EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11, Issue 2, 2025
ISSN 2694-7161
www.ejobsat.cz

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11, Issue 2
2025

Mendel University in Brno
www.ejobsat.com

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Editorial Office Address
EJOBSAT, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic
Registration number MK ČR E22009
The journal is published twice a year.
First edition
Number of printed copies: 40
ISSN 2336-6494 (Print)
ISSN 2694-7161 (Online)

Number 2, 2025 was published on December 31, 2025 by Mendel University Press

CONTENTS

FUTURE OF ENVIRONMENTAL, SOCIAL AND GOVERNANCE AUDITING IN THE CZECH REPUBLIC – EVIDENCE FROM STATUTORY AUDITORS

Veronika Popelková[1]✉, David Hampel[2], Patrik Svoboda[2]

[1] *Masaryk University, Brno, Czech Republic*
[2] *Mendel University in Brno, Czech Republic*

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11 Issue 2
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

This paper analyses the attitudes and opinions of statutory auditors regarding the issue of Environmental, Social and Governance reporting and its verification in the Czech Republic. The research examines auditors' willingness to perform ESG assurance, their attitudes towards ESG issues, and their views on key skills and training needs. A questionnaire survey was conducted among Czech statutory auditors, and the results were analysed using statistical methods. The findings reveal differing attitudes between auditors employed in audit firms and self-employed auditors. Auditors from larger companies are more likely to perceive ESG reporting as a meaningful tool for responsible business and demonstrate greater interest in its verification, whereas self-employed auditors tend to be more sceptical and regard ESG as more of a formal obligation. Although the study focuses on the Czech Republic, it is based on European legislation, and the results can be generalised across the EU.

KEY WORDS

ESG assurance, ESG auditing, ESG reporting, European Corporate Sustainability Reporting Directive

JEL CODES

M14, Q56, M42

1 INTRODUCTION

Over the last decade, environmental, social, and governance (ESG) factors have become critical components of corporate practices and investor decision-making. There is an increasing emphasis on transparent and credible corporate sustainability reporting, which has led to introducing new regulatory frameworks at the European Union level. The Corporate Sustainability Reporting Directive (CSRD) imposes an obligation to externally verify ESG reports

POPELKOVÁ, Veronika, HAMPEL, David, and SVOBODA, Patrik. 2025. Future of Environmental, Social and Governance Auditing in the Czech Republic – Evidence from Statutory Auditors. *European Journal of Business Science and Technology,* 11 (2): 147–162. ISSN 2694-7161, DOI 10.11118/ejobsat.2025.007.

starting in 2024, with verification conducted only by statutory auditors or other independent verification service providers. This new requirement represents a fundamental change in auditing practices and presents challenges for both auditors and companies that will disclose ESG information. While auditors must adapt to new competency requirements and methodologies for verifying ESG reporting, companies face increased administrative and financial burdens related to data collection and verification. The quality of verification standards, which are still under development, will also be a key factor.

The CSRD has introduced ESG reporting obligations at the EU Member State level for various groups of entities in several phases. First, entities under the Non-Financial Reporting Directive will begin mandatory reporting for the first time in 2024. The next phase will include large entities and groups not participating in the first wave. These entities will report for the first time in 2025. The following group will consist of small and medium-sized entities that are issuers of securities, as well as small, non-complex credit institutions and captive insurance companies. These units will report for the first time in 2026. After exceeding the turnover criteria, the final group will include third-country enterprises with a subsidiary or establishment in the European Union. ESG reporting will be mandatory for these companies for the first time in 2028. With the initial reporting period under the CSRD starting in 2024 and the first verification by auditors occurring in 2025, examining this issue is particularly relevant. This research, therefore, focuses on the attitudes of statutory auditors towards ESG reporting and its verification in the Czech Republic. Particular attention is given to the perception of the benefits of ESG reports, the auditors' willingness to verify these reports, and their readiness for the new legislative requirements.

