

Lupu, Iulia; Bobircă, Ana Barbara; Miclăuș, Paul Gabriel; Ciumara, Tudor

## Article

# Risk management of companies included in the EURO STOXX sustainability index: An investors' perception

Amfiteatru Economic Journal

## Provided in Cooperation with:

The Bucharest University of Economic Studies

*Suggested Citation:* Lupu, Iulia; Bobircă, Ana Barbara; Miclăuș, Paul Gabriel; Ciumara, Tudor (2020) : Risk management of companies included in the EURO STOXX sustainability index: An investors' perception, Amfiteatru Economic Journal, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 22, Iss. 55, pp. 707-725, <https://doi.org/10.24818/EA/2020/55/707>

This Version is available at:

<https://hdl.handle.net/10419/281523>

### Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

### Terms of use:

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*



<https://creativecommons.org/licenses/by/4.0/>

## RISK MANAGEMENT OF COMPANIES INCLUDED IN THE EURO STOXX SUSTAINABILITY INDEX. AN INVESTORS' PERCEPTION

Iulia Lupu<sup>1\*</sup>, Ana Barbara Bobircă<sup>2</sup>, Paul Gabriel Miclăuș<sup>3</sup>  
and Tudor Ciumara<sup>4</sup>

<sup>1)4)</sup> “Victor Slăvescu” Centre for Financial and Monetary Research, Bucharest,  
Romania

<sup>2)3)</sup> The Bucharest University of Economic Studies, Romania

### Please cite this article as:

Lupu, I., Bobircă, A.B., Miclăuș, P.G. and Ciumara, T., 2020. Risk Management of Companies Included in the EURO STOXX Sustainability Index. An Investors' Perception. *Amfiteatru Economic*, 22(55), pp. 707-725.

DOI: [10.24818/EA/2020/55/707](https://doi.org/10.24818/EA/2020/55/707)

### Article History

Received: 30 March 2020

Revised: 19 May 2020

Accepted: 2 June 2020

### Abstract

Inclusion in the European Sustainability Index is a feature of companies that are perceived as “sustainable” in general. The objective of the research in this article is to analyse the perception of investors by investigating the extent to which these companies have lower risks than their peers (from the same industry). Consolidated risk measurement methodologies such as value at risk and expected shortfall have been used to conduct this research. We separated companies in the STOXX Europe 600 in two classes: firms that belong to EURO STOXX sustainability index and companies that belong only to the STOXX 600 index. Dynamic daily risk measures have been estimated for all these companies for the last decade (4 January 2010 - 3 March 2020), using data extracted from Bloomberg Professional platform. We show that the sustainable companies exhibit lower risks in the second part of our sample and that this phenomenon is irregular across sectors, but tends to be consistent inside a sector.

**Keywords:** companies' sustainability, risk management, stock indices, value at risk (VaR), expected shortfall.

**JEL Classification:** G11, G15, G32, Q56.

---

\* Corresponding author, **Iulia Lupu** – [iulia.s.lupu@gmail.com](mailto:iulia.s.lupu@gmail.com)

## Introduction

In recent decades, risk management has undergone a wide and complex development, being a topic of interest for the business environment, regulatory institutions and researchers. At the global level, two major development perspectives have emerged: at the micro level and at the macroeconomic level.

At the microeconomic level (at the companies' level), an essential change took place during the 1990s. A first direction of action was observed in the financial sector, after the development of the RiskMetrics method and company under J.P. Morgan. From that moment, in the financial field, things have evolved a lot, and today all banks have risk management departments.

At the macroeconomic level, regulatory authorities have started comprehensive programs and have adopted prudential rules. The Bank for International Settlements, established in 1930 in Basel with the aim of providing institutional support for central bank cooperation, began to develop such rules in the 1980s. This aspect is important given that a good cooperation of central banks has been and is still considered extremely important for maintaining a global financial stability, in the context of increasing of international financial markets activities and cross-border flows of money. The bankruptcy of large banks in Germany and the US led to the foundation of the Basel Committee on Banking Supervision in 1974. Since 1988, this Committee has begun to play a vital role for the financial system through introducing an internationally accepted standard for credit risk measurement called the Basel Capital Accord. This agreement has been updated several times over time by introducing better, more transparent methods for measuring risk. The second review took place at the end of 2006 and is called Basel II. Between 2011-2017, the Basel III Capital Agreement was introduced; it imposed new capital requirements, revised credit risk methods and a debt indicator. The regulations imposed had a timetable for implementation between January 2014 and the end of 2018. The recalibration of the Basel III Agreement, started in 2012, resulted in establishing new capital requirements for the banking sector by the Basel Committee for Banking Supervision in December 2018, known as Basel IV. The accompanying legislative package on risk reduction and bank consolidation was issued in June 2019. It is worth noting that, after the financial crisis of 2007-2008, in order to prevent similar situations to occurred, the regulations developed by the authorities were separated in the two main directions:

- micro-prudential – all financial institutions are required to calculate and report risks (market, credit, operational, etc.);
- macro-prudential - the regulatory authorities have set up national bodies that check the stability of the financial system and calculate the market risk.

The purpose of this article is to study whether the companies listed on the European stock exchanges that are included in the Euro area sustainability index (EURO STOXX sustainability index, SUTE) perform better than those not included in this index, but are included in the index of regional reference (STOXX Europe 600, SXP). Thus, we aim to highlight what is the perception of investors regarding the extent to which companies do risk management.

We considered it appropriate to organize the article as follows. After a brief introduction, the first section presents the main studies and research conducted in the field. The second section

describes the data used and the research methodology, and the third section is dedicated to the main results. In the last part, some final considerations are considered.

### **1. Review of the scientific literature**

In order to maintain the financial stability and a viable economic situation, risk management has become increasingly important. In the previously published scientific papers was documented that the market assesses the risk. Specifically, companies that do risk management have a higher value in the market compared to those that do not.

Empirical evidence regarding the effectiveness of risk management in some industries can be found in the works published since the late 1990s. Tufano (1998) conducts a study on the determinants of exposure for gold mining companies and finds that firms' and markets' specific factors are taken into account by capital markets. A year later, Dunbar (1999) notes the increased interest in risk management after the crisis of 1998. Minton and Schrand (1999) show that investments have a greater sensitivity to the volatility of cash flows, and this increases the need to access capital markets, but at the same time the costs associated with this increase. Allayannis and Weston (2003) demonstrate that, in addition to the negative impact of volatility of cash flows, investors consider earnings volatility an unfavourable aspect; the results of the study are compatible with risk management theory, considering that efforts to obtain financial statements without problems add value for companies.

