İzmir İktisat Dergisi
İzmir Journal of Economics

E-ISSN: 1308-8505 **Year:** 2025 **Vol:** 40 **No:** 3 **Pages:** 638-651
Received: 12.12.2024 **Accepted:** 14.05.2025 **Published Online:** 16.07.2025 **Doi:** 10.24988/ije.1600574
RESEARCH ARTICLE

Are Investors Being Misled? Testing for Bubble Behavior in ESG Scores

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Abstract

In recent years, environmental and social sustainability, supported by strong corporate governance, appears to have been reshaping behaviors of firms, investors, and consumers. The growing public interest in these issues raises questions regarding the extent to which disclosed information and sustainability ratings accurately reflect reality. The primary objective of this study is to empirically investigate whether environmental, social, and governance (ESG) scores have been overvalued over time at a level that may potentially mislead investor behavior. In this context, the study analyzes the presence of speculative bubble behavior in the ESG scores of G-7 countries (United Kingdom, France, Japan, United States, Italy, and Germany) over the period from February 28, 2018 to December 30, 2022, utilizing the Generalized Sup ADF (GSADF) test developed by Phillips et al. (2015). The findings indicate that, despite periodic fluctuations, ESG scores do not generally exhibit bubble behavior. A sharp decline was observed across all countries on March 31, 2020, which is considered to be associated with the World Health Organization's declaration of COVID-19 as a global pandemic on March 11, 2020. Furthermore, the results suggest a high degree of synchronization in ESG score movements among G-7 countries.

Keywords: *Sustainability, Bubble Movements, ESG, GSADF*

Jel Codes: *P28, Q56, L25*

Yatırımcılar Yanıltılıyor mu? ESG Puanlarında Balon Davranışının Testi

Özet

Günümüzde çevresel ve sosyal sürdürülebilirlik, sağlam yönetimin gücüyle firmaların, yatırımcıların ve tüketicilerin davranışlarını yeniden şekillendiriyor gibi görünüyor. Kamuoyunun konuya olan ilgisi, açıklanan bilgi ve derecelendirmelerin gerçeği yansıtıp yansıtmadığı sorusunu beraberinde getiriyor. Bu çalışmanın temel amacı, çevresel, sosyal ve yönetişim (ESG) puanlarının zaman içinde yatırımcı davranışlarını yanıltabilecek düzeyde aşırı değerlenme içerip içermediğini ampirik olarak incelemektir. Bu kapsamda, 28.02.2018 - 30.12.2022 tarihleri arasındaki dönemi kapsayan çalışmada, G-7 ülkelerine (Birleşik Krallık, Fransa, Japonya, ABD, İtalya ve Almanya) ait ESG puanlarında spekülatif balon davranışının varlığı, Phillips vd. (2015) tarafından geliştirilen GSADF testi ile analiz edilmiştir. Elde edilen bulgular, dönemsel dalgalanmalara rağmen ESG puanlarının genel olarak balon davranışı sergilemediğini göstermektedir. Özellikle 31.03.2020 tarihinde tüm ülkelerde keskin bir düşüş gözlemlenmiş olup, bunun Dünya Sağlık Örgütü'nün 11.03.2020 tarihinde COVID-19'u küresel salgın ilan etmesiyle ilişkili olduğu değerlendirilmiştir. Ayrıca, G-7 ülkelerinin ESG puanlarının büyük ölçüde eşgüdümlü hareket ettiği sonucuna ulaşılmıştır.

Anahtar kelimeler: *Sürdürülebilirlik, Balon Hareketleri, ESG, GSADF*

Jel Kodu: *P28, Q56, L25*

CITE (APA): Doğan Başar, B., Tunçel, M.B., Gürsoy, S., & Ekşi, I. H. (2025). Are Investors Being Misled? Testing for Bubble Behavior in ESG Scores. *İzmir İktisat Dergisi*. 40(3). 638-651. Doi: 10.24988/ije.1600574

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1. INTRODUCTION

Concepts such as sustainability, environmental responsibility, and social impact have increasingly become central to the modern financial system, ushering in a new investment paradigm in which not only economic performance, but also ethical considerations and long-term responsibilities are taken into account. The growing global challenges, ranging from environmental degradation and climate change to governance failures and social inequalities, have not only transformed investor preferences beyond purely profit-driven approaches but have also encouraged governments, private sector actors, and financial institutions to develop more inclusive and sustainability-oriented evaluation mechanisms. As a natural reflection of this transformation, Environmental, Social, and Governance (ESG)-based scoring systems have emerged as critical tools for assessing the sustainability performance of both countries and corporations. ESG scores have evolved into key screening criteria within investor decision-making processes, with sustainability-related information flows becoming a fundamental driver of financial market dynamics (Hill, 2020; Polat et al., 2024).