However, the legislative framework is changing. On 26 February 2025, the European Commission adopted a new package of proposals (Omnibus I and Omnibus II) to simplify EU rules, including modifications to the CSRD and the EU Taxonomy. According to these proposals, the timeline for the phased introduction of ESG reporting obligations would be extended. The second reporting wave, which includes large undertakings and groups not covered in the first wave, would be postponed from 2025 to 2028, and the definition of an enormous undertaking for the purposes of CSRD would be amended by increasing the employee threshold from 500 to 1,000. The third wave, covering listed small and medium-sized enterprises, small non-complex credit institutions and captive insurance undertakings, would also be postponed from 2026 to 2028. As a result, only entities currently subject to the Non-Financial Reporting Directive would be required to report for the first time in 2024, with a significant number of companies entering the reporting regime only in 2028 (European Commission, 2025).

Existing literature in the field of ESG reporting and verification has primarily focused on the importance of ESG report verification (e.g., Del Giudice and Rigamonti, 2020; Wang et al., 2022; Moalla and Dammak, 2025; Knechel, 2021; or Friske et al., 2024). Other studies emphasise using modern technologies, such as advanced data analytics and artificial intelligence applications, to verify ESG reports (Gu et al., 2023 or Vasilyeva and Makarenko, 2017). A further group of papers has examined the impact of the presence of an audit committee and its characteristics, such as size, expertise, length of tenure, or independence, on the quality of ESG reports (Pozzoli et al., 2022; Umar et al., 2024; de Almeida and de Sousa Paiva, 2022 or Suttipun, 2021). Other studies have tackled specific research topics, including the impact of a negative ESG reputation on audit quality (Asante-Appiah, 2020), factors affecting ESG auditor remuneration (Kammoun and Khoufi, 2025), the influence of non-audit service provision on ESG risk and firm value (Asante-Appiah and Lambert, 2023), the distinction between mandatory and voluntary assurance of ESG reports (Chung et al., 2024), and assurance by the auditor along with another independent assurance service provider (Bakarich et al., 2023).

In the context of our research, we also highlight, in particular, studies that addressed the importance of external auditor verification of ESG reports. Del Giudice and Rigamonti

(2020) examined whether companies that have their ESG reports audited by an independent third party possess higher ESG scores. They conducted an analysis that investigated the change in ESG scores after disclosing a specific corporate misconduct or scandal. They concluded that the results differed significantly between audited and unaudited reports. Companies with audited ESG reports do not exhibit significant changes in ESG scores after a scandal, which the authors suggest indicates that rating agencies are likely to provide an accurate initial interpretation of sustainability. In contrast, unaudited companies were found to have a significant deterioration in ESG scores after the scandal was revealed. The results of the multivariate analysis confirmed that external audits can considerably enhance the credibility of ESG scores and ESG reports.

The study by Vaihekoski and Yahya (2025) investigates whether audit quality influences the relationship between ESG scores and firm valuation. Results show that companies with high ESG scores audited by Big Four firms have higher market valuations, likely due to greater credibility and investor confidence. At the same time, no significant link is found for firms audited by non-Big Four auditors. High-quality audits appear to enhance the reliability of ESG disclosures, reduce information asymmetry and improve transparency.

Wang et al. (2022) test the effect of ESG performance on investment activity using regression analysis on a sample of Chinese companies listed on the A-share (shares of companies incorporated in mainland China, traded in renminbi, and listed on the Shanghai or Shenzhen Stock Exchange) from 2011 to 2020. ESG scores from the Bloomberg database measure ESG performance. The results show that high ESG performance significantly increases investment activity, and audit quality partially mediates the relationship between ESG performance and investment efficiency. According to the study, ESG performance is lower in state-owned firms, underdeveloped regions, and firms with low accounting information quality. Friske et al. (2024) investigated the factors influencing compliance with Global Reporting Initiative (GRI) standards in sustainability reporting. They concluded that one of the key factors is independent third-party verification. According to the authors, external verification of ESG reports by auditors positively impacts compliance with reporting standards.