An extensive analysis of the scientific literature on the added value to the company through the use of risk management is performed by Smithson and Simkins (2005). The most important conclusion is that risk management produces positive effects and adds value to companies, but it also depends on the type of risk to which a company is exposed. MacKay and Moeller (2007) demonstrate that risk management can add value to companies when their revenues and costs are related to prices in a nonlinear way. Purnanandam (2008) extends the research of risk management models in companies by adding costs related to financial difficulties and demonstrates that risk management actions are taken after the debt is issued, even if they have not been imposed. Rountree, Weston and Allayannis (2008) bring attention to the issue of cash flow volatility and draw attention to the negative perception from investors point of view. Cornaggia (2010) brings new evidence on how risk management, by relaxing financial constraints, allows for investments in productivity; at the end, an increased productivity has a positive effect on the results of companies as well. The performance of risk management in commercial banks is confirmed by Berkowitz and O'Brien (2002), Perignon, Deng and Wang (2008) and Perignon and Smith (2010a, 2010b), among others.

The global financial crisis triggered in 2007-2008, but also the worsening situation of large companies in the early 2000s led to the emergence of regulations to support risk management in companies (Malik, Zaman and Buckby, 2020). The results of the study published in early 2020 demonstrate that risk management at the company level significantly influences, in a positive way, the performance of companies.

The main means of measuring the risk discussed in the specialized economic literature are value at risk (VaR) and expected shortfall (ES), also recognized by recent official regulations adopted at the level of the European Union (The European Parliament and The Council of the European Union, 2019) based on the decisions of the Basel Committee on Banking Supervision.

VaR, one of the most popular risk measurement methods, represents the level of loss that will not be exceeded for a certain level of confidence and for a certain period of time. Although VaR has roots in economic history since the beginning of the 20th century, the method developed and gained credibility in the 1990s, becoming one of the most used tools for risk measurement. Jorion (1996a, 1996b) is one of the important names that contributed to the development and promotion of this method. In the mid-1990s, the RiskMetrics model, developed by J. P. Morgan, appeared and became known by the publication of a technical document on how to calculate and implement it (J.P. Morgan, 1996). Then, there was an increase in popularity and was observed a mass acquisition by investment banks in order to measure the risk of their portfolios. Moreover, the Basel Committee considered the VaR methodology useful for calculating the capital expenditures incurred by financial institutions for financial risk.

In the economic literature, research on VaR models has been conducted by Duffie and Pan (1997), Marshall and Siegel (1997), Andersen et al. (2006), Kuuster, Mitnik and Paoletta (2006), Christoffersen (2009), but we also find institutional studies such as that of the Basel Committee on Banking Supervision (2011).

Expected shortfall, also known as Conditional Value at Risk (CVar) or Mean Excess Loss, is a risk assessment method that determines the amount of risk that has an investment portfolio, to implement efficient risk management, by addressing a more conservative risk exposure (Basel Committee on Banking Supervision, 2016). The method was developed and promoted by Artzner et al. (1997 and 1999). After the appearance of the new method, some questions raised in the economic literature and critical views concerning the limitations of the VaR method emerged (Acerbi and Tasche, 2002; Danielsson et al., 2001; Kou, Peng and Heyde, 2013). Expected shortfall method became widely used subsequent to its inclusion by the Basel Committee on Banking Supervision (2012, 2016) as a calculation method for capital regulations, the transition from VaR to ES being recommended above all in periods subject to major financial discomfort.

A comparative analysis between VaR and ES is performed by Yamai and Yoshida (2002), presenting the advantages and disadvantages of using the ES method to the detriment of VaR, carrying out the analysis on three levels: estimation errors, optimization elements and decomposition of risk factor analysis. Although the general conclusion is that ES is easier to analyse and optimize, for ES to have the same accuracy as that given by VaR, a larger sample is needed. At the same time, Cont, Deguest and Scandolo (2010) drew attention to the fact that for the choice and construction of risk measurement methods, statistical power should not be forgotten in addition to the "coherence" of risk measurement (one of the criticisms for VaR method is that it does not have the capacity to be "cumulative" and therefore not "coherent").

The future direction of development of these risk measurement methods (VaR and ES) is their use for data that have different frequency by applying the MIDAS (Mixed Data Sampling) methodology, as proposed by Trung (2020).

A comprehensive analysis of the literature (121 scientific articles) that addresses investor perception is conducted by Martin (2019).

The concept of sustainability has evolved over time, in recent years there have been more and more institutionalized ways of recognition and measurement. Delai and Takahashi (2011), in order to construct a reference model for measuring sustainability based on known

sustainability measurement initiatives, present in detail and critically the identified measurement indicators.

The approach to sustainability using stock market indices is found in Ching et al. (2016); This paper proposes a reference model to reveal sustainability, built using the conditions necessary for inclusion in four globally recognized sustainability stock indices (Dow Jones Sustainability Index, Corporate Sustainability Index ISE - Latin America, Frankfurt STOXX and Financial Times FTSE ESG), a description of the categories of the included sub-themes being presented in Table no. 1.

**Table no. 1. Description of stock market sustainability indices according to the number of sub-themes considered**

Stock market index	Environment	Social	Economic	Corporate governance	Total
Corporate Sustainability Index ISE	19	19	3	4	45
Financial Times FTSE ESG	15	17	3	6	41
STOXX	16	16	1	6	41
Dow Jones Sustainability Index	11	13	4	5	33

*Source: Authors' processing according to Ching, Toste and Tardelli, 2016, p.64*

The inclusion of companies in the sustainability index is also studied at the level of Turkey (Borsa Istanbul Turkey - BIST Sustainability Index), the results showing a reduction in risk for them and an increase in resistance to severe crises (Yilmaz, Aksoy and Tatoglu, 2020). An interesting aspect for our study is the conclusion of the study by Gomez-Trujillo, Vélez-Ocampo and González-Pérez (2020) which, after analysing a sample of 156 articles published in the period 2000-2019, highlights that sustainability is a feature of the company that precedes its reputation and is "a tool to improve stakeholder acceptance and perceptions of companies' activities."

## 2. Data and methodology

The premise from which we start in this analysis is that capital markets when analysed on a daily basis are efficient from the perspective of the theory developed by Fama (1965). Therefore, any information is included in the price of the listed shares, which means that these prices reflect investors' perceptions of future developments. In the classical sense (Neumann and Morganstern, 1944), market participants are forced to make an assessment of the risks of the investments they have in mind. If initially this perception of risks was captured by the utility function, now the theory of behavioural finance initially developed by Khaneman and Tversky (1979) studies the extent to which these perceptions are reflected in price dynamics. In our analysis we will consider that there is an equivalence relationship between risk measures (obtained from price dynamics) and investors' perceptions of these risks.

The stock indices developed by STOXX are very diverse (taking into account the fields of activity, the local and regional coverage, the stages of economic development, etc.), and depending on the objective pursued for each of them, the methodology applied for asset selection is different and constantly adapts to economic and political changes.

An important category of stock indices developed by STOXX are benchmark indices that are calculated for the major developed stock markets, covering the major regions of the world: STOXX North America 600, STOXX Asia / Pacific 600 and STOXX Europe 600. Each of

these indices is calculated for the largest 600 companies in the region, is reviewed quarterly (in March, June, September and December), and the base value (100) is set for December 31, 1991. There is also an aggregate alternative, STOXX Global 1800, which brings together the three major regional indicators. For our analysis, carried out at European level, the STOXX Europe 600 index is a representative one, reflecting the evolution of the whole region. From this index, as with the other "600" indices, derivative indices are calculated. Such indices are EURO STOXX, which includes companies from countries eligible for the euro area or STOXX Europe sustainability.