In this context, the increasing interest in the influence of ESG ratings on investor behavior has led to intensified academic debates regarding the reliability, methodological consistency, and market-based validity of these scores. A significant body of empirical literature has demonstrated that ESG scores exert a meaningful influence on the behavior of both individual and institutional investors (Sultana et al., 2017; Park and Jang, 2021; Rooh et al., 2023; Bang et al., 2023; Economidou et al., 2023; Liu et al., 2021; Chipalkatti et al., 2021; Kamau and Li, 2023). These studies reveal a positive and statistically significant relationship between the level of ESG disclosure and investor orientation, suggesting that ESG related information plays a decisive role in guiding capital flows and portfolio allocations.

However, an important debate in the literature remains unresolved: Do ESG scores reflect fundamental economic realities over time, or are they shaped by speculative pricing behaviors driven by investor sentiment and expectations? Understanding whether ESG scores are rationally priced in financial markets is crucial—not only for protecting investor confidence but also for assessing the long-term credibility of sustainability investments and the integrity of ESG rating frameworks. The primary objective of this study is to empirically examine whether ESG scores exhibit overvaluation over time to an extent that may mislead investor behavior. In the context of the growing trend of ESG-oriented investments in financial markets, the study seeks to explore whether ESG scores are evaluated by the market through a rational perspective or a speculative lens. Accordingly, the study aims to identify whether ESG scores demonstrate bubble behavior over time series and to assess the implications of such behavior on investor decision-making processes.

In this context, the study seeks to answer the following research questions:

(1) Do ESG scores exhibit bubble behavior over time? The answer to this question is critical in assessing the extent to which ESG scores are grounded in rational fundamentals within financial markets. If ESG scores are significantly overvalued relative to the actual performance of firms, this may result in misleading signals for investors and negatively affect the efficiency of capital allocation. The identification of speculative bubbles in ESG scores would raise concerns about the financial soundness and long-term viability of sustainability-oriented investments. Furthermore, such a finding would call into question the credibility, transparency, and methodological consistency of ESG rating systems.

(2) To what extent do investors consider ESG scores in their decision-making processes? This question is important for evaluating the practical functionality of ESG scores from the perspective of investors and their influence on market behavior. If investors actively incorporate ESG scores into their investment decisions, this indicates that ESG has evolved into an effective screening tool in

financial markets. However, investor reliance on these scores is inherently linked to the accuracy and reliability of ESG data. Therefore, understanding the degree of ESG's impact on investment decisions plays a critical role in interpreting market dynamics and portfolio strategies. Moreover, this analysis may reveal whether ESG-based investing represents a temporary trend or a fundamental shift in investment paradigms.

Following the introduction to the study, there will be a literature section containing similar previous studies on the subject. Then, in the methodology section where the empirical findings of the study are included, the econometric model to be used will be introduced and the findings will be presented. Finally, in the conclusion section, the findings will be interpreted and their contribution to the academic literature will be expressed. Additionally, what the findings mean for both investors and policy makers will be discussed and suggestions will be offered.

2. LITERATURE

ESG activities of companies generally refer to the combination of environmental, social and corporate governance issues that may affect the ability to implement business strategy and create value in the long term.

Companies' ESG reports provide value for all stakeholders, including investors, customers, employees, competitors, the media, lenders, civil society organizations, academics, analysts and researchers (Şeker and Şengür, 2022).

Previous studies on this subject show that the impact of the ESG score on companies is concentrated in financial and non-financial companies, in different country groups and sectors, and using various variables. It is possible to classify studies in the ESG literature into several groups. In the first group, there are studies focusing on the relationship between the ESG characteristics of companies and the characteristics of the markets in which they operate. Most of these studies are country- or state-level characteristics based on the geographical location of firms or the characteristics of the industries in which they are located (Borghesi et al, 2014; Cai et al, 2016; Doğan Başar et al, 2025; Tunçel et al, 2025).