In their study, Moalla and Dammak (2025) examined the effect of audit quality on ESG information transparency in US companies and the relationship between firms' media exposure, audit quality, and ESG information transparency. They concluded that high audit quality positively affects ESG information transparency. They also found that firms with higher media exposure are viewed as riskier from the external auditor's perspective. Consequently, audit procedures are more extensive, leading to more transparent ESG disclosures. Knechel (2021) also confirms the role of external auditors in verifying ESG reports. ESG factors are becoming increasingly important to investors and stakeholders. According to Knechel (2021), auditors can improve the quality of ESG disclosures. In their study, Aly and Badawy (2024) highlight that external audits independently verify sustainability information and increase stakeholder confidence in reported information. Hirsch and Heichl (2025) examined the effect of different disclosure formats and the presence of independent auditors on the quality and reliability of ESG reports. The authors used panel regression to analyse these factors. One conclusion of the study regarding the importance of audited ESG reports is that these reports have higher credibility and reliability. The study also shows that external verification of reports increases transparency and trust in the information provided.

Training auditors in ESG is essential to ensuring high-quality verification of non-financial information following new EU legislation, particularly the CSRD Directive and ESRS standards. This demands entirely new competencies – from comprehending the principle of double materiality and regulations such as the EU taxonomy to implementing international standards for the verification of non-financial data, such as the International Standard on Assurance Engagements (ISAE) 3000

(Revised) or the International Standard on Sustainability Assurance (ISSA) 5000. ESG auditing is a highly specialised activity that necessitates multidisciplinary knowledge in the areas of law, ecology, social sciences, and risk management, alongside specific soft skills and personal qualities. Auditors require training to apply standards for the verification of non-financial information, such as the International Standard on Assurance Engagements (ISAE) 3000 (Revised), the International Standard on Assurance Engagements (ISAE) 3410 on Greenhouse Gas Statements, or the new International Standard on Sustainability Assurance (ISSA) 5000). High-quality and systematic training is therefore crucial to enabling auditors to provide relevant and credible services, mitigate the risk of greenwashing, and safeguard the public interest (Rawat et al., 2025). Simultaneously, it allows them to cultivate new professional avenues and adapt to the evolving demands of a market that increasingly expects responsible and transparent behaviour from companies. Insufficient training can result in doubts about audit quality, reputational risk, and potential non-compliance with legal requirements.

Mandatory external verification of ESG reports in the European Union was introduced by Directive 2022/2464 of the European Parliament and of the Council on 14 December 2022, amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC, and Directive 2013/34/EU regarding corporate sustainability reporting (hereinafter referred to as the Corporate Sustainability Reporting Directive, CSRD). This mandatory verification can be conducted by the statutory auditor or by another independent provider of assurance services. The requirements for statutory auditors are outlined in Directive 2006/43/EC of the European Parliament and the Council on statutory audits of annual and consolidated accounts. In the Czech legal system, this Directive is transposed into Act No. 93/2009 Coll., on auditors, as amended (Czech Republic, 2009), which defines the general requirements for applicants seeking an auditor's licence, the framework content of the auditor's examination, and the obligation of supervised practice.

The binding reporting framework for sustainability information is the Sustainability Reporting Standards (ESRS), adopted by the European Commission on 31 July 2023, and Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020. This regulation establishes a framework to facilitate sustainable investments and amends Regulation (EU) 2019/2088 (the Taxonomy Regulation), which includes a classification of economic activities considered sustainable concerning the Statutory Environmental Objectives (EU, 2023).

The European Commission has not yet issued verification standards to confirm sustainability information. Therefore, national verification standards can currently be applied to assess ESG reports until the European Commission adopts its verification standards. The most commonly used standard in member countries is the International Standard on Assurance Engagements (ISAE) 3000 (Revised), which is not dedicated to audits or reviews of historical financial information, and is presently utilised to verify voluntary ESG reporting compiled based on GRI standards. This standard is also employed in the Czech Republic and pertains to verification engagements at the limited assurance level. The International Standard on Assurance Engagements (ISAE) 3410 on Greenhouse Gas Statements is used for verifying greenhouse gas (GHG) reporting engagements. This separate standard allows auditors to validate the GHG emissions section of an ESG report.

