Systemic risk of European institutions: estimation and ranking by Marginal Expected Shortfall

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Abstract: The task of processing a systemic event and its negative externalities requires approaches to measure systemic risks and break it down into contributions of different institutions. The objective of this paper is to assess systemic risk in European banks during the period following the 2007 financial crisis. To do so, we estimated the systemic risk of a sample of 281 European institutions from January 01, 2006 to December 31, 2012. We used the Marginal Expected Shortfall (MES) to measure systemic risk. The results showed that the total systemic risk supported by European banks is very high. Moreover, the contribution of financial institutions in the risk of their system is very important. This prompted the international authorities to intervene, as the case of the countries of the Euro zone, where the IMF, the ECB and the WB intervened but lead to a permanent solution to the accumulation of systemic risk.

Keywords: Systemic risk; MES; euro zone; DECO-GARCH

JEL Classifications: D53; E02; E44; G21; G32

1. Introduction

The failure of some financial institutions such as Lehman Brothers, Northern Rock and HRE after the financial crisis of 2007 showed that the failure of a single firm may have a negative and significant impact on the financial system as a whole. Therefore, the approach of specific firm or micro-prudential is not sufficient to promote the financial stability. Careful evaluation of the contribution of a financial company in the systemic risk should be an important part in the macro-prudential financial supervision (Puzanova and Duellmann, 2013).

The risk which refers to a financial system as a whole is often treated as a systemic risk. This term was defined as the risk of financial collapse with loss in the overall system.

The task of processing a systemic event and its negative externalities requires approaches to measure systemic risks and break it down into contributions of different institutions. In addition, the macro-prudential approach will be based on measurements of the magnitude of the potential loss or the cost associated with systemic events on procedures for the establishment of an adequate capital base in the financial system absorbs this cost.

The systemic risk measures took into account the risk of extreme losses for a financial company in the event of market disruption. Many methods of assessing systemic risk and the contribution of risk were discussed in the financial literature. Several recent approaches have been developed to detect the extreme risk of a financial system by examining the direct and indirect links of the financial sector. The market prices of financial instruments and credit risk modeling have already been used in the literature to measure systemic risk. Acharya et al. (2012) and Brownlees and Engle (2012) proposed an economic and statistical approach to measuring systemic risk of banks. The externality that generates systemic risk is the tendency of a financial institution to be undercapitalized when the financial system as a whole is under-capitalized (Acharya et al., 2012).

The CoRisk analysis is based on the analysis developed by Adrian CoVaR and Brunnermeier (2008, 2011). This analysis is introduced by Chan-Lau (2010), in which he studied the risk of interdependence between the various financial institutions. The CoRisk analysis can be defined as a risk measurement Codependency between financial institutions. In his study, Chan-Lau (2010) measured the default risk of the transmission of a bank to another bank or the entire financial system. The risk of Codependency (CoRisk) can be estimated by the quantile regression method developed for the first time by Koenker and Basset (1978).

Chan-Lau used the VaR to measure systemic risk. The estimation method is the bivariate quantile regression. The data used in this study are the values of CDS spreads. The inputs used to measure systemic risk are implied default probabilities CDS. Chan-Lau measured in his study the default probabilities for 26 banks. The study period is from May 2, 2003 to February 27, 2009. The main idea of this study is to calculate the impact of the bankruptcy of a bank in the probability of default of other banks.

Brownlees and Engle (2011) proposed a new model of systemic risk. The model developed by its two authors is named the SRISK (ShortRISK). The SRISK measures the contribution of a financial institution to systemic risk and systemic risk across the financial system as a whole. The SRISK index of an institution is determined by the projected shortage of capital of this company in the event of a systemic event that defined as a substantial decrease in the market in a given time horizon. The shortage depends on the level of indebtedness of a firm, its size and its loss of such conditional capital, which is defined as the expected deficit marginal (Marginal Expected Shortfall (MES)).

Brownlees and Engle (2011) proved that companies with a high SRISK are those that have a strong contribution to the underfunding of the financial market in times of crisis. Its companies are considered those most systemically risky. The sum of SRISK of the entire financial system is the potential shortage of capital that the government is under pressure to recapitalize its policy in this capital. Conceptually this type of calculation is similar to the fault tests that are consistently applied to financial institutions. This type of calculation is based on publicly available information and is inexpensive.

Brownless and Engle (2011) used the same sample used by Acharya et al. (2010). They split the sample into four groups of US firms that have a market capitalization of more than 5 billion dollars at the end of June 2007. The four groups are repositories (29 institutions), brokers (32 institutions), companies Insurance (10 institutions) and non-depository institutions (23 institutions). The study period began in June 3, 2000 to June 30, 2010.

Its two authors measured the systemic risk by Expected Shortfall technique. Their results are obtained using two methods for estimating the conditional correlation (Conditional Correlation: DCC-GARCH) and simulation Monte Carlo (Monte Carlo Simulation). The inputs of their approach are virtually asset returns that are obtained from the data on stock prices and balance sheet data.

Acharya et al. (2009, 2010, and 2012) have developed a new model for measuring systemic risk. This model is named the Systemic Expected Shortfall (SES) or the expected systemic deficit. Acharya et al. (2009, 2010, and 2012) showed that the SES is measurable and it can observe the level of indebtedness of an institution, its volatility, and the volatility of the financial system, the correlation between the financial system and the institution and appearance finally a systemic crisis.

Acharya et al. (2009, 2010, and 2012) proposed a measure of systemic risk for 102 American firms grouped into four groups. They used to estimate the expected shortfall systemic risk. Their empirical validation is done on the basis of balance sheet data and stock prices. Operated the study period is almost one year (June 2006 to June 2007). Moreover, they used the law of Gaussian and Power law as estimation methods following a sampling and made empirical scale. The authors have proposed a simple and intuitive method to measure the contribution of each bank systemic risk and thus, to propose some means of limiting this risk. Their studies have verified the importance of the debt level of firms in their contributions to systemic risk.

The objective of this paper is to assess systemic risk in European banks. This objective is only a quantification of the propagation of default in European banking systems mainly during the

period following the 2007 financial crisis. Then, we used the Marginal Expected Shortfall (MES) to estimate the systemic risk of a sample of 281 European institutions of 16 countries for the period from January 01, 2006 to December 31, 2012. Also, we proceed in ranking of European institutions based on the level of their contributions on the systemic risk.
The rest of this paper is organized as follow. Section 2 presents econometric methodology. Section 3, summarizes data characteristics used in our study. In section 4, we analyze and interpret the empirical results. Finally, section 5 concludes.

2. Methodology

The MES is the marginal contribution of an institution to systemic risk i system. This contribution is measured by the Expected Shortfall (ES). MES The measure was proposed for the first time by Acharya et al. (2010) and it was developed to a conditional release by Brownlees and Engle (2012).

By definition The Expected Shortfall (ES) or deficit under the threshold $\alpha\%$ is expected to return $\alpha\%$, but, it can be beneficial when it exceeds a given threshold C. Expected Shortfall conditional of a system is given by:

$$ES_{mt}(C) = \mathrm{E}_{t-1}\left(r_{mt} \left| r_{mt} < C\right.\right) = \sum_{i=1}^{N} w_{it} \mathrm{E}_{t-1}\left(r_{it} \left| r_{mt} < C\right.\right) \quad (2)$$

Then the MES is the partial derivative of ES system relative to the proportion of the company *i* in the economy.

$$MES_{it}(C) = \frac{\partial ES_{mt}(C)}{\partial w_{it}} = \mathrm{E}_{t-1}\left(r_{it} \left| r_{mt} < C\right.\right) \quad (3)$$

The MES can be considered an extension to the concept of marginal VaR proposed by Jorion (2007) to the expected shortfall is a risk measure introduced by Artzner et al. (1999).

The measurement MES the increased risk for the system (measured by ES) induced a slight increase in the value of the firm i in the system. More MES of a firm, the higher its individual contribution to the financial system risk is high.

MES template extension is the expected systemic deficit (Systemic Expected Shortfall). The SES is the reduction of the amount of a bank's capital below its target level (defined as a fraction of the assets k) in the case of a global systemic crisis:

$$\frac{SES_{it}}{W_{it}} = kL_{it} - 1 - \mathrm{E}_{t-1}\left(r_{it} \left| \sum_{i=1}^{N} W_{it} < k \sum_{i=1}^{N} A_{it} \right. \right) \tag{4}$$

Where, L_{it} means the leveraged A_{it} refers to the total assets and W_{it} means the market capitalization or market value of equity. The term conditional expectation can be expressed as a linear function of MES (Acharya et al., 2010):

$$SES_{it} = \left(kL_{it} - 1 + \theta MES_{it} + \Delta_i \right) W_{it} \tag{5}$$

Where, θ and Δ_i are constants.