The EURO STOXX sustainability index is a representative sustainability index for companies from the euro area listed on the stock exchange (companies from 11 euro area countries are included in the sustainability index, each with a different weight (as of March 2020): Austria (0.6%), Belgium (3.8%), Finland (4.3%), France 32.9%), Germany (29.8%), Ireland (2.1%), Italy (6.2%), Luxembourg (0.3%), Holland (10.9%), Portugal (0 , 6%) and Spain (8.5%)) derived from the regional index STOXX Europe 600 and subsequently from STOXX Europe sustainability, which considers three basic criteria: the environment, the social criterion and the governance criterion. The companies included in the index are chosen taking into account a sustainability rating that contains information about the company, but a rating is attributed also to the sector of activity of which a specific company is part, using the standard method developed by Sarasin Bank. This method evaluates companies, taking into consideration and weighting certain elements specific to a particular industry according to their importance (such as environmental issues), but common aspects related to governance in general are also appreciated. The two obtained ratings, for the company and for the sector of activity, are then represented in a sustainability matrix that contains on both axes scores between 0 and 5, 5 being the best rating. The sectors with the lowest ratings are those in the oil and gas field, and those with the highest ratings are in the telecommunications and IT fields. According to the methodology of this bank, the companies are considered sustainable if they manage to fit in the right upper area of the sustainability matrix, as seen in Figure no. 1 in the spaces coloured with blue. The five lines and columns represent low values, below average, average, above average and high ratings, starting from the bottom left with the lowest value. Thus, companies operating in low rating business sectors must obtain a maximum rating for the company to be considered sustainable.

Company rating	<i>High</i>					
	<i>Low</i>	Rating of the activity sector				<i>High</i>

**Figure no. 1. The sustainability matrix developed by Sarasin Bank**  
*Source: Author processing after J. Safra Sarasin Holding Ltd., 2020, p.100*

According to the STOXX methodology, in the case of the EURO STOXX sustainability index, the first ten sectors of activity contributed with 82% at the end of January 2020 to its formation as follows: industrial goods and services (12%), technology (11.6%), health (10.8%), individual and household goods (10.6%), utilities (8.1%), insurance (7.7%), chemicals (7.3%), food and beverages (5.3%), construction and materials (4.4%), telecommunications (4.2%). The first three companies (depending on their share in the index, respectively 3.72%, 3.14% and 3.07%) were from Germany, the Netherlands and France, having activities in the fields of Technology (the first two) and Goods for individual and household use.

The number of components is variable, and the evaluation and inclusion or exclusion of some companies from the index is done annually, in September. The index was introduced on October 15, 2001, and the basic value (100) is that of December 31, 1998. Unlike the standard method used by Sarasin Bank that does not take into account sectors such as alcohol, gambling, tobacco, weapons, firearms and/or adult entertainment only if they represent less than 5% of the company's revenues, STOXX includes in the EURO STOXX sustainability index sectors such as tobacco, adult entertainment, defence and armament.

Our data consists in daily stock price values for the six hundred companies that comprise the STOXX Europe 600 index for the period spanning between January 4, 2010 and March 3, 2020. As presented above, the members of the EURO STOXX sustainability index are among these companies. Data was obtained from a Bloomberg Professional (2020) terminal, through the Bloomberg Finance Laboratory, Bucharest University of Economic Studies. The first round of analysis consisted in the elimination of all companies for which we had more than 5% of data that was not available. This phenomenon is the result of situations when these companies were not available in the markets due to special trading conditions or they were not yet listed.

Table no. 2 exhibits statistics computed for all the log-returns evaluated for all the companies that passed our non-null requirements. We exhibit the number of companies available for each industry for the two categories included in our analysis. We observe patterns that comply with the regular statistical properties of log-returns computed for financial assets.

**Table no. 2. Statistics computed for average returns for all stocks in our sample**

Industries	Statistics for Returns in both indices					
	Mean	Median	Standard Deviation	Kurtosis	Skewness	No. companies
Automobiles & Components	6.0E-05	0.0E+00	1.7E-02	7.46	-0.74	6
Banks	-4.4E-04	-1.5E-04	1.9E-02	7.28	-0.36	9
Capital Goods	1.2E-04	2.7E-04	1.3E-02	7.71	-0.69	27
Commercial & Professional Services	3.6E-04	6.0E-04	1.2E-02	6.48	-0.82	5
Consumer Durables & Apparel	4.5E-04	5.5E-04	1.2E-02	4.96	-0.61	9
Consumer Services	1.7E-04	1.4E-04	1.2E-02	12.77	-1.17	3
Diversified Financials	2.5E-04	6.0E-04	1.3E-02	8.34	-0.83	9
Energy	5.4E-05	0.0E+00	1.3E-02	7.01	-0.63	6
Food & Staples Retailing	-5.4E-06	1.4E-05	1.3E-02	3.11	-0.17	5



Industries	Statistics for Returns in both indices					
	Mean	Median	Standard Deviation	Kurtosis	Skewness	No. companies
Food, Beverage & Tobacco	2.9E-04	3.4E-04	9.6E-03	7.03	-0.73	7
Health Care Equipment & Services	5.4E-04	5.4E-04	1.0E-02	6.71	-0.82	8
Household & Personal Products	2.7E-04	2.2E-04	1.0E-02	3.01	-0.30	4
Insurance	-4.1E-06	3.2E-04	1.4E-02	16.11	-1.13	12
Materials	1.9E-04	4.4E-04	1.3E-02	6.08	-0.65	16
Media & Entertainment	-6.9E-05	3.4E-05	1.1E-02	8.78	-0.98	11
Pharmaceuticals, Biotechnology & Life Sciences	4.9E-04	6.6E-04	1.1E-02	3.89	-0.58	15
Real Estate	8.2E-05	3.5E-04	1.1E-02	14.08	-1.03	12
Retailing	3.3E-04	3.3E-04	4.9E-18	-2.00	-1.00	2
Semiconductors & Semiconductor Equipment	5.6E-04	6.5E-04	1.8E-02	2.56	-0.42	3
Software & Services	5.5E-04	9.0E-04	1.2E-02	7.27	-0.93	13
Technology Hardware & Equipment	8.2E-05	2.0E-04	1.8E-02	6.92	-0.49	2
Telecommunication Services	-1.4E-04	0.0E+00	1.1E-02	8.28	-0.69	11
Transportation	4.9E-05	1.5E-05	1.2E-02	14.91	-1.35	7
Utilities	-2.1E-05	1.5E-04	1.2E-02	19.53	-1.59	19
Industries	Statistics for Returns in STOXX Europe 600 index and not in EURO STOXX sustainability index					
	Mean	Median	Standard Deviation	Kurtosi	Skewness	No. companies
Automobiles & Components	3E-05	0E+00	2E-02	6.61	-0.79	9
Banks	-3E-04	0E+00	2E-02	9.90	-0.66	29
Capital Goods	3E-04	7E-04	1E-02	7.84	-0.94	47
Commercial & Professional Services	1E-04	4E-04	1E-02	9.58	-1.17	16
Consumer Durables & Apparel	3E-04	4E-04	1E-02	12.01	-1.23	13
Consumer Services	2E-04	3E-04	1E-02	20.51	-1.70	9
Diversified Financials	1E-04	6E-04	1E-02	9.95	-1.13	31
Energy	-3E-04	7E-05	2E-02	20.39	-1.60	15
Food & Staples Retailing	1E-05	0E+00	1E-02	4.77	-0.17	6
Food, Beverage & Tobacco	4E-04	6E-04	8E-03	9.81	-0.94	20
Health Care Equipment & Services	4E-04	7E-04	1E-02	6.36	-0.89	16
Household & Personal Products	2E-04	2E-05	1E-02	3.04	-0.09	3