This paper aims to verify the sufficient capacity in the ESG assurance services sector in the Czech Republic and empirically validate the so-called "Matrix of Professional Competencies and Personal Assumptions of ESG Auditors," compiled based on the legislative and theoretical background in Popelková and Svoboda (2025). This matrix provides a comprehensive overview of the requirements for ESG auditors (listed in Tab. 1 below), including legal requirements, technological skills, ethical standards, and soft skills necessary for the ESG audit profession. The 17 professional competencies and personal prerequisites were selected based

on a content analysis of the available literature. The following sources served as the primary basis for developing the matrix (Popelková and Svoboda, 2025):

- Article 8 of Directive 2006/43/EC of the European Parliament and the Council;
- § 4 of the Czech Act on Auditors, as amended from 1 January 2024;
- overview of ESG modules within the CPD (Continuous Professional Development) programme of the Chamber of Auditors of the Czech Republic;
- the International Code of Ethics for Professional Accountants and the draft International Ethics Standards for Sustainability Assurance (International Ethics Standards Board for Accountants);
- ČSN EN ISO 19011:2019 – Guidelines for Auditing Management Systems (international standard providing guidance on auditing principles, managing audit programmes, and conducting management system audits);
- IFAC (2024): A Literature Review of Competencies, Educational Strategies, and Challenges for Sustainability Reporting and Assurance (study summarising global research on the skills and knowledge required for professionals engaged in sustainability reporting and assurance).

The following research questions were identified in the context of the present research:

- Does the ESG Auditor Professional Competencies and Personal Attributes Matrix include only the competencies and personal attributes deemed relevant to the profession of ESG auditor?
- Is there a relationship between auditors' willingness to audit ESG reports and the nature of audit work?
- Is there a relationship between auditors' willingness to audit ESG reports and how they acquire additional knowledge of ESG issues?
- Is there a relationship between auditors' views on ESG issues and the nature of audit practice?
- Is there a relationship between auditors' views on ESG issues and their willingness to audit ESG reports?

2 MATERIALS AND METHODS

The data required to achieve the objectives of this study were gathered through a questionnaire survey of statutory auditors, i.e., individuals who have been issued an audit license. All auditors with an email address published in the official register of auditors were contacted; specifically, 427 auditors were reached out to of 1061 active auditors as of 31 January 2024. The sample survey was conducted from May to July 2024. The questionnaire was sent to the auditors by email twice: the initial invitation was distributed in May 2024, followed by one reminder in June 2024. This was the period during which the CSRD was transposed into the Czech legal system, and statutory auditors were mandated to verify ESG reports. During this timeframe, statutory auditors received training in ESG reporting and verification to ensure they could perform external verification of these reports in 2025 for the 2024 reporting period. The sample survey was executed using Google Forms. The complete questionnaire is included in Appendix A. The questionnaire is linked to the research questions as follows: the first research question is addressed in question 6; the other research questions involve willingness to conduct an ESG audit (question 3 in the questionnaire), attitude towards ESG audits (questions 1 and 2), auditor training (questions 4 and 5), all in combination with the legal status of the auditor (question 7).

The questionnaire was completed by 82 out of the 427 auditors contacted. This response rate is comparable to similar surveys targeting specific professional groups, e.g., Eulerich et al. (2022) or Rossi and Hampel (2024).

To verify the sample's representativeness, the proportion of self-employed auditors in the sample was checked to determine whether the proportion of self-employed auditors in the population corresponds to the proportion of self-employed auditors. For this purpose, the Bernoulli distribution parameter test was used with H_0 parameter equal to 0.35, which is the proportion of self-employed auditors in the population (sourced from the official register of auditors). The relevance of the data in the ESG auditor's Professional Competencies and Personality Assumptions Matrix was again assessed using the Bernoulli distribution parameter test. The proportion of the sum of the frequencies for the response options 'rather important' and 'important' and the number of respondents serves as the estimate of this parameter. Testing the substantive significance of the items in the Professional Competence Matrix is possible using the H_0 parameter equal to 0.5 and the alternative hypothesis that the parameter is greater than 0.5. An analogous approach was used in Lee et al. (2016) for the case of testing the effects of auditors' self-efficacy and professional development.