The calculation is made by the MES the DECO-GARCH art proposed by Brownlees and Engle (2012). Documentation for DECO models will be formulated for many performance series. Consider a vector N series different return $r_t = \left[r_{1,t}, \ldots, r_{N,t} \right]$ where all series have been lowered. In addition, conditional covariance matrix can be defined for all performance series like $\mathrm{E}_{t-1}\left[r_t r_t^{'} \right] = H_t$. We can continue to decompose H_t as follows:

$$H_t = D_t R_t D_t \tag{6}$$

where $H_t = diag(\sigma_{i,t})$ to $i = (1,2)$. $\sigma_{i,t}$ is the conditional volatility of the performance series and represents the i th diagonal entry H_t.

Finally, R_t is the conditional correlation matrix of two return series. The DECO-GARCH puts specific parametric assumptions for the evolution of D_t and R_t separately.

The conditional variance of each series of individual performance is modeled like a standard GARCH process:

$$\mathrm{E}_{t-1}\left[r_{i,t}^2 \right] = \sigma_{i,t}^2 \tag{7}$$

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \beta \sigma_{t-1}^2 \tag{8}$$

Using the standard GARCH model, we can estimate residues for each series of performance after we adjusted the univariate GARCH model. Formally, these are defined as follows:

$$\varepsilon_{i,t} = \frac{r_{i,t}}{\sigma_{i,t}} \tag{9}$$

In addition, the vector of residuals volatility $\varepsilon_t = \left[\varepsilon_{1,t}, \ldots, \varepsilon_{N,t} \right]^{'}$ presents the same correlation structure as the original two return series.

The DECO-GARCH model assumes a specific parametric assumption for the conditional correlation matrix. Then, at a given date DECO-GARCH model assumes that all pairwise correlations are identical. It turns out that, despite the appearance of strong restrictions, the DECO model can provide consistent estimates of DCC parameters in large systems. The correlation matrix is defined as an equi-correlation matrix and evolves as:

$$R_t = \left(1-\rho_t\right) I_N + \rho_t J_N \tag{10}$$

$$\rho_t = \frac{2}{N(N-1)} \sum_{i>j} \frac{q_{i,j,t}}{\sqrt{q_{i,i,t} q_{j,j,t}}} \tag{11}$$

$$\bar{q}_{i,j,t} = \rho_{i,j} + \alpha_{DECO}(\varepsilon_{i,t-1}\varepsilon_{j,t-1} - \bar{\rho}_{i,j}) + \beta_{DECO}(q_{i,j,t-1} - \bar{\rho}_{i,j}) \tag{12}$$

Where $\bar{\rho}_{i,j}$ is the unconditional correlation between $\varepsilon_{i,t}$ and $\varepsilon_{j,t}$. The complete specification GARCH-DECO is therefore obtained partner after the modeling of the univariate return series have individual GARCH processes and their standardized residual series as a DECO process. The complete specification of DECO-GARCH is obtained after modeling univariate performance series by an individual GARCH process and their residual normalized set as a process DECO.

All parameters $\left(\omega_{i=1,2}; \alpha_{DECO}; \beta_{DECO}\right)$ DECO-GARCH model are estimated by maximum likelihood system.

To implement the maximum likelihood, we assume that the accumulated performance series $r_t = \left[r_{1,t}, r_{2,t}\right]'$ is normally with a conditional multivariate covariance H_t as defined above. Thus, it is assumed that $r_t \sim N\left(0, H_t\right)$ leads to the natural definition of the function of maximum likelihood. It can be shown that the probability function can be decomposed into a volatile component and a correlation component, which naturally leads to an estimation procedure in two stages. First, we estimate univariate GARCH models to each series of performance. Then, using the estimated residuals $\varepsilon_t = \left[\varepsilon_{1,t}, \varepsilon_{2,t}\right]' = D_t^{-1} r_t$.

We can estimate the correlation parameters α_{DECO} and β_{DECO} by maximizing the following function:

$$L_c\left(\alpha_{DECO}, \beta_{DECO}\right) = -\frac{1}{2}\sum_t \left(\log\left|R_t\right| + \varepsilon_t' R_t^{-1} \varepsilon_t - \varepsilon_t' \varepsilon_t'\right) \tag{13}$$

As in the GARCH models require that $\alpha_{DECO} > 0, \beta_{DECO} > 0, \alpha_{DECO} + \beta_{DECO} < 1$.

After estimating the correlations (DECO), we can present the SRISK model used for the calculation of systemic risk.

The return of firm i and procurement are as follows:

$$r_{mt} = \sigma_{mt}\varepsilon_{mt} \tag{14}$$

$$r_{it} = \sigma_{it}\rho_{it}\varepsilon_{mt} + \sigma_{it}\sqrt{1-\rho_{it}^2}\xi_{it} \tag{15}$$

For any event conditioned by a threshold C:

$$\begin{aligned} ES_{mt}(C) &= \mathrm{E}_{t-1}\left(r_{mt} \middle| r_{mt} < C\right) \\ &= \sigma_{it}\rho_{it}\mathrm{E}_{t-1}\left(\varepsilon_{mt} \middle| \varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) \\ &\quad + \sigma_{it}\sqrt{1-\rho_{it}^2}\mathrm{E}_{t-1}\left(\xi_{it} \middle| \varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) \end{aligned} \tag{16}$$

Based on the hypothesis that ε_{mt} and ξ_{it} are independent, we get:

$$\begin{aligned} ES_{mt}(C) &= \mathrm{E}_{t-1}\left(r_{mt} \middle| r_{mt} < C\right) \\ &= \sigma_{it}\rho_{it}\mathrm{E}_{t-1}\left(\varepsilon_{mt} \middle| \varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) \\ &\quad + \underbrace{\sigma_{it}\sqrt{1-\rho_{it}^2}\mathrm{E}_{t-1}\left(\xi_{it} \middle| \varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right)}_{0} \\ &= \sigma_{it}\rho_{it}\mathrm{E}_{t-1}\left(\varepsilon_{mt} \middle| \varepsilon_{mt} < \frac{C}{\sigma_{mt}}\right) \end{aligned} \tag{17}$$

You can also write,

$$ES_{mt}(C) = \sigma_{it}\rho_{it}\mathrm{E}_{t-1}\left(\varepsilon_{mt} \middle| r_{mt} < C\right) \tag{18}$$

In addition, the volatility of the beta of firm i over time is expressed by equation (19):

$$\beta_{it} = \frac{\mathrm{cov}\left(r_{it}, r_{mt}\right)}{\mathrm{var}\left(r_{mt}\right)} = \frac{\sigma_{it}\rho_{it}}{\sigma_{mt}} \tag{19}$$

By combining the equation beta to equation (18) returns:

$$\begin{aligned} ES_{mt}(C) &= \sigma_{it}\rho_{it}\mathrm{E}_{t-1}\left(\varepsilon_{mt}\left|r_{mt} < C\right.\right) \\ &= \beta_{it}\sigma_{mt}\mathrm{E}_{t-1}\left(\varepsilon_{mt}\left|r_{mt} < C\right.\right) \\ &= \beta_{it}\mathrm{E}_{t-1}\left(r_{mt}\left|r_{mt} < C\right.\right) \end{aligned} \tag{20}$$

The MES is expressed as the product of the beta that varies in time and the expected return of the market at a given threshold C.

The deficit anticipated market performance $ES_{mt}(\alpha)$ matches the expected market return for a given threshold equal to the conditional VaR (Jorion, 2007) $C = VaR_{mt}(\alpha)$:

$$ES_{mt}(\alpha) = \mathrm{E}_{t-1}\left(r_{mt}\left|r_{mt} < VaR_{mt}(\alpha)\right.\right) \tag{21}$$

Thus, the MES a firm i at a given threshold $C = VaR_{mt}(\alpha)$, Is denoted $MES_{it}(\alpha)$ and expressed by the product between the beta and the expected deficit market performance.

$$MES_{it}(\alpha) = \beta_{it}ES_{mt}(\alpha) \tag{22}$$

The expected deficit systemic (SES) is given by:

$$\begin{aligned} SES_{it}(\alpha) &= \left(kL_{it} - 1 + \theta MES_{it}(\alpha) + \Delta_i\right)W_{it} \\ &= \left(kL_{it} - 1 + \theta\beta_{it}ES_{mt}(\alpha) + \Delta_i\right)W_{it} \end{aligned} \tag{23}$$

The expression of ES and SS for the market performance can be expressed while assuming that ε_{mt} is characterized by a normal standard distribution. Thus, we obtain:

$$VaR_{mt}(\alpha) = \sigma_{mt}\Phi^{-1}(\alpha) \tag{24}$$

Therefore,

$$ES_{mt}(\alpha) = \frac{-\sigma_{mt}\phi(\Phi^{-1}(\alpha))}{\alpha} \tag{25}$$

Where, $\phi(.)$ and $\Phi(.)$ mean respectively the normal standard distribution function and probability and function of the cumulative distribution. The ESM is expressed as follows:

$$MES_{it}(\alpha) = -\beta_{it}\sigma_{mt}\lambda(\Phi^{-1}(\alpha)) \tag{26}$$

Where, $\lambda(z) = \dfrac{\phi(z)}{\Phi(z)}$ noted the Mills ratio.

The determination of the MES has two consequences main. First, on a given date, systemic risk ranking of financial institutions based on the ESM (in absolute value) is strictly equivalent to the rankings that would be produced by the sort of businesses based on their betas.