In the other group, there are studies linking ESG practices at the firm level with the boards and management structure of companies (Borghesi et al, 2014; Barko et al, 2018; Li et al, 2018; Buallay et al, 2022; Dyck et al, 2023). In another group, there are studies investigating the relationships between ESG scores and firm risk, cost of capital and development (El Ghoul et al, 2016; Tseng et al, 2019; Zerbib, 2019; Eichholtz et al, 2019; Mohammad and Wasiuzzaman, 2021; Goldstein et al, 2022).

The other group includes studies on the effects of ESG scores on investor behavior, which constitute the essence of this study. In a significant part of these studies, findings were found that the disclosure/degree of ESG scores affects the behavior of individual/institutional investors (Sultana et al, 2017; Park and Jang, 2021; Rooh et al, 2023; Bang et al, 2023; Economidou et al, 2023). On the other hand, there are also studies that did not find a relationship (Białkowski and Sławik, 2022; Espahbodi et al, 2019) and found a mixed relationship (Sanseverino et al, 2023). In the literature, the effects of ESG scores not only on individual and institutional investors but also on foreign direct capital to countries have been analyzed and their effects have been found (Liu et al, 2021; Chipalkatti et al, 2021; Kamau and Li, 2023). In this regard, no study has been found that investigates whether ESG scores exhibit a bubble movement. We can say that this statement is limited to the period in which the study was prepared. Therefore, this study has a pioneering nature in terms of its subject and it is hoped that it will contribute to the literature.

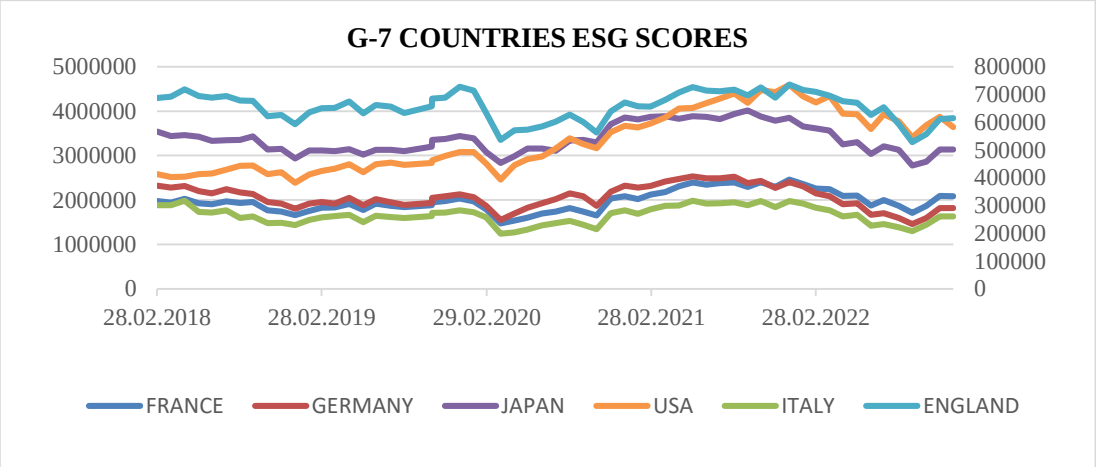
3. DATA SET, ECONOMETRIC METHOD AND FINDINGS OF THE STUDY

3.1 Data Set

This study aims to identify the existence of speculative bubbles in the ESG scores of G7 countries and pinpoint the locations of these movements, if any. In the study, G-7 countries (England, France, Japan, America, Italy and Germany), whose data were completely accessible, were included in the analysis. In the study, a 59-month data set was created for the period 28.02.2018 - 30.12.2022. The data used in the study was provided from www.msci.com.

Time series graphs of ESG scores of the countries included in the study are shown in Figure 1;

Figure 1: Time Series Graphs of ESG Scores



According to Figure 1, it can be seen that there was a serious decrease in the ESG scores of all countries on 31.03.2020. The main reason for this decrease may be that the COVID-19 outbreak was declared a global epidemic by the World Health Organization on 11.03.2020. In general, it is seen that the ESG scores of the countries in question move together.

3.2 Econometric Method

The Generalized Sup Augmented Dickey-Fuller (GSADF) test, developed by Phillips, Shi, and Yu (2015), is widely recognized in the literature as one of the most effective methods for detecting multiple speculative bubbles over time. Traditional bubble detection techniques—such as the standard ADF or the original SADF test—are typically limited to identifying only a single bubble and its collapse point, offering a rather narrow analytical framework. In contrast, the GSADF test was designed to overcome these limitations by allowing for the detection of multiple episodes of bubble formation and collapse throughout a given time series.

