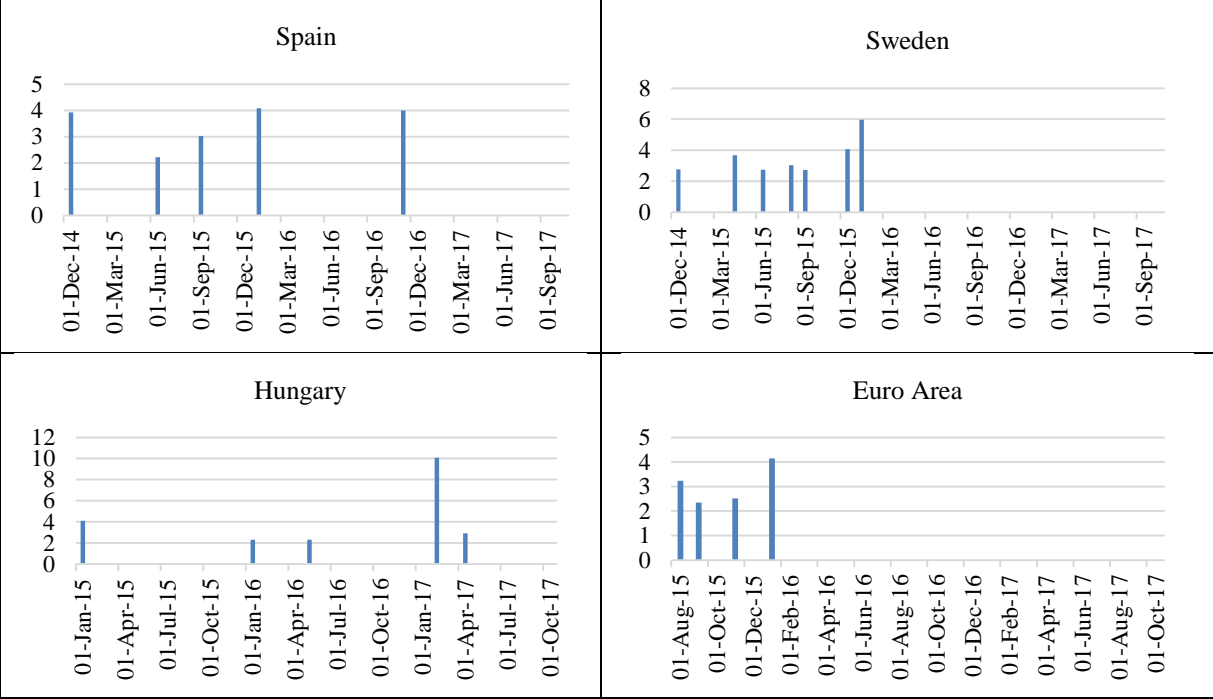
Source: Authors' processing using Bloomberg and European Commission data

### Frequency and Amplitude of Significant Changes in European Stock Markets to PMI Changes









Source: Authors' processing using Bloomberg and Markit Economics data.