Industries	Statistics for Returns in both indices					
	Mean	Median	Standard Deviation	Kurtosis	Skewness	No. companies
Insurance	2E-04	4E-04	1E-02	14.99	-1.22	22
Materials	1E-04	2E-04	1E-02	5.65	-0.63	35
Media & Entertainment	4E-04	6E-04	1E-02	7.80	-0.98	12
Pharmaceuticals, Biotechnology & Life Sciences	4E-04	9E-04	9E-03	7.10	-0.87	14
Real Estate	3E-04	4E-04	1E-02	15.26	-1.38	22
Retailing	1E-04	5E-04	1E-02	29.62	-2.28	15
Semiconductors & Semiconductor Equipment	5E-04	3E-04	2E-02	3.97	-0.65	3
Software & Services	4E-04	9E-04	1E-02	11.41	-1.55	9
Technology Hardware & Equipment	4E-04	3E-04	1E-02	4.03	-0.41	6
Telecommunication Services	2E-05	1E-04	1E-02	8.41	-0.75	8
Transportation	2E-04	5E-04	1E-02	6.55	-0.96	10
Utilities	-1E-05	3E-04	9E-03	15.01	-1.31	11

*Source: Own conceptualization, following the processing of statistical data extracted from the data platform Bloomberg Professional, 2020, through the Bloomberg Finance Laboratory, Bucharest University of Economic Studies*

The companies in our sample were divided into 24 sectors according to the Global Industry Classification Standard (GICS), which is developed jointly by Morgan Stanley Capital International and Standard&Poors. We notice that the number of companies varies across these sectors, which is why our computation consisted in averaging the risk measures across companies inside each sector and provide comparison between the two groups.

Three companies (Konecranes Oyj from the capital goods group, RTL Group SA from the Media & Entertainment group and Gerresheimer AG from the pharmaceutical, biotechnology and life sciences group) were removed from the STOXX Europe 600 index on December 23 2019, as mentioned in the release from that date. In our study, they remained in the analysed sample until the end of the period.

The EURO STOXX sustainability index contains a reduced number of companies that comply with the requirements to be included in this index as compared to the STOXX Europe 600 index. We notice that the higher discrepancies are observed for Banks, where we have only 9 companies inside EURO STOXX sustainability index and 29 companies that are only in STOXX Europe 600 index, but also for Diversified Financial, where we notice 9 companies in EURO STOXX sustainability index and 31 in STOXX Europe 600 index. We can consider that, from the EURO STOXX sustainability index perspective, financial institutions have the tendency to not be considered sustainable altogether. We could also consider that we have the same perspective for the Capital goods, with 27 sustainable companies and 47 in STOXX Europe 600 index and for Diversified financial, with 9 in EURO STOXX sustainability index and 31 in STOXX Europe 600 index.

The non-financial companies are less well represented in both indices but they are more present in the EURO STOXX sustainability index. We have this case for Automobiles &

Components, Food & Staples Retailing, Media & Entertainment and Semiconductors & Semiconductor Equipment.

We employed two types of risk measures: the Value-at-Risk and the Expected Shortfall, as previously explained. We use these indicators in order to capture the extent to which investors perceive the risk associated with the two categories of companies. Using the efficient markets hypothesis, according to which the past evolution of the prices of a listed company is public information, accessible to all investors, with negligible costs, we appreciate that the properties of this dynamic influence investment decisions and therefore investors' perceptions of capital allocation risks. Based on this hypothesis, we will appreciate that a high value for VaR influences the investors' perception regarding the (higher) risks related to the investment in the company for which this indicator was calculated.

Therefore, by comparing the VaR values for two companies (corresponding to the two categories analyzed, respectively sustainable and unsustainable companies), investors will perceive a higher risk for the company to which a higher VaR corresponds. Consequently, the difference between the two values of the VaR indicator is a proof that investors perceive the risks of investing in the two companies differently.

The VaR was computed as the value of returns for which the probability to have returns lower than that is  $p= 1\%$ . Given this probability, our first approach consisted in the estimation of a VaR that takes into account the assumption of a normal distribution that changes in time as a function of dynamic volatility. Therefore:

$$\Pr(R_t < VaR_t^p) = p, \text{ therefore} \tag{1}$$

$$\Pr\left(\frac{R_t}{\sigma_t} < \frac{-VaR_t^p}{\sigma_t}\right) = p, \text{ which means that} \tag{2}$$

$$\Phi\left(\frac{-VaR_t^p}{\sigma_t}\right) = p \text{ under the normal distribution,} \tag{3}$$

where  $\Phi(*)$  represents the cumulative density function of the standard normal distribution. Hence, given an estimate for  $\sigma_t$ , we can compute the VaR normal as

$$VaR_t = -\sigma_t \Phi_p^{-1}. \tag{4}$$

For the Expected Shortfall computed for the normal distribution we use the average of all values that are lower than the VaR.

For robustness check, we also use a second version of these two measures by means of historical simulation both for VaR and Expected Shortfall. The results are very similar and we exhibit them for the average across all assets.