Indeed, the higher return of a company is sensitive to market performance over its systemic risk. Therefore, to identify companies that have the greatest systemic risk, simply resort to their highest betas.

Secondly, for a given financial institution, the time profile of the systemic risk measured by its MES can be different from the evolution of its systematic risk measured by its beta conditional. For an ES variable market over time, predicting the systematic risk of the firm i can not be sufficient to predict the future evolution of its contribution to systemic risk.

3. Data

The sample used in this article is made up of 281 European financial institutions belong to the 16 countries of the euro zone. The structure of our sample is homogeneous since it is composed only of banks. The choice of these banks is justified by the availability of data and the context of deficit of European financial institutions. In addition, we have retained in our work only banks that exist in the financial market during the study period chosen in our research work.

Different countries used in our doctoral thesis as well as the number of banks in each country are given in Table 1. The study period is from January 1, 2006 to December 31, 2012. This period was characterized by the declaration of the bankruptcy of several banks following the outbreak of the financial crisis of 2007.

In Appendix 1, we presented a list of different libraries used in our research. The choice of its banks is justified by the level of systemic risk in European countries.

In Figure 1, we presented the evolution of systemic risk in European banks. From this figure, we noticed that the systemic risk in the euro zone peaked in the fourth quarter of 2008 and the first quarter of 2009. This period corresponds to the early onset of the liquidity crisis and debt in Euro zone. The maximum value of the European Systemic Risk financial institutions is equal to USD 2.3 trillion in late 2008. Following the stimulus applied by the authorities of

European international and national regulations, the risk decreased to the beginning of the year 2011 it equals 1.4 trillion USD. After that period and following the outbreak of the sovereign debt crisis in Europe, systemic risk has increased that he reach 2 trillion USD in the second half of 2011 until the end of the second half of 2012.

In Figure 2, we presented the level of systemic risk, measured by the SRISK, each European country in the late fourth quarter of 2012. According to this figure, we noticed that France (320 billion USD), Britain (270 billion USD), Germany (USD 150 billion), and Italy (80 billion USD) have high levels of systemic risk compared to other European countries.

In Figure 3, we presented the systemic risk contribution in the GDP of each European country. From this figure, we found that France (11.5%), Britain (10%) and Greece (10%) have the ratio SRISK/highest GDP compared to other European countries.

In Figure 4, we presented the contribution of systemic risk in the market capitalization of individual banks in each European country. From this figure, we found that Greece (147%), France (88%) and Germany (60%) have the ratio SRISK/Market capitalization highest compared to other European countries.

In Figure 5, we presented the systemic risk contribution in the total assets of individual banks in each European country. From this figure, we found that Greece (4.2%), France (3.7%) and Germany (2.9%) showed the ratio SRISK/Total Assets highest compared to other European countries.

According to this preliminary analysis, we found that Greece and France are the most affected by the 2007 financial crisis by analyzing the level of systemic risk of financial institutions of his country.

Table 1: The sample

Country	**Number of bank**
Austria	6
Belgium	15
Denmark	5
Finland	5
France	38
Germany	21
Greece	12
Italy	25
Netherlands	8

Norway	7
Poland	12
Spain	10
Suede	22
Switzerland	27
Turkish	19
Great Britain	49
Total	281

Figure 1: The evolution of systemic risk (as measured by SRISK) of the European institutions (billion USD)

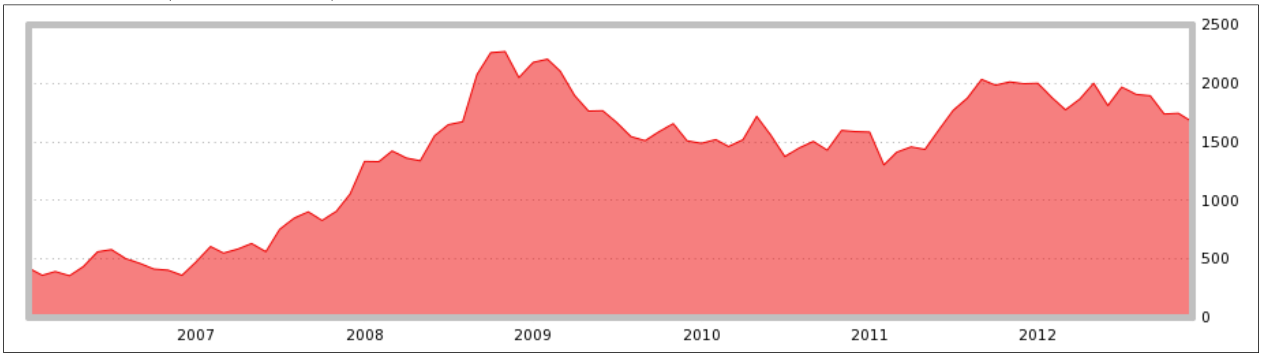


Figure 2: The evolution of systemic risk (as measured by SRISK) European countries (billion USD) in December 31, 2012