By utilizing expanding and rolling window procedures, the GSADF test computes the supremum of ADF test statistics, enabling researchers to pinpoint not only the onset but also the potential termination of speculative behavior. This characteristic is particularly valuable in financial markets, where asset prices and market indicators often experience frequent and dynamic fluctuations. Moreover, the method's integration of Monte Carlo simulation techniques enhances the statistical robustness and reliability of the results.

In this context, the adoption of the GSADF test in the present study is considered a methodologically sound and strategic decision—not only for identifying the presence of bubble behavior in ESG scores, but also for precisely mapping the temporal dynamics of such movements. Accordingly, the study employs ESG scores for G7 countries over the period from February 2018 to December 2022 to investigate the existence of speculative bubble behavior. The GSADF test statistic is calculated as shown in Equation 1.

$$GSADF\ (r_0) = \sup_{\substack{r_2 \in [r_0, 1] \\ r_1 \in [0, r_2, r_0]}} \{ADF_{r1}^{r2}\}. \quad (1)$$

R₀ in the equation indicates the smallest sample window, **R₁**indicates the starting point of the sample, and **R₂** indicates the end point of the sample. After speculative bubble movements are detected, the retrospective SADF (BSADF) test is applied to determine in which periods the bubbles in question occurred (Şahin, 2020: 66).

The hypotheses of the GSADF test, which was conducted to investigate speculative bubble activity in the ESG scores of G-7 countries, are expressed as follows;

$\boldsymbol{H_0}$**:** There is No Balloon Movement in the Variables.

$\boldsymbol{H_1}$ **:** There is Balloon Movement in the Variables.

In the GSADF test, the test statistic value was calculated according to Phillips et al. (2015), H_0cannot be rejected and therefore there is no bubble movement in the relevant series.

3.3 Findings

In this study, ESG scores of G-7 countries were used to identify speculative bubble movements and periods of bubble formation. For this purpose, the Generalized Sup ADF (GSADF) test, developed by Phillips et al. (2015), was applied. Before presenting the empirical findings, descriptive statistics related to ESG scores are provided in Table 1.

Table 1: Descriptive Statistics

Variable	England ESG	France ESG	Japan ESG	USA ESG	Italy ESG	Germany ESG
Mean	656039.4	1975746.	3374501.	3320638.	265273.9	2064376.
Median	661688.0	1946845.	3340657.	3153988.	263443.0	2060542.
Maximum	735778.0	2456674.	4015991.	4593595.	317503.0	2532984.
Minimum	527698.0	1471121.	2776815.	2383552.	199062.0	1456371.
Std. Deflection	51729.52	236794.0	325300.0	660878.7	31683.5	264676.5
Distortion	-0.594111	0.258078	0.361015	0.350996	-0.16112	-0.135786
Kurtosis	2.590918	2.425057	2.047385	1.709873	2.19205	2.350588

J-B Statistics	3.882244	1.467564	3.512473	5.303164	1.86001	1.218072
J-B Probability	0.143543	0.480090	0.172694	0.070540	0.39455	0.543875

Table 1 shows that the countries of England, Italy and Germany are skewed to the left, while the countries of France, Japan and America are skewed to the right. According to the kurtosis values, it is seen that all countries have a sharp distribution. In addition, according to the Jargue-Bera normal distribution test results, it is seen that all variables comply with normal distribution.

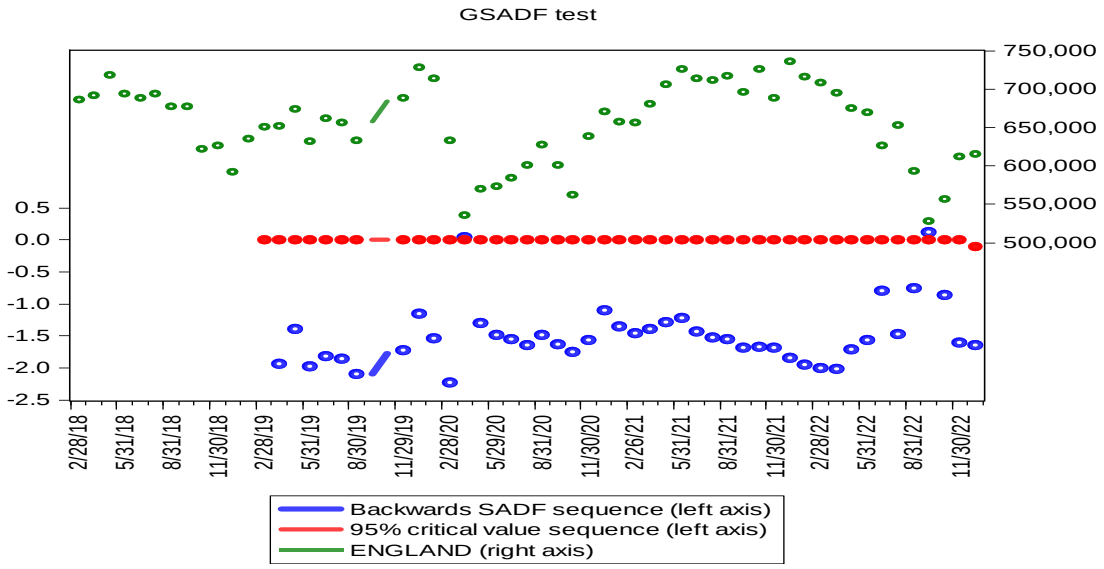
The results of the Sup ADF (GSADF) test used in the study and GSADF graphs for speculative bubble movements are reported separately for each country included in the study.