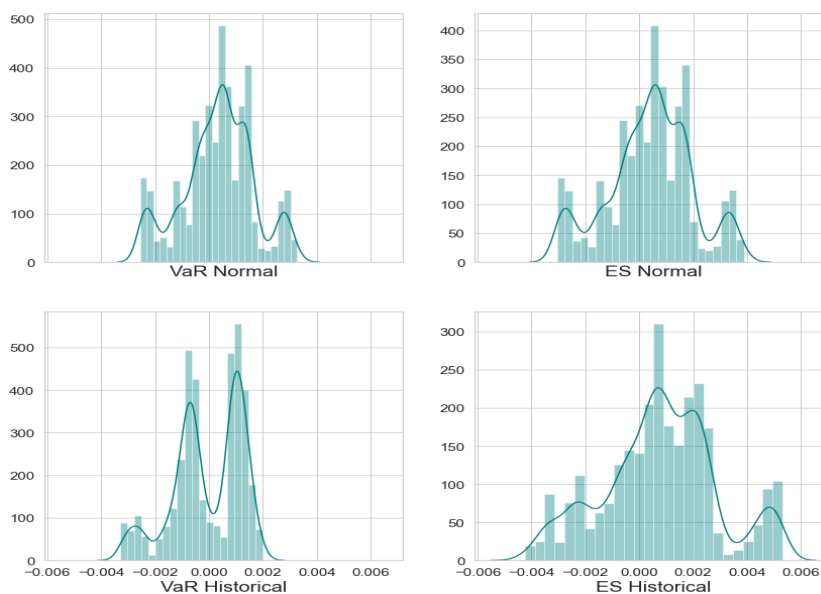
In order to obtain dynamics of our measures we estimate these gauges for rolling samples of 250 days (corresponding to an approximate year) that change with one day when we move through time. These computations are performed for each company in our sample, which produced 2410 values for each type of risk measure (VaR normal, ES normal, VaR historical and ES historical).

### 3. Results and discussions

Given the way in which companies are evaluated according to the ratings obtained for the two dimensions (sector and company) in order to be considered sustainable, our analysis proposes to verify the extent to which companies belonging to the EURO STOXX sustainability index are less risky than companies that do not belong to this index, but are included in the STOXX Europe 600. The choice of companies in the STOXX Europe 600 index acts as a filter to ensure that we use companies with a high degree of liquidity in our analysis. We consider that this level of liquidity is necessary to validate the premise that the price dynamics and implicitly the risk extracted from this evolution reflect the perception of investors.

The four risk and average measures were calculated for all companies in each of the two groups: companies that are present only in STOXX Europe 600 and companies that are present in both STOXX Europe 600 and the EURO STOXX sustainability index. The differences between these two groups were made at each time point, resulting in 2,410 values for each risk measure. A first description of our results is presented in Figure no. 2, where we can see the empirical distributions (histograms) for each set of differences. Figure no. 2 shows that the differences are not stable in time and they also tend to have multi-modal distributions (especially for the case of the historical risk measures – the charts in the lower part). We also notice that zero is not clearly in the middle of the x axis, which means that we should investigate the existence of a consistency in the differences in which investors perceive risks for these two categories of companies.

The multi-modal perspective raises the question of whether these differences belong to separate distributions, i.e. that we could experience a regime shift in their time dynamics.



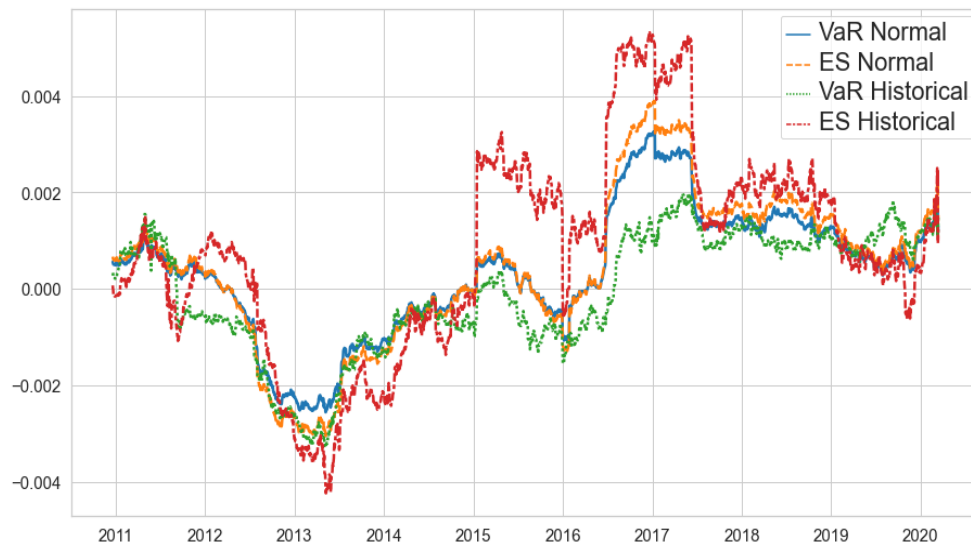
**Figure no. 2. Distribution of differences in risk computations computed as averages across all companies in the two categories**

*Source: Own conceptualization, following the processing of statistical data extracted from the data platform Bloomberg Professional, 2020, through the Bloomberg Finance Laboratory, Bucharest University of Economic Studies*

Figure no. 3 depicts the dynamics of these differences for the four measures. We can notice that, with only episodic exceptions these four measures capture similar phenomena. On average, the differences between these measures were somewhat positive until 2012, when they became negative and persisted in this realm until 2015. In the second half of our sample, these changes are rather positive and the four measures tend to communicate the same narrative.

We interpret this change in dynamics as a suggestion that investors started to acknowledge the importance of sustainable investments originated by the European companies and allocated lower levels of risks to these companies (highlighted by lower values of VaR, historical VaR, ES and historical ES). We could therefore conclude that this chart provides evidence for support of the conjecture that investors' perception reduces the volatility of companies considered as sustainable when compared with the companies with similar level of liquidity (also included in STOXX Europe 600 index) but with different sustainability profiles. The same opinion is supported by Ching, Toste and Tardelli (2016), which mentions that the inclusion of a company in a stock market sustainability index can be perceived by investors as a positive signal.

The variation of these measures together with the fact that companies in these two indices are non-uniformly divided across GICS sectors led us to believe that a thorough picture of these variations may be obtained by investigating the details of these dynamics at the level of each of these sectors.



**Figure no. 3. Dynamics of differences in risk measures computed as averages across all companies (risk measures of companies only in STOXX Europe 600 index less risk measures of companies both in STOXX Europe 600 index and EURO STOXX sustainability index)**

*Source: Own conceptualization, following the processing of statistical data extracted from the data platform Bloomberg Professional, 2020, through the Bloomberg Finance Laboratory, Bucharest University of Economic Studies*

Therefore, the stages of our approach were the following: the four indicators (normal VaR, normal ES, historical VaR and historical ES) were calculated for each company in our sample; 2,400 data series resulted (four indicators for the 600 companies), each series containing 2,410 values; for the 24 sectors established according to the GICS classification, sustainable and unsustainable companies were identified; for each of the two groups of companies, the values of the four risk indicators were calculated, for each of the 2,410 days for which they were previously estimated. Therefore, we obtained eight sets of risk values for each sector (four for each of the companies in the STOXX Europe 600 index and in the EURO STOXX sustainability index, as shown in Tables no. 2 and 3).

Our objective was to estimate the difference between risk of companies that are not sustainable (i.e. not included in EURO STOXX sustainability index) and the risk of companies that are considered sustainable. As result, we computed the differences between the averages of risk measures across companies at each point in time and for each sector and produced statistics for all these averages. The results of these computations are presented both in Table no. 3 and in the figure in the appendix. The chart in the appendix shows histograms for the differences in risk measures for each industry. This set of charts presents the results for the VaR normal metrics. We mention that the other three measures produce very similar pictures for each industry, and we did not produce them here for lack of space, but can be shown upon request along with other statistics.