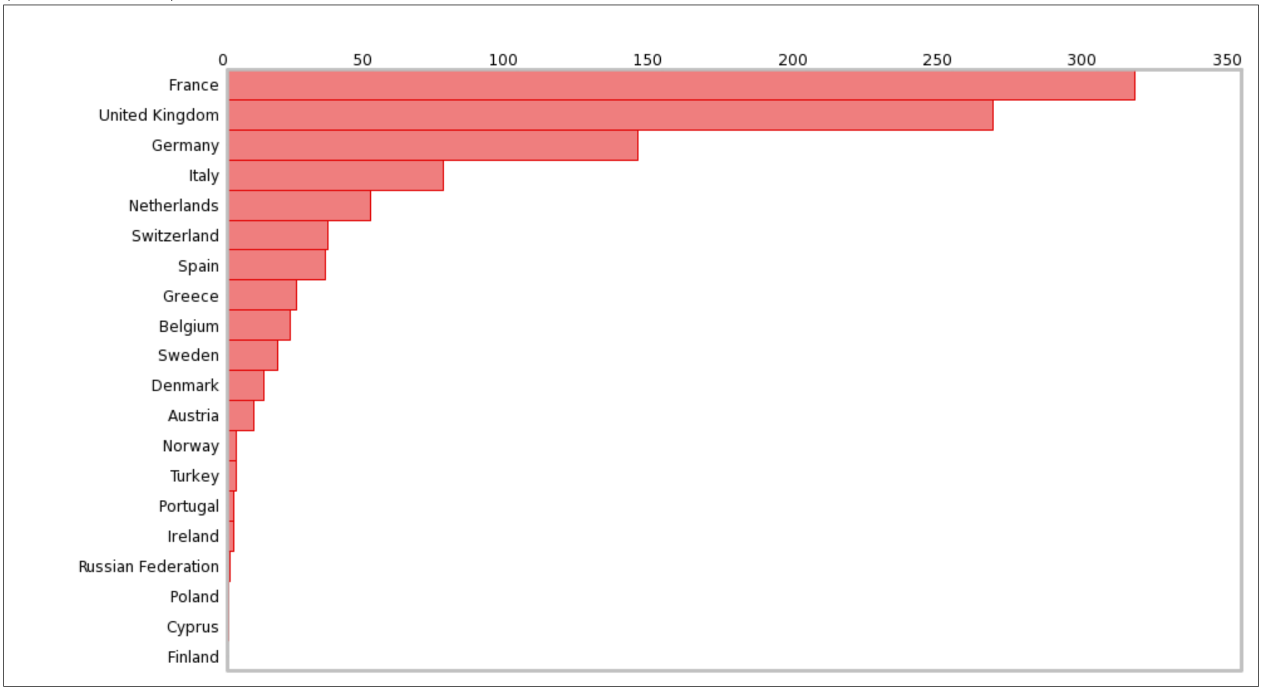


Figure 3: The ratio SRISK / GDP for the European countries in December 31, 2012

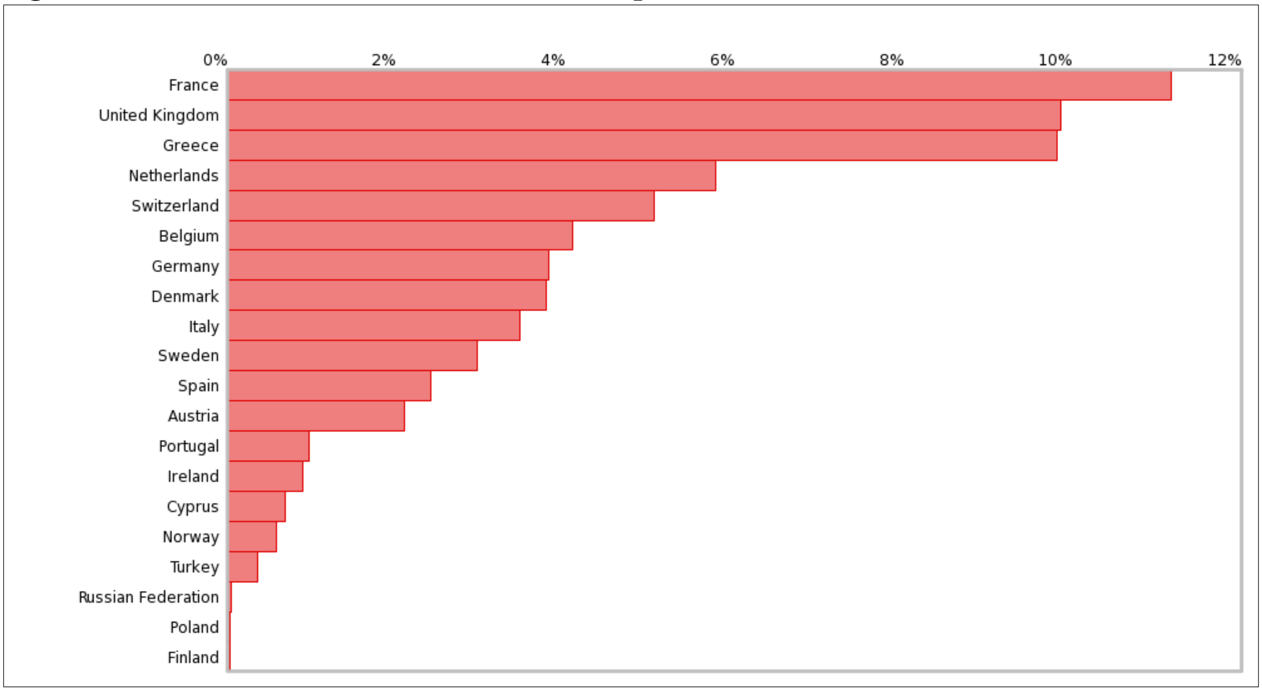


Figure 4: The ratio SRISK / Market capitalization for European countries in December 31, 2012

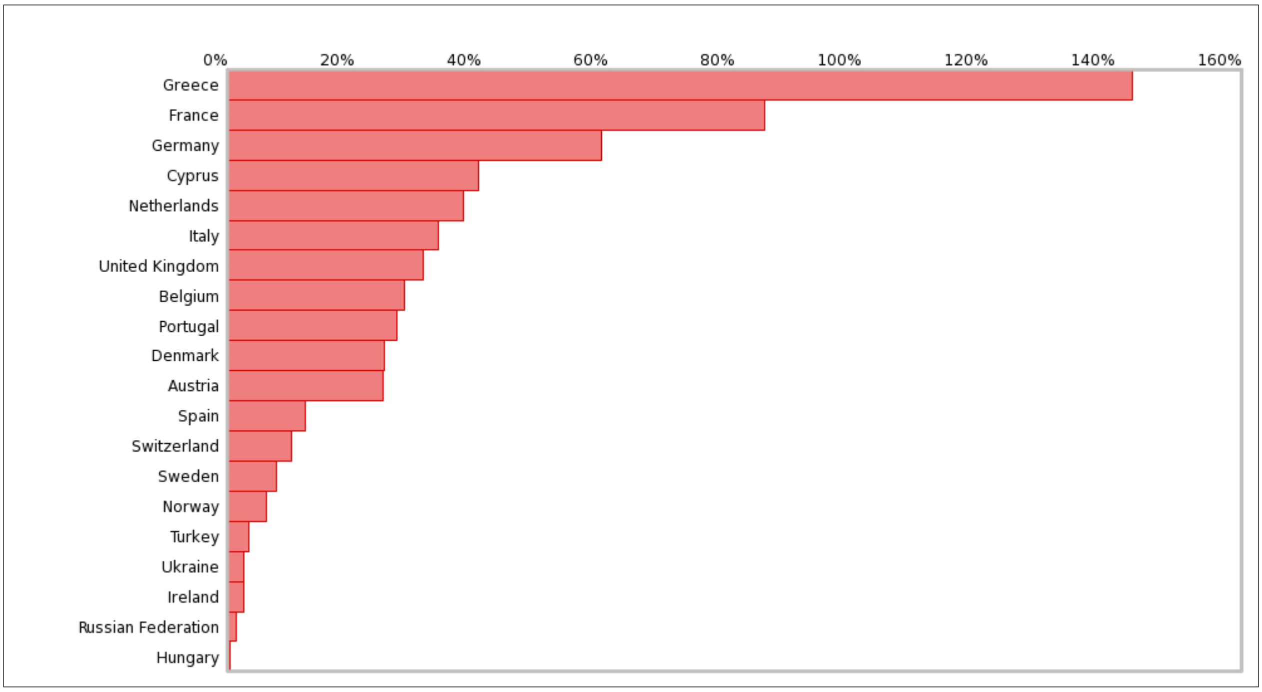
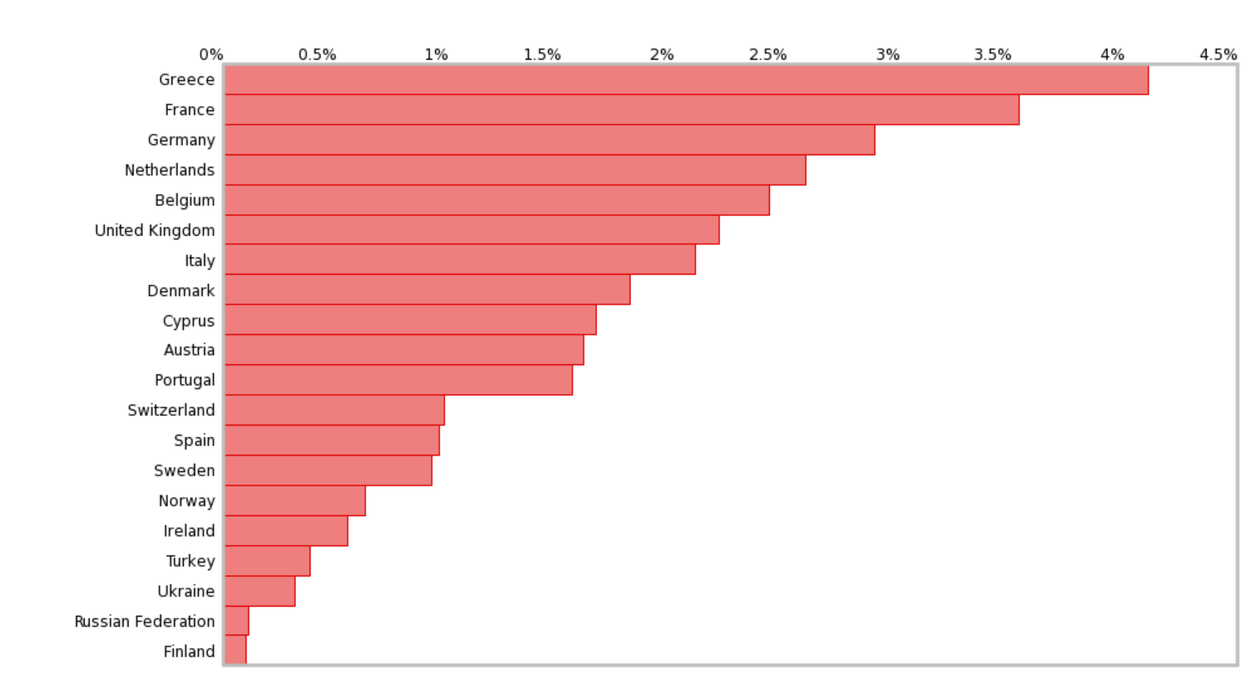


Figure 5: The SRISK / Total Assets ratio for European countries in December 31, 201



4. Results

We estimated the systemic risk measured by MES technique for different banks used in this paper for a period of 7 years (from January 1, 2006 to December 31, 2012). We used the methodology DECO-GARCH to estimate the correlation between the performance of a bank and the return the market to which it belongs.

In table 2, we presented descriptive statistics for the correlation between each bank and the system in which it operates. This correlation is estimated by maximum likelihood using the methodology DECO-GARCH (1,1).

According to Table 2, we observed that on average banks of Germany (0.73), Belgium (0.68), Norway (0.68), Sweden (0.68), and Italy (0.67) have the highest dynamic equicorrelation with their systems which they operate. This level reflects the correlation dependence between banks returns of its country and the performance of their markets. Furthermore, this correlation is positive. From this positive sign, we can define the risk factors relating to the market is one of the main factors of the performance of banks in our sample. Thus, this high level of correlation can justify the spread of systemic risk of European banks. The level of risk measured by the standard deviation of the correlation between the performance of banks and the system efficiency is low since it is less than 1.

In Table 3, we presented the descriptive statistics for the MES variable which is the expected loss for each dollar invested in the capital of a bank when the market down 2% for one day.

The capital of each bank marginal loss compared to the total loss of the system evolves with a fairly significant rate because of the dependency relationship between the banks of the euro zone and systems which they operate. According to this table, we noticed that on average banks of Turkish (3.070197), Sweden (3.059716), Poland (2.903542), Italy (2.81945), and Austria (2.766458) have the highest values in the MES. Thus, we noticed that the banks of Belgium (10.82), Austria (9.06), Greece (7.74), Italy (7.5), Norway (7.06), and Spain (6.98) are the maximum values of the highest MES during the period of study. This proves that the expected loss of the amounts invested in the capital of European banks is high. Thus, the presence of a positive and strong correlation and accumulation expected losses in the capital of European financial institutions justify the spread of systemic events and subsequently the beginning of a systemic crisis.