GSADF test results and GSADF graphics for England are shown in Table 2 and Figure 2.

Table 2: England ESG Scores GSADF Test Results

	GSADF Test Statistics	Critical Values		
		%1	%5	%10
England ESG	0.12	1.55	1.09	0.86
Note: ***, **, * indicate significance at level 1%, 5% and 10%, respectively.				

Figure 2: England ESG Scores GSADF Test Results



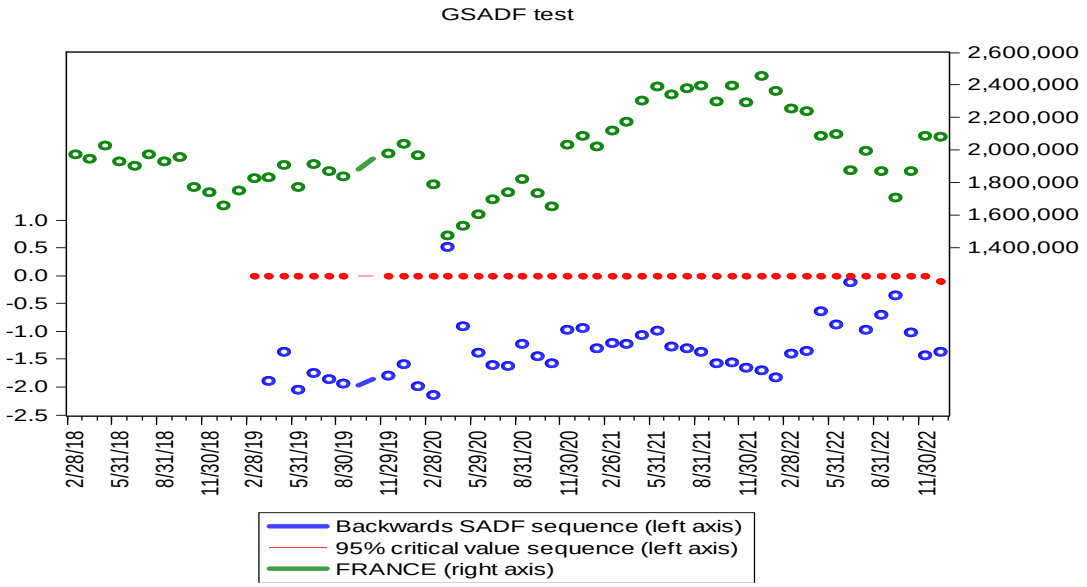
According to both the test statistics presented in Table 2 and the representation presented in Figure 2, it is seen that there is no speculative bubble activity in the monthly UK ESG scores in the period 28.02.2018 - 30.12.2022.

GSADF test results and GSADF graphics for France are shown in Table 3 and Figure 3.

Table 3: France ESG Scores GSADF Test Results

	GSADF Test Statistics	Critical Values		
		%1	%5	%10
France ESG	0.52	1.56	1.09	0.86
Note: ***, **, * indicate significance at level 1%, 5% and 10%, respectively.				