A concentration on the right side of the horizontal axis shows that companies that are not classified as sustainable have higher risks than the others, i.e. the differences between their corresponding risk measures are positive. We notice that this is the case for a few industries like Semiconductors & Semiconductor Equipment, Consumer Durables and Apparel and Commercial & Professional Services. On the other hand, the champions on the other side are mostly financial institutions, i.e. mostly the companies that belong to sectors like Banks, Insurance, Capital Goods, Diversified Financials but also Food & Staples Retailing and Technology Hardware & Equipment. We need to notice though that financial institutions are also the ones with the highest weight in the group of companies that are less sustainable, while the others tend to have a larger proportion of companies inside the sustainable group.

**Table no. 3. Statistics of differences in risk measures for companies in STOXX Europe 600 index and not in EURO STOXX sustainability index and companies present in both indices, computed for each industry**

Industries	Differences in VaR Normal measures					
	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Automobiles & Components	0.004	0.004	0.003	0.003	-0.002	0.014
Banks	-0.007	-0.007	-0.013	0.006	-0.017	0.002
Capital Goods	-0.001	-0.001	-0.002	0.003	-0.008	0.004
Commercial & Professional Services	0.002	0.002	0.000	0.003	-0.002	0.011
Consumer Durables & Apparel	0.006	0.006	0.007	0.004	-0.001	0.017
Consumer Services	0.000	0.000	0.001	0.003	-0.005	0.006
Diversified Financials	0.000	0.001	-0.007	0.003	-0.008	0.005
Energy	0.005	0.006	0.006	0.004	-0.004	0.022
Food & Staples Retailing	-0.006	-0.006	-0.002	0.004	-0.014	0.002

Industries	Differences in VaR Normal measures					
	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Food, Beverage & Tobacco	0.001	0.001	0.004	0.002	-0.003	0.005
Health Care Equipment & Services	0.001	0.001	-0.002	0.002	-0.004	0.005
Household & Personal Products	-0.001	-0.001	-0.003	0.003	-0.008	0.006
Insurance	-0.002	-0.002	-0.005	0.003	-0.008	0.003
Materials	0.001	0.001	0.001	0.001	-0.003	0.005
Media & Entertainment	0.001	0.001	0.001	0.003	-0.006	0.005
Pharmaceuticals, Biotechnology & Life Sciences	-0.003	-0.003	-0.002	0.002	-0.009	0.001
Real Estate	-0.002	-0.004	-0.005	0.005	-0.012	0.006
Retailing	0.004	0.003	0.011	0.004	-0.002	0.017
Semiconductors & Semiconductor Equipment	0.011	0.010	0.008	0.007	-0.005	0.028
Software & Services	0.005	0.004	0.006	0.005	-0.008	0.021
Technology Hardware & Equipment	-0.008	-0.006	-0.009	0.005	-0.022	0.002
Telecommunication Services	-0.003	-0.003	0.000	0.004	-0.011	0.003
Transportation	0.005	0.004	0.003	0.002	0.001	0.010
Utilities	-0.004	-0.004	-0.014	0.005	-0.016	0.005
Industries	Differences in ES Normal measures					
	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Automobiles & Components	0.005	0.005	0.004	0.004	-0.002	0.016
Banks	-0.009	-0.008	-0.016	0.007	-0.020	0.003
Capital Goods	-0.002	-0.002	-0.006	0.003	-0.009	0.005
Commercial & Professional Services	0.003	0.002	0.000	0.004	-0.003	0.013
Consumer Durables & Apparel	0.007	0.007	0.008	0.005	-0.001	0.021
Consumer Services	0.000	0.000	-0.004	0.003	-0.006	0.008
Diversified Financials	0.000	0.001	0.002	0.004	-0.010	0.006
Energy	0.007	0.007	0.007	0.005	-0.005	0.026
Food & Staples Retailing	-0.007	-0.007	-0.003	0.005	-0.017	0.002
Food, Beverage & Tobacco	0.002	0.002	0.005	0.002	-0.004	0.006
Health Care Equipment & Services	0.001	0.001	-0.002	0.003	-0.004	0.006
Household & Personal Products	-0.002	-0.002	-0.003	0.004	-0.009	0.007
Insurance	-0.002	-0.002	-0.006	0.003	-0.009	0.003
Materials	0.001	0.001	0.001	0.002	-0.003	0.005
Media & Entertainment	0.001	0.001	0.001	0.004	-0.008	0.006

Industries	Differences in VaR Normal measures					
	Mean	Median	Mode	Standard Deviation	Minimum	Maximum
Pharmaceuticals, Biotechnology & Life Sciences	-0.003	-0.003	-0.004	0.002	-0.010	0.002
Real Estate	-0.003	-0.005	-0.005	0.006	-0.015	0.007
Retailing	0.005	0.003	0.013	0.005	-0.002	0.020
Semiconductors & Semiconductor Equipment	0.013	0.011	0.023	0.009	-0.006	0.033
Software & Services	0.005	0.005	0.007	0.006	-0.010	0.026
Technology Hardware & Equipment	-0.009	-0.007	-0.003	0.006	-0.027	0.002
Telecommunication Services	-0.004	-0.004	0.000	0.004	-0.014	0.004
Transportation	0.005	0.005	0.005	0.002	0.001	0.012
Utilities	-0.005	-0.005	-0.016	0.006	-0.019	0.006

*Source: Own conceptualization, following the processing of statistical data extracted from the data platform Bloomberg Professional, 2020, through the Bloomberg Finance Laboratory, Bucharest University of Economic Studies*

A similar perspective is depicted by Table no. 3. We notice that the same industries mentioned above are the ones that have negative means (financial institutions), while Semiconductors & Semiconductor Equipment, Software & Services and Transportation have positive means. This distribution across sectors can be attributed to the fact that we have a different weight for some sectors in our samples and also to the fact that other factors than risk management could explain the dynamics of stock market performance for these sectors. For instance, the small number of banks that are included in the EURO STOXX sustainability index as opposed to the large group of banks in the STOXX Europe 600 index could partially explain the fact that the risk is not necessarily smaller for the former than the latter. The dependence on other factors that could overshadow the impact of sustainability is likely to operate.

## Conclusions

Our paper investigates the extent to which investors tend to perceive sustainable companies, categorized as such by their inclusion in the EURO STOXX sustainability index, as having lower risks than companies not included in the index. This investigation is triggered by the expectation that inclusion in this index should be the feature of companies with higher stability on the long term, which are perceived by the market as healthy growth investments.

This goal was achieved by researching the extent to which companies that allocate resources to sustainable development (and as such are included in the EURO STOXX sustainability index) are perceived as less risky by investors and therefore their involvement in sustainable activities reflects their performance. According to this opinion, these companies are more likely to be included in investors' portfolios, which means that they are perceived as having a higher value. To perform this analysis, we used several risk measurement methods and investigated this both for all companies belonging to the EURO STOXX sustainability index



and for each of the sectors to which these companies refer, according to the GICS classification.