Descriptive statistics on the volatility of the equity of the different banks in the Euro zone are presented in Table 5. The results presented in this table, we found that on average equity of banks that belong to banking systems of Turkish (50.60789), Greece (47.33462), Austria (47.00208), Spain (41.33), Finland (39.6725), Poland (39.41979), Sweden (38.58977), and Norway (38).

In Table 5, we presented the descriptive statistics of the average leverage of banks in each European country. In fact, the leverage is equal to a book value of liabilities of a bank divided by the market value of equity. From this table, we noticed that on average banks of Greece (45.01981), Belgium (43.29625), Germany (26.0219), Italy (16.7135), Norway (14.61071), and Spain (14.40863) have the highest leverage among banks of the other countries mentioned in our research. In addition, banks in Belgium (279.1939) And Greece (101367) Have the volatility of the higher leverage compared to other banks in our sample.

Table 2: Descriptive Statistics of the DECO-GARCH (1,1) of European banks

(The sample is composed of 281 European banks during the period 01/01/2006 - 31/12/2012)

Country	Average	Maximum	Minimum	Standard deviation	Skewness	Kurtosis
Austria	0.3222917	0.56	0.09	0.1195068	0.0441881	2.518637
Belgium	0.3399167	0.68	0.11	0.1263947	0.4327894	2.570271
Denmark	0.34325	0.52	0.14	0.0979112	-0.3860333	2.438524
Finland	0294	0.59	-0.01	0.1654334	-0.0125083	2.03088
France	0.3020066	0.65	-0.08	0.1581898	0.1688845	2.311402
Germany	0.3490476	0.73	0	0.1759125	-0.0686187	2.261896
Greece	0.2470192	0.41	0.04	0.0824018	-0.2931751	2.315121

Italy	0.3885	0.67	0.02	0.1071736	-0.0551134	3.010451
Netherlands	0.385375	0.66	0.05	0.1468914	-0.206969	2.39649
Norway	0.3153571	0.68	0.1	0.1311621	0.4058384	2.815422
Poland	0.3391667	0.59	0.09	0.1003433	-0.0163868	2.560692
Spain	0.3895	0.67	0.05	0.1452619	-0.399723	2.545058
Suede	0.3992045	0.68	0.09	0.1297137	-0.2147156	2.454638
Switzerland	0.3027315	0.64	-0.02	0.1576969	0.0503701	2.184217
Turkish	0.2965789	0.55	0.11	0.0943862	-0.0099856	2.35915
Great Britain	0.3618367	0.64	0.01	0.1272418	-0.1910302	2.466086

Table 3: Descriptive Statistics of the MES of European banks

(The sample is composed of 281 European banks during the period 01/01/2006 - 31/12/2012)

Country	Average	Maximum	Minimum	Standard deviation	Skewness	Kurtosis
Austria	2.766458	9.06	0.34	1.944617	0.8870127	3.609788
Belgium	2.231167	10.82	0.49	1.382215	2.860596	15.41821
Denmark	2.1255	3.57	1.01	0.6945832	0.0866083	2.419143
Finland	2.49	4.71	0.8	1.101696	0.1489401	2.065372
France	2.120888	6.65	-1.11	1.376048	0.8819277	3.372464
Germany	2.457738	6.08	0.1	1.25853	0.3565158	2.947593
Greece	2.668846	7.74	0.96	1.293998	1.47902	5.543549
Italy	2.81945	7.5	0.29	1.196275	0.7722942	3.536127
Netherlands	2.687125	6.68	0.89	1.26026	0.8730286	3.495332
Norway	2.454286	7.06	0.81	1.164546	1.228678	5.772229
Poland	2.903542	5.42	1.06	0.8824857	0.0098557	2.583673
Spain	2722	6.98	0.45	1.230254	0.6990796	4.134667
Suede	3.059716	5.6	0.95	0.8891514	0.1111578	3.226727
Switzerland	1.820972	5.35	0.06	1.137915	0.6166923	2.462693
Turkish	3.070197	6.97	1.04	0.8917387	1.157841	5.803076
Great Britain	2.591582	5.64	0.29	1.044397	0.2419493	2.637012

Table 5: Descriptive Statistics of the volatility of the equity of European banks

(The sample is composed of 281 European banks during the period 01/01/2006 - 31/12/2012)

Country	Average	Maximum	Minimum	Standard deviation	Skewness	Kurtosis
Austria	47.00208	201.7	10.8	40.52518	2.488944	9.309743
Belgium	30.3025	202	13.8	22.43014	4.664988	31.91066
Denmark	28.3475	73.9	14	12.39508	2.032348	7.047098
Finland	39.6725	77.7	17.4	15.7856	0.9272932	2.850177
France	31.86349	138.3	11.7	15.58517	2.290562	11.74178
Germany	36.58929	195.5	14.3	21.93389	3.084249	19.06761
Greece	47.33462	130.7	11.8	23.67891	1.384762	4.849449
Italy	33.0985	98.3	0	16.51254	1.056053	5.240987
Netherlands	31.6725	122.7	14.3	17.88367	2.308222	10.48209
Norway	38	105.4	18.1	19.42417	1.846391	6.101873
Poland	39.41979	92.8	13.7	11.94431	1.273677	6.776303
Spain	41.33	176.8	16.4	22.73188	3.364764	18.90316
Suede	38.58977	284	16.2	26.28356	5.367002	45.85579
Switzerland	1.820972	5.35	0.06	1.137915	0.6166923	2.462693
Turkish	50.60789	284.2	26.4	23.48447	6.698511	65.72769
Great Britain	35.60791	151.3	11	19.85293	2.154533	9.165913

Table 6: Descriptive Statistics of the leverage effect of European banks

(The sample is composed of 281 European banks during the period 01/01/2006 - 31/12/2012)

Country	Average	Maximum	Minimum	Standard deviation	Skewness	Kurtosis
Austria	13.97167	41.1	1.92	9.917049	1.171049	3.803583
Belgium	43.29625	2974.42	1	279.1939	9.891269	103.2634
Denmark	14.2425	94.41	2.06	18.16811	2.567477	10.7721
Finland	7.49325	31.44	1.83	6.725169	1.828884	6.393586
France	16.61526	159.35	1.03	22.62948	2.840167	14.22862
Germany	26.0219	434.15	1.01	44.3914	5.398256	44.95648
Greece	45.01981	623.58	1.03	101367	3.925989	19.77729

Italy	16.7135	168.37	1	18.74529	3.737942	25.19721
Netherlands	11.44037	87.22	1.31	16.68116	2.195008	8.118134
Norway	14.61071	57.09	1.69	13.71284	1.476417	4.972713
Poland	5.848438	19.11	1.22	4.088024	1.399401	4.299524
Spain	14.40863	84.96	1.87	12.7673	2.721622	13.82345
Suede	6.231023	80.51	1.02	9.725322	4.262016	27.81811
Switzerland	10.21551	58.56	1.45	9.126595	2.223102	9.943362
Turkish	5.136382	18.51	1.02	3.595637	1.598615	6.129922
Great Britain	9.71699	157.17	1.07	16.65226	3.938839	25.28564

Similarly, table 8 summarizes the classification of European banks according to the systemic risk level measured by the MES. In this table, we presented the first 10 banks for each year those are ranked in descending order according to the systemic risk value measured by the MES. From this table, we noticed that among the bank list will change from one year to another.

For the evolution of systemic risk, we noticed that the SRISK peaked during 2008 (11.38) especially after the outbreak of the subprime crisis of 2007. After that date and after the recovery plan and implemented reforms by national and international regulatory authorities, the capital loss for all EU institutions has been reduced to only two years. This loss increased again after the outbreak of the sovereign debt crisis in the Euro zone in 2011 and mainly in 2012.

We also conducted a ranking of the top 50 banks according to the measure of systemic risk MES. This ranking was presented in Appendix 3 to 7 years of study (01/01/2006-01/12/2012).

So, we will only concentrate on the top 50 banks since the remaining banks in our sample have a very low level of systemic risk compared to those previously classified.