Figure 3: France ESG Scores GSADF Test Results



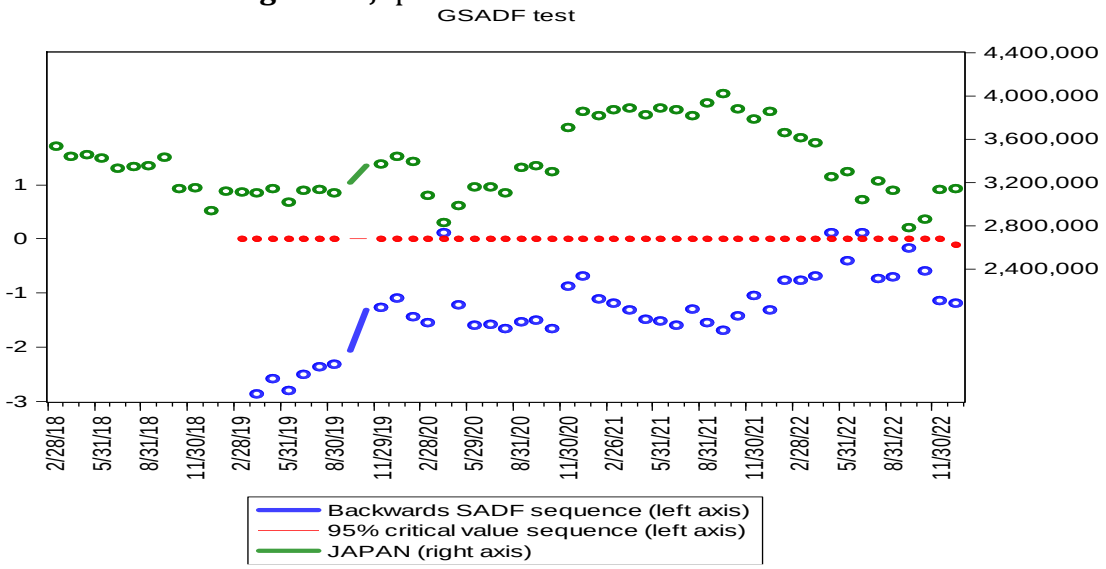
According to the test statistics presented in Figure 3 and Table 3, it is seen that there is no speculative bubble activity in the monthly French ESG scores in the period 28.02.2018 - 30.12.2022.

GSADF test results and GSADF graphics for Japan are shown in Table 4 and Figure 4.

Table 4: Japan ESG Scores GSADF Test Results

	GSADF Test Statistics	Critical Values		
		%1	%5	%10
Japan ESG	0.11	1.55	1.08	0.85
Note: ***, **, * indicate significance at level 1%, 5% and 10%, respectively.				

Figure 4: Japan ESG Scores GSADF Test Results



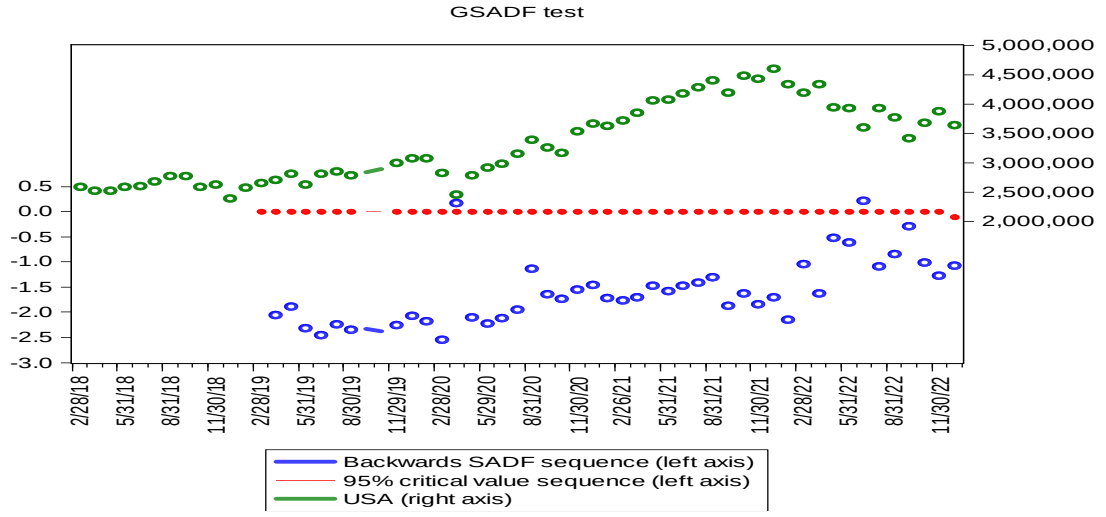
According to both the test statistics presented in Table 4 and Figure 4, it is seen that there is no speculative bubble activity in monthly Japan ESG scores in the period 28.02.2018 - 30.12.2022.