The originality of this study lies in the empirical demonstration that the risks of sustainable companies are different from those of unsustainable companies, according to the perception of investors resulting from the valuation of these companies and reflected in the dynamics of share price quoted on euro area stock exchanges. Our analysis revealed that a shift took place in the evolution of investors' perceptions around 2015 and since then companies included in the EURO STOXX sustainability index are less risky than companies that are not included in this index. We noted that the risk differences exhibit trends and they tend to be stable in time, even though they do not have the same shape across industries. We found evidence that for most of the financial institutions the sustainable feature does not necessarily add to risk reduction but there are companies for which this difference can be perceived.

Given the new directions of development of research possibilities by the emergence of new methods to include in the VaR and ES analysis of data with different frequencies (by adapting the MIDAS methodology), in future research can be approached more complex analyzes, containing various control variables for company specifics.

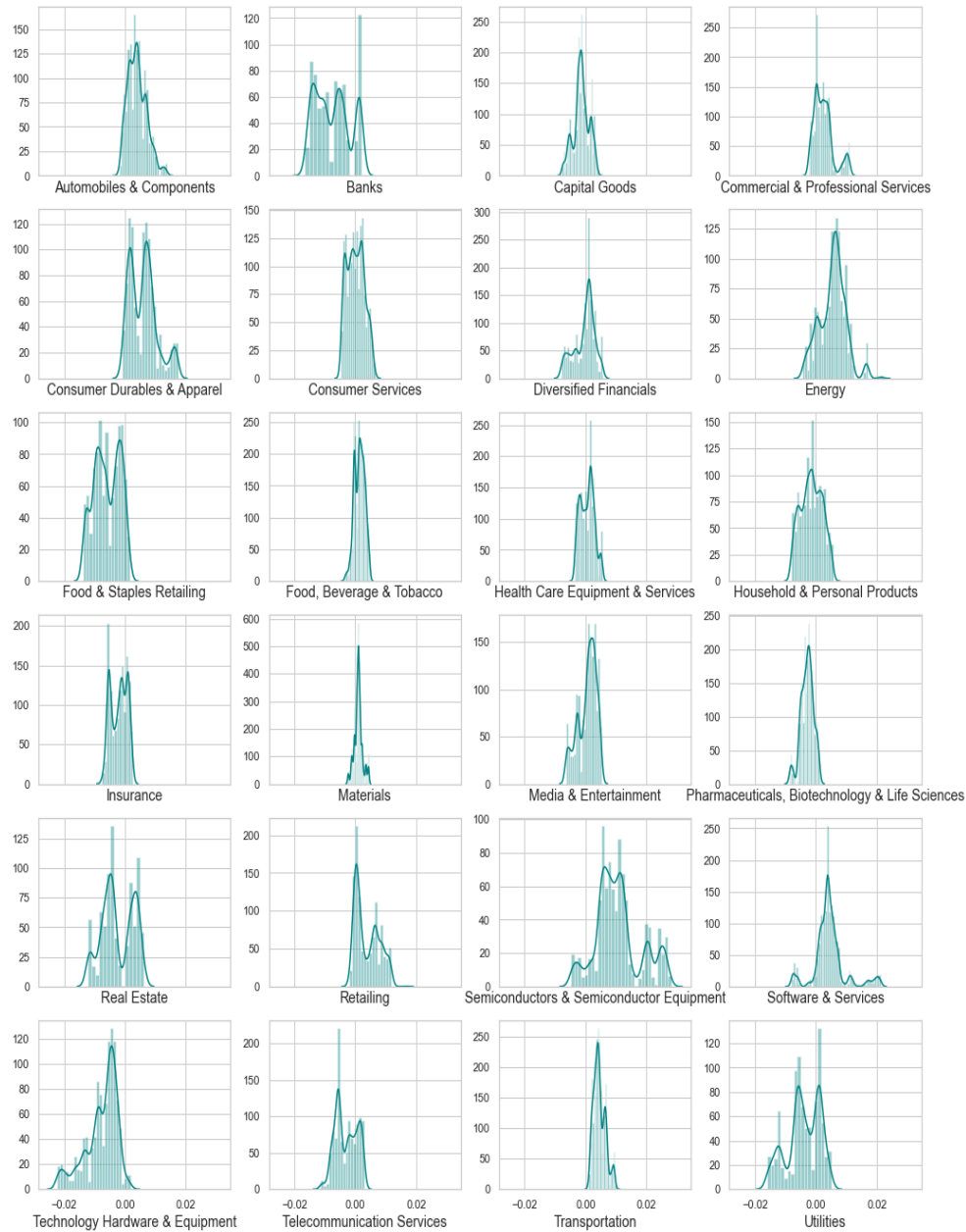
### References

- Acerbi, C. and Tasche, D., 2002. On the coherence of expected shortfall. *Journal of Banking and Finance*, 26(7), pp.1487–1503.
- Allayannis, G. and Weston, J., 2003. *Earnings Volatility, Cash-Flow Volatility and Firm Value*. Manuscript. Charlottesville: University of Virginia.
- Andersen, T.G., Bollerslev, T., Christoffersen, P.F. and Diebold, F.X., 2006. Practical Volatility and Correlation Modeling for Financial Market Risk Management. In: M. Carey and R. Stulz (eds.). *The NBER Volume on Risks of Financial Institutions*. Chicago: University of Chicago Press.
- Basel Committee for Banking Supervision, 2012. *Fundamental review of the trading book*. [pdf] Available at: <[www.bis.org/publ/bcbs219.htm](http://www.bis.org/publ/bcbs219.htm)> [Accessed 9 February 2020].
- Basel Committee for Banking Supervision, 2011. *Messages from the Academic Literature on Risk Measurement for the Trading Book*. Working Paper. Basel: Basel Committee on Banking Supervision,.
- Basel Committee for Banking Supervision, 2016. *Standards. Minimum capital requirements for market risk*. Bank for International Settlements. [pdf] Available at: <<https://www.bis.org/bcbs/publ/d352.pdf>> [Accessed 9 February 2020].
- Berkowitz, J. and O'Brien, J., 2002. How accurate are Value-at-Risk models at commercial banks?. *Journal of Finance*, 57(3), pp.1093-1112.
- Bloomberg, 2020. *Bloomberg Professional*. Bloomberg Finance Laboratory, Bucharest University of Economic Studies. [online] Available at: <<https://www.bloomberg.com/product/bloomberg-finance-lab/>> [Accessed 7 March 2020].
- Ching, H.Y., Toste, T. and Tardelli, R., 2016. A reference model of sustainability disclosure based on four sustainability stock indexes. *Journal of Management Research*, 8(4), pp.44–67.
- Christoffersen, P.F., 2009. Value-at-Risk models. In: T.G. Andersen, R.A Davis, J.-P. Kreiss, and T. Mikosch (eds.). *Handbook of Financial Time Series*. Dusseldorf: Springer Verlag.