Table 8: The classification of European banks by the MES
(The sample is composed of 281 European banks during the period 01/01/2006 - 31/12/2012)

Institution	**MES**	**Rank**
31/12/2006		
Yapi Kredi Finansal Kiralama AO	3.88	1

AXA SA	3.54	2
Turkiye Sinai Kalkinma Bankasi AS	3.37	3
Yapi Kredi Sigorta AS	3.34	4
ING Groep NV	3.18	5
Prudential PLC	3.09	6
Anadolu Anonim Turk Sigorta Sirketi	3.01	7
Skandinaviska Enskilda Banken AB	2.99	8
Credit Suisse Group AG	2.98	9
BNP Paribas SA	2.95	10
31/12/2007		
Paragon Group of Cos PLC / The	5.14	1
Banca Italease SpA	4.93	2
Prudential PLC	4.17	3
Permanent TSB Group Holdings PLC	4.10	4
IKB Deutsche Industriebank AG	4.01	5
Standard Life PLC	3.80	6
Natixis SA	3.78	7
AXA SA	3.77	8
Premafin Finanziaria SpA	3.72	9
Skandinaviska Enskilda Banken AB	3.53	10
31/12/2008		
Irish Bank Resolution Corp. Ltd. / Old	11.38	1
Bank of Ireland	5.97	2
AXA SA	5.65	3
KBC Groep NV	5.57	4
HBOS PLC	5.57	5
Prudential PLC	5.48	6
Deutsche Bank AG	5.42	7

Skandinaviska Enskilda Banken AB	5.41	8
Credit Suisse Group AG	5.35	9
Aegon NV	5.22	10
31/12/2009		
Allied Irish Banks PLC	5.97	1
Bank of Ireland	5.94	2
ING Groep NV	5.47	3
Permanent TSB Group Holdings PLC	5.32	4
Barclays PLC	5.08	5
Erste Group Bank AG	4.85	6
Aegon NV	4.75	7
Credit Agricole SA	4.75	8
KBC Groep NV	4.65	9
Commerzbank AG	4.58	10
31/12/2010		
Bank of Ireland	8.36	1
Allied Irish Banks PLC	6.62	2
Societe Generale SA	5.36	3
KBC Groep NV	5.25	4
AXA SA	5.23	5
UniCredit SpA	5.19	6
Credit Agricole SA	4.97	7
ING Groep NV	4.95	8
Assicurazioni Generali SpA	4.80	9
Banco Bilbao Vizcaya Argentaria SA	4.71	10
31/12/2011		
Dexia SA	6.88	1
ING Groep NV	6.68	2
Societe Generale SA	6.65	3

SNS REAAL NV	6.40	4
KBC Groep NV	6.37	5
Commerzbank AG	6.03	6
AXA SA	5.96	7
Aegon NV	5.92	8
Credit Agricole SA	5.89	9
BNP Paribas SA	5.86	10
31/12/2012		
Dexia SA	10.82	1
Banco Popolare SC	5.54	2
Commerzbank AG	5.42	3
National Bank of Greece SA	4.96	4
Deutsche Bank AG	4.86	5
UniCredit SpA	4.85	6
Societe Generale SA	4.78	7
KBC Groep NV	4.69	8
Credit Agricole SA	4.68	9
Unione di Banche Italiane SCPA	4.64	10

The classification of financial institutions according to the evolution of systemic risk allows good control authorities choose and fully exploit their stimulus plan against triggering a systemic crisis. This ranking allows regulators of financial and banking system to distinguish between banks by degree of risk and according to their degree of contribution to the risk of the entire system.

5. Conclusion and remarks

Measuring the contribution of a bank in the systemic risk of a banking system has the objective of this paper. This contribution is reflected in the presence of the specific characteristics of a bank which in turn may affect the transmission of the defect to other banks. Most approaches and theories concerning the measurement of systemic risk focus on the quantification and monitoring of it. In our paper, we estimate the systemic risk for

European banks included. This estimate is based on the exposure of a literature review regarding the estimation of systemic risk for financial institutions. Then, we used the MES approach to analyze the existence of systemic risk in the banking systems in the euro area during the period of study in our research ranging from January 01, 2006 to December 31, 2012. We found that there are systemic events in European banking systems mainly after the outbreak of the financial crisis of 2007 and after the outbreak of the sovereign debt crisis in 2010. Similarly, we did a ranking of the different financial institutions based on the marginal loss in investment (MES). Based on this classification, we noticed that there is a high level of contribution from European banks in the risk of their systems. We've broken down systemic risk for the first 20 European banks.

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Appendix

Apendix 1: The list of European institutions used in this paper during the period 01/01/2006 to 31/12/2012

Country	**List of European institutions**
Austria	CA Immobilien Anlagen AG Conwert Immobilien Invest SE Erste Group Bank AG Immofinanz AG Oberbank AG Raiffeisen Bank International AG
Belgium	Ackermans & van Haaren NV National Bank of Belgium Befimmo SA BHF Kleinwort Benson Group Brederode SA Cofinimmo SA Dexia SA Gimv NV Groupe Bruxelles Lambert SA Henex Intervest Offices & Warehouses NV KBC Groep NV Sofina SA Warehouses De Pauw SCA Wereldhave Belgium NV
Denmark	Danske Bank A / S Ringkjoebing Landbobank A / S Spar Nord Bank A / S Topdanmark A / S Tryg A / S
Finland	Alandsbanken Abp Citycon OYJ Pohjola Bank Oyj Sampo Oyj Sponda OYJ
France	ABC Arbitrage

	Altarea SCA APRIL SA AXA SA BNP Paribas SA Boursorama Caisse Regionale de Credit Agricole Mutuel Alpes Provence Caisse Regionale de Credit Agricole Mutuel of Touraine and Poitou Caisse Regionale de Credit Agricole Mutuel de Normandie-Seine Caisse Regionale de Credit Agricole Mutuel de Paris and the Ile-de-France Caisse Regionale de Credit Agricole Mutuel d'Ille-et-Vilaine Caisse Regionale de Credit Agricole Mutuel Nord de France CIC CNP Assurances Credit Agricole Atlantique Vendee Credit Agricole du Morbihan Credit Agricole Loire Haute-Loire Credit Agricole SA Credit Regionale de Credit Agricole Mutuel Sud Rhone Alpes Euler Hermes Group Eurazeo SA FFP Fimalac Financiere de L'Odet Fonciere De Paris SIIC Fonciere des Murs SCA Fonciere Des Regions Fonciere Developpement SA Housing Gecina SA Klépierre Natixis SA Nexity SA SCOR SE SIIC de Paris SA Societe Fonciere Lyonnaise SA Societe Generale SA Union Financiere de France SA BQE Wendel SA
Germany	Aareal Bank AG Allianz SE Comdirect Bank AG Commerzbank AG DAB Bank AG Dahlbusch AG Deutsche Bank AG Deutsche Boerse AG Deutsche Euroshop AG Deutsche Postbank AG GBW AG Generali Deutschland Holding AG Grenkeleasing AG Hannover Rueck SE HSBC Trinkaus & Burkhardt AG IKB Deutsche Industriebank AG

	IVG Immobilien AG MLP AG Muenchener Rueckversicherungs-Gesellschaft AG in Muenchen Oldenburgische Landesbank AG Wuestenrot & Wuerttembergische AG
Greece	Agricultural Bank of Greece Alpha Bank AE Attica Bank SA Bank of Greece Emporiki Bank SA Eurobank Ergasias SA Grivalia Properties REIC Hellenic Exchanges - Athens Stock Exchange SA Holding Lamda Development SA Marfin Investment Group Holdings SA National Bank of Greece SA Piraeus Bank SA TT Hellenic Postbank SA
Italy	Assicurazioni Generali SpA Azimut Holding SpA Banca SpA Intermobiliare Banca Monte dei Paschi di Siena SpA Banca Popolare dell'Emilia Romagna SC Banca Popolare di Milano Scarl Banca Profilo SpA Banco di Desio e della Brianza SpA Banco di Sardegna SpA Beni Stabili SpA SIIQ Credito Bergamasco SpA Credito Emiliano SpA Credito Valtellinese SC DeA Capital SpA Immobiliare Grande Distribuzione SIIQ SpA Intesa Sanpaolo SpA Mediobanca SpA Mediolanum SpA Milano Assicurazioni SPA Prelios SpA Societa Cattolica di Assicurazioni SCRL UniCredit SpA Unione di Banche Italiane SCPA Unipol Gruppo Finanziario SpA UnipolSai SpA
Netherlands	Aegon NV Corio NV Eurocommercial Properties NV HAL Trust ING Groep NV Kardan NV NSI NV Van Lanschot NV Vastned Retail NV Wereldhave NV
Norway	ABG Sundal Collier Holding ASA DNB ASA Gjensidige Forsikring ASA Olav Thon Eiendomsselskap ASA SpareBank 1 SMN

	SpareBank 1 SR-Bank ASA Storebrand ASA
Poland	Bank BPH SA Bank Handlowy w Warszawie SA Bank Millennium SA Bank Pekao SA Bank Zachodni WBK SA Echo Investment SA Getin Holding SA Globe Trade Centre SA ING Bank Slaski SA Kredyt Bank SA M Bank SA PKO Bank Polski SA
Spain	Banco Bilbao Vizcaya Argentaria SA Banco de Sabadell SA Banco de Valencia SA Banco Espanol de Credito SA Banco Popular Espanol SA Banco Santander SA Bankinter SA Grupo Catalana Occidente SA Mapfre SA Metrovacesa SA
Suede	Atrium Ljungberg AB Avanza Bank Holding AB Castellum AB Fabege AB HQ AB Hufvudstaden AB Industrivarden AB Investment AB Kinnevik Investment AB Latour Investment AB Oresund Investor AB Klovern AB Kungsleden AB L AB E Lundbergforetagen Nordea Bank AB Nordnet AB Ratos AB Skandinaviska Enskilda Banken AB Svenska Handelsbanken AB Swedbank AB Wallenstam AB Wihlborgs Fastigheter AB
Switzerland	ACE LTD Allreal Holding AG Baloise Holding AG Bank Coop AG Bank Sarasin & Cie AG Banque Cantonale de Geneve Basler Kantonalbank Berner Kantonalbank AG Credit Suisse Group AG Edmond de Rothschild SA Switzerland EFG International AG Helvetia Holding AG Intershop Holdings AG Luzerner Kantonalbank AG