GSADF test results and GSADF graphs for America are shown in Table 5 and Figure 5.

Table 5: USA ESG Scores GSADF Test Results

	GSADF Test Statistics	**Critical Values**		
		%1	**%5**	**%10**
USA ESG	0.21	1.55	1.07	0.86
Note: ***, **, * indicate significance at level 1%, 5% and 10%, respectively.				

Figure 5: USA ESG Scores GSADF Test Results



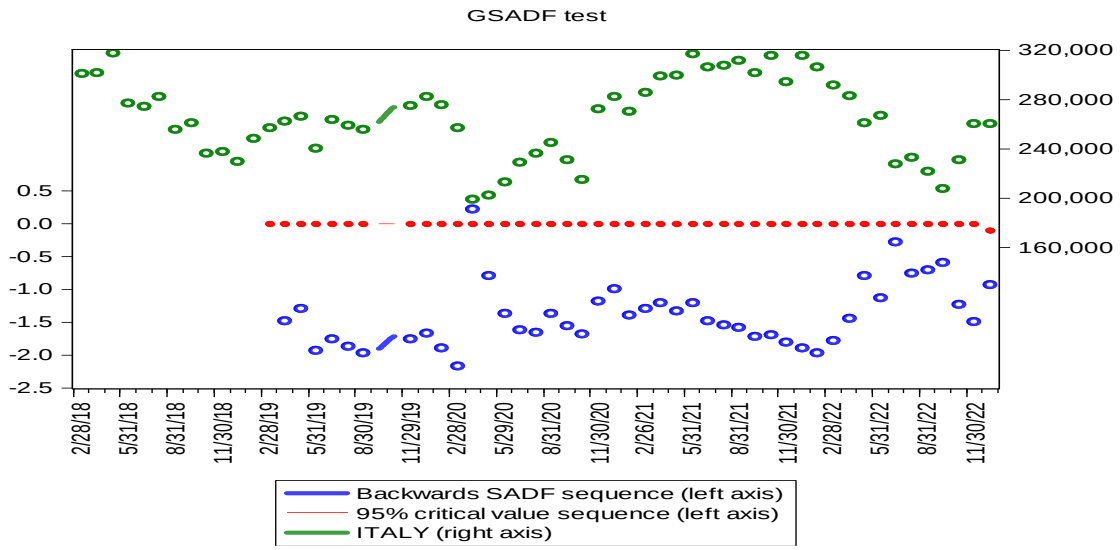
According to Table 5 and Figure 5, it proves that there is no speculative bubble activity in the monthly American ESG scores in the period 28.02.2018 - 30.12.2022

GSADF test results and GSADF graphics for Italy are shown in Table 6 and Figure 6.

Table 6: Italy ESG Scores GSADF Test Results

	GSADF Test Statistics	Critical Values		
		%1	%5	**%10**
Italy ESG	0.22	1.55	1.07	0.86
Note: ***, **, * indicate significance at level 1%, 5% and 10%, respectively.				

Figure 6: Italy ESG Scores GSADF Test Results



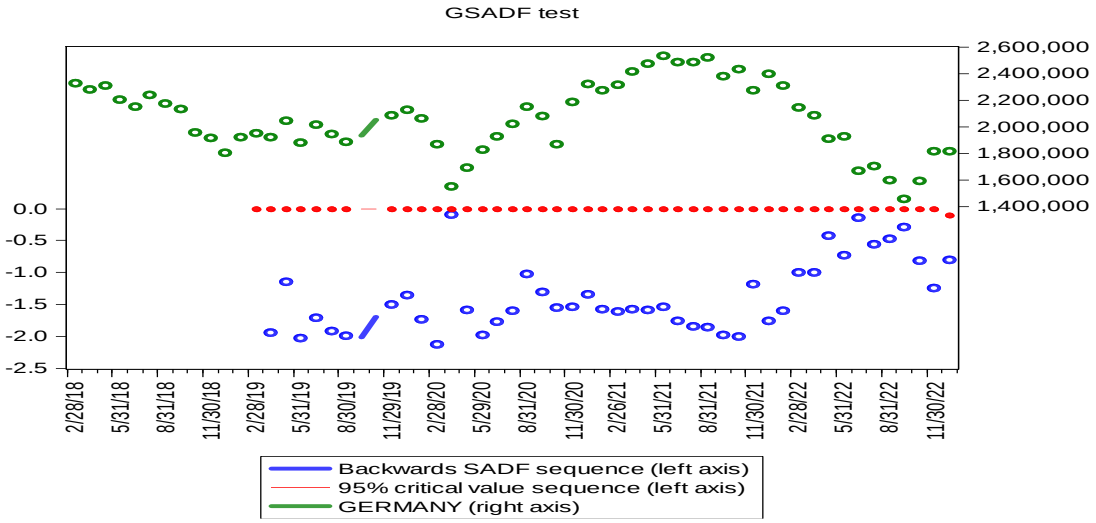
According to both the test statistics presented in Table 6 and the representation presented in Figure 6, it can be seen that there is no speculative bubble activity in the monthly Italian ESG scores in the period 28.02.2018 - 30.12.2022.