- Cont, R., Deguest, R. and Scandolo G., 2010. Robustness and sensitivity analysis of risk measurement procedures. *Quantitative Finance*, 10(6), pp.593-606.
- Cornaggia, J., 2010. *Does Risk Management Matter?*. Manuscript. Bloomington: Indiana University.
- Danielsson, J., Embrechts, P., Goodhart, C., Keating, C., Muennich, F., Renault, O. and Shin, H.S., 2001. *An academic response to Basel II*. Special paper no.130. London: School of Economics. Financial Markets Group.
- Delai, I. and Takahashi, S., 2011. Sustainability measurement system: a reference model proposal. *Social Responsibility Journal*, 7(3), pp.438-471.
- Duffie, D. and Pan, J., 1997. An overview of Value-at-Risk. *Journal of Derivatives*, 4(3), pp.7-49.
- Dunbar, N., 1999. The new emperors of Wall Street. *Risk*, 1, pp.26-33.
- Fama, E.F., 1965. The behavior of stock-market prices. *Journal of Business*, 38(1), pp.34-105.
- Gómez-Trujillo, A.M., Vélez-Ocampo, J. and González-Pérez, M.A., 2020. A literature review on the causality between sustainability and corporate reputation. What goes first?. *Management Of Environmental Quality*, 31(2), pp.406-430.
- Jorion, P., 1996a. Risk: Measuring the Risk in Value At Risk. In: S. Grayling (ed.). *VaR: Understanding and Applying Value-at-Risk*. London: Risk Books. pp.187-193.
- Jorion, P., 1996b. *Value at Risk: The New Benchmark for Controlling Market Risk*. New York: Irwin Professional.
- J.P.Morgan, 1996. *RiskMetrics Technical Document*, [pdf] Available at: <<https://www.msci.com/documents/10199/5915b101-4206-4ba0-ae2-3449d5c7e95a>> [Accessed 3 March 2020].
- J.Safra Sarasin Holding Ltd., 2020. *Annual Report 2019*. [pdf] Available at: <[https://www.jsafrasarasin.com/internet/com/nl/jssh\\_annual\\_report\\_2019.pdf](https://www.jsafrasarasin.com/internet/com/nl/jssh_annual_report_2019.pdf)> [Accessed 9 March 2020].
- Kahneman, D. and Tversky, A., 1979. Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2), pp.263-291.
- Kou, S., Peng, X. and Heyde, C.C., 2013. External risk measures and basel accords. *Mathematics of Operations Research*, 38(3), pp.393-417.
- Kuester, K., Mittnik, S. and Paolella, M.S., 2006. Value-at-Risk prediction: A comparison of alternative strategies. *Journal of Financial Econometrics*, 4(1), pp.53-89.
- MacKay, P. and Moeller, S.B., 2007. The value of corporate risk management. *Journal of Finance*, 62(3), pp.1379-1419.
- Malik, M.F., Zaman, M. and Buckby, S., 2020. Enterprise risk management and firm performance: Role of the risk committee. *Journal of Contemporary Accounting & Economics*, 16(1), pp.1-22.
- Marshall, C. and Siegel, M., 1997. Value-at-Risk: Implementing a risk measurement standard. *Journal of Derivatives*, 4(3), pp.91-111.
- Martin, R., 2019. Examination and implications of experimental research on investor perceptions. *Journal of Accounting Literature*, 43, pp.145-169.
- Minton, B. and Schrand, C., 1999. The impact of cash flow volatility on discretionary

- investment and the costs of debt and equity financing. *Journal of Financial Economics*, 54(3), pp.423-460.
- Perignon, C., Deng, Z. and Wang, Z., 2008. Do banks overstate their Value-at-Risk?. *Journal of Banking and Finance*, 32(5), pp.783-794.
- Perignon, C. and Smith, D., 2010a. The level and quality of Value-at-Risk disclosure by commercial banks. *Journal of Banking and Finance*, 34(2), pp.362-377.
- Perignon, C. and Smith, D., 2010b. Diversification and Value-at-Risk. *Journal of Banking and Finance*, 34(1), pp.55-66.
- Purnanandam, A., 2008. Financial distress and corporate risk management: Theory and evidence. *Journal of Financial Economics*, 87(3), pp.706-739.
- Rountree, B., Weston, J.P. and Allayannis, G., 2008. Do investors value smooth performance?. *Journal of Financial Economics*, 90(3), pp.237-251.
- Smithson, C. and Simkins, B.J., 2005. Does Risk Management Add Value? A Survey of the Evidence. *Journal of Applied Corporate Finance*, 17(3), pp.8-17.
- STOXX, 2020. *Stoxx® Index Methodology Guide (Portfolio Based Indices)*. [pdf] Available at: <[https://www.stoxx.com/document/Indices/Common/Indexguide/stoxx\\_index\\_guide.pdf](https://www.stoxx.com/document/Indices/Common/Indexguide/stoxx_index_guide.pdf)> [Accessed 27 March 2020].
- STOXX, 2020. *Sustainability Indices. EURO STOXX® Sustainability Index*. [pdf] Available at: <<https://www.stoxx.com/document/Bookmarks/CurrentFactsheets/SUTU.pdf>> [Accessed 9 March 2020].
- The European Parliament and The Council of The European Union, 2019. Regulation (EU) 2019/876 of The European Parliament and of The Council of 20 May 2019 amending Regulation (EU) No 575/2013 as regards the leverage ratio, the net stable funding ratio, requirements for own funds and eligible liabilities, counterparty credit risk, market risk, exposures to central counterparties, exposures to collective investment undertakings, large exposures, reporting and disclosure requirements, and Regulation (EU) No 648/2012. *Official Journal of the European Union*, L 150/1. [online] Available at: <<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019R0876>> [Accessed 9 March 2020].
- Trung, H.L., 2020. Forecasting value at risk and expected shortfall with mixed data sampling. *International Journal of Forecasting*, In Press, Corrected Proof., doi.org/10.1016/j.ijforecast.2020.01.008.
- Tufano, P., 1998. The determinants of stock price exposure: Financial engineering and the gold mining industry. *Journal of Finance*, 53(3), pp.1015-1052.
- Von Neumann, J. and Morgenstern, O., 1944. *Theory of games and economic behavior*. Princeton: Princeton University Press.
- Yamai, Y. and Yoshida, T., 2002. Comparative Analyses of Expected Shortfall and Value-at-Risk: Their Estimation Error, Decomposition, and Optimization, *Monetary and Economic Studies*, 20(1), pp.87-121.
- Yilmaz, M.K., Aksoy, M. and Tatoglu, E., 2020. Does the Stock Market Value Inclusion in a Sustainability Index? Evidence from Borsa Istanbul. *Sustainability*, 12(483), pp.1-22.

**Appendix no. 1: Distributions of differences in VaR metrics (using the normal distribution) computed as averages across all companies in each sector**



*Source: Own conceptualization, following the processing of statistical data extracted from the data platform Bloomberg Professional, 2020, through the Bloomberg Finance Laboratory, Bucharest University of Economic Studies*