	Mobimo Holding AG Pargesa Holding SA PSP Swiss Property AG Swiss Life Holding AG Swiss Prime Site AG Swiss Re AG Swissquote Group Holding Ltd. UBS Group AG Valiant Holding AG Vaudoise Assurances Holding SA Vontobel Holding AG Walliser Kantonalbank Zurich Insurance Group AG
Turkish	Akbank TAS Aksigorta AS Anadolu Anonim Turk Sigorta Sirketi Anadolu Hayat Emeklilik AS Aviva Sigorta AS Denizbank AS Finansbank AS / Turkey Haci Omer Sabanci Holding AS Is Gayrimenkul Yatirim Ortakligi AS KOC Holding AS Sekerbank TAS Turk Ekonomi Bankasi AS Turkiye Garanti Bankasi AS Turkiye Is Bankasi Turkiye Kalkinma Bankasi AS Turkiye Sinai Kalkinma Bankasi AS Turkiye Bankasi Vakiflar Tao Yapi Kredi Sigorta AS Yapi ve Kredi Bankasi AS
Great Britain	3i Group PLC Aberdeen Asset Management PLC Admiral Group PLC Amlin PLC Aviva PLC Barclays PLC Big Yellow Group PLC Brewin Dolphin Holdings PLC British Land Co PLC / The Close Brothers Group PLC Coats Group PLC Daejan Holdings PLC Derwent London PLC F & C Asset Management PLC Grainger PLC Great Portland Estates PLC Hammerson PLC Helical Bar PLC Henderson Group PLC HSBC Holdings PLC ICAP PLC IG Group Holdings PLC Intermediate Capital Group PLC Intu Properties PLC Investec PLC Jardine Lloyd Thompson Group PLC Land Securities Group PLC Legal & General Group PLC

	Lloyds Banking Group PLC London Stock Exchange Group PLC Man Group PLC Old Mutual PLC Paragon Group of Cos PLC / The Provident Financial PLC Prudential PLC Quintain Estates & Development PLC Rathbone Brothers PLC Royal Bank of Scotland Group PLC RSA Insurance Group PLC Savills PLC Schroders PLC SEGRO PLC Shaftesbury PLC Songbird Estates PLC St James's Place PLC ST Modwen Properties PLC Standard Chartered PLC UNITE Group PLC / The Willis Group Holdings Plc

Appendix 2: Classification of European banks by the MES

- **31/12/2006**

Institution	MES	Rank
Yapi Kredi Finansal Kiralama AO	3.88	1
AXA SA	3.54	2
Turkiye Sinai Kalkinma Bankasi AS	3.37	3
Yapi Kredi Sigorta AS	3.34	4
ING Groep NV	3.18	5
Prudential PLC	3.09	6
Anadolu Anonim Turk Sigorta Sirketi	3.01	7
Skandinaviska Enskilda Banken AB	2.99	8
Credit Suisse Group AG	2.98	9
BNP Paribas SA	2.95	10
Deutsche Bank AG	2.88	11
Allianz SE	2.85	12
Aegon NV	2.81	13
Societe Generale SA	2.80	14
IKB Deutsche Industriebank AG	2.73	15
CNP Assurances	2.66	16
DEPFA Bank PLC	2.52	17
UBS Group AG	2.48	18
Credit Agricole SA	2.42	19
Aviva PLC	2.25	20
Deutsche Postbank AG	2.21	21
Commerzbank AG	2.12	22
Sekerbank TAS	2.11	23
Barclays PLC	2.11	24
ICAP PLC	2.09	25
Legal & General Group PLC	2.08	26
Aareal Bank AG	2.07	27
Svenska Handelsbanken AB	2.05	28
Dexia SA	1.80	29
Swiss Life Holding AG	1.78	30

Banca Profilo SpA	1.71	31
Credito Valtellinese SC	1.71	32
Credito Artigiano SpA	1.57	33
Danske Bank A / S	1.51	34
Bank of Greece	1.48	35
Landesbank Berlin Holding AG	1.22	36
Generali Deutschland Holding AG	1.16	37
SpareBank 1 SMN	1.13	38
Vaudoise Assurances Holding SA	1.06	39
Fonciere Massena	0.94	40
Banque Cantonale de Geneve	0.94	41
National Bank of Belgium	0.92	42
ABC Arbitrage	0.87	43
SpareBank 1 SR-Bank ASA	0.81	44
Alandsbanken Abp	0.80	45
Wuestenrot & Wuerttembergische AG	0.70	46
Hannoversche Hypothekenbank AG Berlin	0.66	47
Bank of Valletta PLC	0.52	48
Caisse Regionale de Credit Agricole Mutuel d'Ille-et-Vilaine	0.19	49
HSBC Bank Malta PLC	0.06	50

- **31/12/2007**

Institution	MES	Rank
Paragon Group of Cos PLC / The	5.14	1
Banca Italease SpA	4.93	2
Prudential PLC	4.17	3
Permanent TSB Group Holdings PLC	4.10	4
IKB Deutsche Industriebank AG	4.01	5
Standard Life PLC	3.80	6
Natixis SA *	3.78	7
AXA SA	3.77	8
Premafin Finanziaria SpA	3.72	9
Skandinaviska Enskilda Banken AB	3.53	10
Barclays PLC	3.46	11
Societe Generale SA	3.43	12
Deutsche Bank AG	3.38	13
Allianz SE	3.35	14
Credit Suisse Group AG	3.28	15
UBS Group AG	3.18	16
Credit Agricole SA	3.17	17
Old Mutual PLC	3.16	18
Irish Bank Resolution Corp. Ltd. / Old	3.12	19
Bank of Ireland	3.12	20
BNP Paribas SA	3.12	21
Commerzbank AG	3.10	22
CNP Assurances	3.05	23
Dexia SA	3.04	24
Swedbank AB	3.00	25
Aegon NV	2.95	26
Aviva PLC	2.92	27
HBOS PLC	2.88	28
Royal Bank of Scotland Group PLC	2.87	29
ING Groep NV	2.82	30
Nordea Bank AB	2.74	31

Aareal Bank AG	2.69	32
Legal & General Group PLC	2.64	33
Lloyds Banking Group PLC	2.62	34
Erste Group Bank AG	2.60	35
Svenska Handelsbanken AB	2.58	36
Allied Irish Banks PLC	2.52	37
Banca Monte dei Paschi di Siena SpA	2.46	38
SNS REAAL NV	2.46	39
Deutsche Postbank AG	2.23	40
DNB ASA	2.05	41
Swiss Life Holding AG	1.98	42
Danske Bank A / S	1.90	43
Wuestenrot & Wuerttembergische AG	1.84	44
Generali Deutschland Holding AG	1.38	45
Bank of Greece	1.23	46
SpareBank 1 SR-Bank ASA	1.18	47
CIC	1.01	48
Landesbank Berlin Holding AG	0.84	49
National Bank of Belgium	0.72	50

- **31/12/2008**

Institution	MES	Rank
Irish Bank Resolution Corp. Ltd. / Old	11.38	1
Bank of Ireland	5.97	2
AXA SA	5.65	3
KBC Groep NV	5.57	4
HBOS PLC	5.57	5
Prudential PLC	5.48	6
Deutsche Bank AG	5.42	7
Skandinaviska Enskilda Banken AB	5.41	8
Credit Suisse Group AG	5.35	9
Aegon NV	5.22	10
BNP Paribas SA	5.15	11
Standard Chartered PLC	5.03	12
Aviva PLC	5.03	13
Banco Popolare SC	5.00	14
ING Groep NV	4.96	15
Swedbank AB	4.95	16
DNB ASA	4.88	17
Legal & General Group PLC	4.75	18
Societe Generale SA	4.75	19
Barclays PLC	4.73	20
Standard Life PLC	4.70	21
Erste Group Bank AG	4.62	22
Dexia SA	4.43	23
UBS Group AG	4.42	24
Allianz SE	4.41	25
Old Mutual PLC	4.32	26
Natixis SA	4.30	27
Royal Bank of Scotland Group PLC	4.27	28
UniCredit SpA	4.25	29
Nordea Bank AB	4.22	30
Commerzbank AG	4.20	31
Banco Santander SA	4.15	32
Banco Bilbao Vizcaya Argentaria SA	4.08	33
Swiss Re AG	4.04	34