GSADF test results and GSADF graphics for Germany are shown in Table 7 and Figure 7.

Table 7: Germany ESG Scores GSADF Test Results

	GSADF Test Statistics	Critical Values		
		%1	%5	%10
Germany ESG	-0.09	1.55	1.07	0.86
Note: ***, **, * indicate significance at level 1%, 5% and 10%, respectively.				

Figure 7: Germany ESG Scores GSADF Test Results



According to Table 7 and Figure 7, it is proven that there is no speculative bubble activity in the monthly German ESG scores in the period 28.02.2018 - 30.12.2022.

CONCLUSION AND POLICY RECOMMENDATIONS

In recent years, there has been a significant increase in public interest in sustainability and environmental issues, a trend that is also reflected in academic literature. Particularly, interest in ESG-based evaluation systems has grown not only at the public level, but also among governments, corporations, and financial actors. The increasing adoption of ESG ratings and ESG-linked financing approaches has brought various criticisms and debates concerning the reliability, transparency, and alignment of these systems with financial fundamentals. In this context, the question of how accurately ESG scores reflect actual corporate performance has become a matter of critical importance, especially from the perspective of investor behavior.

The primary objective of this study is to empirically examine whether environmental, social, and governance (ESG) scores exhibit speculative overvaluation over time that could potentially mislead investors. For this purpose, the study covers the period from February 28, 2018 to December 30, 2022 and investigates the existence of bubble behavior in the ESG scores of G-7 countries (United Kingdom, France, Japan, United States, Italy, and Germany) by applying the Generalized Sup ADF (GSADF) test developed by Phillips et al. (2015).

The empirical findings indicate that the ESG scores of G-7 countries do not exhibit speculative bubble behavior during the analyzed period. This result suggests that the sustainability performance of these countries is not artificially inflated in financial markets and that ESG scores are grounded in realistic fundamentals. Accordingly, it can be concluded that investors who prioritize sustainability

can consider ESG-based investments in G-7 countries with a sense of confidence, as the indicators do not display speculative distortions. From the perspective of ESG-driven investment decisions, these countries offer a reliable foundation.

These findings hold important implications not only for the academic also for investors, policymakers, ESG rating agencies, and corporations. For investors, the absence of bubble behavior in ESG scores implies that investment strategies based on these metrics are fundamentally sound and less exposed to market distortions. This affirms that ESG-focused investment funds are well-positioned to meet growing demand, and that sustainability investments reflect a long-term strategic orientation rather than a temporary speculative trend.

From the standpoint of policymakers, the findings demonstrate that ESG-related policies are receiving rational responses in financial markets and are being positively embraced by market participants. This indicates that regulatory frameworks and incentive mechanisms aimed at promoting sustainable development goals contribute to building market confidence.

For ESG rating agencies, the results provide evidence that the scores they produce do not contribute to market speculation, thereby affirming the methodological robustness of their rating frameworks. This may further support efforts to enhance transparency and comparability in ESG reporting and evaluation standards.

In future studies, researchers are encouraged to go beyond the use of MSCI data and incorporate ESG scores produced by other international agencies, such as Bloomberg, Refinitiv, and Sustainalytics, to allow for comparative analyses. This would enable a broader assessment of how different methodological approaches affect market perception. Moreover, while the current study focuses exclusively on developed countries, future research should also include emerging economies to evaluate the global consistency and credibility of ESG scores. Sector-specific analyses would also be valuable, as the impact of ESG scores on investor behavior may vary across industries. Finally, future research could benefit from integrated models that examine not only the speculative properties of ESG scores but also their relationship with firms' long-term financial performance, cost of capital, and market valuation, thereby providing a more comprehensive understanding of the role of ESG in financial markets.

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