Credit Agricole SA	3.97	35
Swiss Life Holding AG	3.87	36
Allied Irish Banks PLC	3.85	37
CNP Assurances	3.68	38
Lloyds Banking Group PLC	3.66	39
Deutsche Postbank AG	3.61	40
Danske Bank A / S	3.57	41
Svenska Handelsbanken AB	3.51	42
SNS REAAL NV	3.45	43
HSBC Holdings PLC	3.15	44
Intesa Sanpaolo SpA	3.13	45
Banca Monte dei Paschi di Siena SpA	2.72	46
Assicurazioni Generali SpA	2.56	47
Landesbank Berlin Holding AG	1.34	48
CIC	1.31	49
National Bank of Belgium	1.24	50

- **31/12/2009**

Institution	MES	Rank
Allied Irish Banks PLC	5.97	1
Bank of Ireland	5.94	2
ING Groep NV	5.47	3
Permanent TSB Group Holdings PLC	5.32	4
Barclays PLC	5.08	5
Erste Group Bank AG	4.85	6
Aegon NV	4.75	7
Credit Agricole SA	4.75	8
KBC Groep NV	4.65	9
Commerzbank AG	4.58	10
AXA SA	4.53	11
Prudential PLC	4.39	12
Deutsche Bank AG	4.39	13
Societe Generale SA	4.30	14
Dexia SA	4.15	15
Royal Bank of Scotland Group PLC	4.10	16
Natixis SA	4.04	17
Banco Popolare SC	4.01	18
Old Mutual PLC	3.98	19
Skandinaviska Enskilda Banken AB	3.96	20
Credit Suisse Group AG	3.94	21
Allianz SE	3.78	22
Banco Bilbao Vizcaya Argentaria SA	3.70	23
Swedbank AB	3.66	24
UBS Group AG	3.64	25
Banco Santander SA	3.62	26
Legal & General Group PLC	3.62	27
SNS REAAL NV	3.58	28
Nordea Bank AB	3.55	29
Aviva PLC	3.55	30
Lloyds Banking Group PLC	3.55	31
Assicurazioni Generali SpA	3.54	32
BNP Paribas SA	3.54	33
UniCredit SpA	3.53	34
Standard Life PLC	3.51	35
HSBC Holdings PLC	3.43	36

Danske Bank A / S	3.30	37
Svenska Handelsbanken AB	3.24	38
DNB ASA	3.22	39
Deutsche Postbank AG	3.06	40
CNP Assurances	2.99	41
Intesa Sanpaolo SpA	2.93	42
Banca Monte dei Paschi di Siena SpA	2.89	43
Swiss Life Holding AG	2.75	44
Generali Deutschland Holding AG	1.90	45
Bank of Greece	1.71	46
CIC	1.33	47
Espirito Santo Financial Group S.A.	1.27	48
Landesbank Berlin Holding AG	1.21	49
National Bank of Belgium	1.02	50

- **31/12/2010**

Institution	MES	Rank
Bank of Ireland	8.36	1
Allied Irish Banks PLC	6.62	2
Societe Generale SA	5.36	3
KBC Groep NV	5.25	4
AXA SA	5.23	5
UniCredit SpA	5.19	6
Credit Agricole SA	4.97	7
ING Groep NV	4.95	8
Assicurazioni Generali SpA	4.80	9
Banco Bilbao Vizcaya Argentaria SA	4.71	10
BNP Paribas SA	4.65	11
Dexia SA	4.61	12
Erste Group Bank AG	4.28	13
Unione di Banche Italiane SCPA	4.21	14
Banco Santander SA	4.18	15
Intesa Sanpaolo SpA	4.04	16
Barclays PLC	4.04	17
Deutsche Bank AG	4.00	18
Royal Bank of Scotland Group PLC	3.97	19
Banco Popolare SC	3.95	20
Deutsche Postbank AG	3.95	21
Aegon NV	3.91	22
Natixis SA	3.88	23
Banco Espanol de Credito SA	3.82	24
Prudential PLC	3.75	25
Banco Popular Espanol SA	3.66	26
London Stock Exchange Group PLC	3.66	27
Banca Monte dei Paschi di Siena SpA	3.63	28
SNS REAAL NV	3.62	29
Skandinaviska Enskilda Banken AB	3.60	30
Credit Suisse Group AG	3.59	31
Lloyds Banking Group PLC	3.59	32
Aviva PLC	3.58	33
Allianz SE	3.53	34
Commerzbank AG	3.51	35
CNP Assurances	3.50	36
Legal & General Group PLC	3.48	37
Old Mutual PLC	3.45	38

UBS Group AG	3.43	39
Standard Life PLC	3.40	40
Swedbank AB	3.28	41
Deutsche Boerse AG	2.91	42
Nordea Bank AB	2.82	43
Svenska Handelsbanken AB	2.79	44
Danske Bank A / S	2.68	45
HSBC Holdings PLC	2.61	46
Friends Life Group Ltd	2.05	47
Bank of Greece	2.04	48
CIC	1.85	49
Landesbank Berlin Holding AG	1.32	50

- **31/12/2011**

Institution	MES	Rank
Dexia SA	6.88	1
ING Groep NV	6.68	2
Societe Generale SA	6.65	3
SNS REAAL NV	6.40	4
KBC Groep NV	6.37	5
Commerzbank AG	6.03	6
AXA SA	5.96	7
Aegon NV	5.92	8
Credit Agricole SA *	5.89	9
BNP Paribas SA	5.86	10
Natixis SA *	5.76	11
UniCredit SpA	5.75	12
Unione di Banche Italiane SCPA	5.74	13
Raiffeisen Bank International AG	5.59	14
Erste Group Bank AG	5.59	15
Deutsche Bank AG	5.31	16
Barclays PLC	5.27	17
Banco Popolare SC	5.14	18
Allianz SE	4.90	19
Bank of Ireland	4.78	20
Lloyds Banking Group PLC	4.76	21
Intesa Sanpaolo SpA	4.74	22
Banca Monte dei Paschi di Siena SpA	4.65	23
Royal Bank of Scotland Group PLC	4.62	24
DNB ASA	4.50	25
Assicurazioni Generali SpA	4.42	26
Banco Bilbao Vizcaya Argentaria SA	4.41	27
Aviva PLC	4.27	28
Skandinaviska Enskilda Banken AB	4.24	29
Swedbank AB	4.18	30
Prudential PLC	4.08	31
Banco Santander SA	4.07	32
Credit Suisse Group AG	4.03	33
Nordea Bank AB	3.97	34
CaixaBank SA	3.88	35
Standard Life PLC	3.83	36
CNP Assurances	3.81	37
Old Mutual PLC	3.72	38
Legal & General Group PLC	3.69	39
Swiss Life Holding AG	3.48	40

Deutsche Boerse AG	3.38	41
UBS Group AG	3.32	42
Svenska Handelsbanken AB	3.26	43
London Stock Exchange Group PLC	3.07	44
Friends Life Group Ltd	2.77	45
HSBC Holdings PLC	2.73	46
Danske Bank A / S	2.63	47
CIC	1.76	48
Bank of Greece	1.54	49
Deutsche Postbank AG	1.41	50

- **31/12/2012**

Institution	MES	Rank
Dexia SA	10.82	1
Banco Popolare SC	5.54	2
Commerzbank AG	5.42	3
National Bank of Greece SA	4.96	4
Deutsche Bank AG	4.86	5
UniCredit SpA	4.85	6
Societe Generale SA	4.78	7
KBC Groep NV	4.69	8
Credit Agricole SA *	4.68	9
Unione di Banche Italiane SCPA	4.64	10
Erste Group Bank AG	4.49	11
Natixis SA *	4.34	12
UBS Group AG	4.30	13
Banco Popular Espanol SA	4.26	14
ING Groep NV	4.25	15
Credit Suisse Group AG	4.23	16
Bank of Ireland	4.21	17
Intesa Sanpaolo SpA	4.18	18
Prudential PLC	4.11	19
Banca Monte dei Paschi di Siena SpA	4.08	20
AXA SA	4.07	21
Barclays PLC	4.07	22
SNS REAAL NV	4.04	23
Bankia SA	4.01	24
Aegon NV	3.93	25
BNP Paribas SA	3.85	26
Banco de Sabadell SA	3.81	27
London Stock Exchange Group PLC	3.80	28
Assicurazioni Generali SpA	3.71	29
CaixaBank SA	3.64	30
Aviva PLC	3.56	31
Skandinaviska Enskilda Banken AB	3.53	32
Lloyds Banking Group PLC	3.52	33
CNP Assurances	3.46	34
Standard Life PLC	3.32	35
Banco Bilbao Vizcaya Argentaria SA	3.32	36
Banco Santander SA	3.32	37
Allianz SE	3.26	38
Nordea Bank AB	3.18	39
Royal Bank of Scotland Group PLC	3.15	40
DNB ASA	3.11	41
Legal & General Group PLC	3.05	42

Danske Bank A / S	3.01	43
Friends Life Group Ltd	2.92	44
Svenska Handelsbanken AB	2.74	45
Deutsche Boerse AG	2.69	46
Bank of Greece	2.56	47
HSBC Holdings PLC	2.27	48
CIC	2.12	49
National Bank of Belgium	1.38	50