The dependence between responses to each question was assessed using a contingency table test of independence (we tested the test assumptions about theoretical frequencies, which required them to be at least 5 in 80% of cases and greater than 2 in the remaining 20%). In the event of a statistically significant dependence, the strength of the dependence was evaluated using Cramer's coefficient, which ranges from 0 (weak dependence) to 1 (strong dependence). The nature of any detected dependence was explained through Haberman's residual analysis. This approach was used, e.g. in Gajanová and Nadányiová (2018), where correspondence analysis is employed instead of Haberman's residual analysis. A description of the methods mentioned above is given in Agresti (2007). Finally, hierarchical cluster analysis was applied (various distance measures between objects and clusters were employed), resulting in a dendrogram and characteristics of the detected clusters, similar to those in Lamboglia and Mancini (2021); a mathematical description can be found in Martinez and Martinez (2016). The calculations were conducted at a significance level of 0.05 and were executed in the MATLAB R2024b computational system.

3 RESULTS

Firstly, the hypothesis was tested regarding whether the proportion of self-employed auditors in the sample corresponds to the proportion of self-employed auditors in the population, i.e., 35%. Based on $p = 0.088$, we do not reject the null hypothesis; therefore, the proportion of self-employed auditors in the sample is not statistically significantly different from the proportion in the population. Since the practice of auditing is significantly influenced by the personality of the auditor, we can conclude that the results obtained from the sample survey can be generalised to the entire population of auditors.

The first question addressed whether ESG should be part of corporate strategies and if it should be prioritised over the objective of maximising value for owners/shareholders. A total of 46.3% of auditors believe that ESG should be integrated into corporate strategy and should also take precedence over the goal of maximising value. In contrast, 11% of auditors contend that ESG should be part of corporate strategies but should be subordinate to the objective of maximising value. The perspective that ESG should be regarded with equal importance to value maximisation is held by 42.7% of auditors. The results indicate that most auditors (89%) believe that ESG should be prioritised above the objective of value maximisation or held on the same level of consideration.

When asked whether the auditors believe that the ESG report is merely a formal document with no impact on CSR, 48.8% of auditors responded that the ESG report is not just a formal document and does have an impact on

CSR. A total of 34.1% of auditors think that it is solely a formal document without any real influence. Additionally, 17.1% of auditors provided different responses in the open-ended section. Among these auditors, a significant proportion assert that the true impact of ESG reports cannot be currently assessed. Some indicate that most companies will likely regard them more as formal documents with no tangible impact. These auditors also emphasise that the effect of ESG reports will depend on management's moral integrity and the company's overall attitude towards sustainability. The auditors observe that current legislation artificially enforces the impact of ESG reporting, and the high administrative burden may reduce its effectiveness. Some respondents emphasise that future developments and global cooperation on ESG will be crucial, as will the significance that users place on ESG reporting.

A total of 28 auditors responded to the follow-up question and shared their views on making the ESG report more than just a formal document, allowing it to have a real impact on corporate social responsibility. Some auditors believe that ESG documentation is primarily a formal matter with no substantial impact on sustainability, as companies tend to produce it merely to fulfil a legal obligation. Others see the potential for its meaningful use if companies recognise its importance and the public begins to actively value responsible business practices. One suggestion is to simplify and integrate ESG reports into annual reports, where companies would include relevant information at their discretion. Additionally, there is a need to raise awareness of the meaning of ESG among the professional and lay public so that companies do not view ESG as an administrative hurdle.

Some auditors warn against excessive regulation and call for more freedom in corporate disclosures or looser rules that emphasise recommendations rather than strict legislation. Other suggestions include reducing the cost of report production by simplifying administrative processes, for example. Some auditors question whether ESG will genuinely contribute to responsible business practices unless there are stricter sanctions or a global consensus on standards. Others emphasise that ESG must be economically viable – reporting costs should be lower than the benefits, such as improved financing. There are also sceptical views that it will not bring about fundamental changes without a global approach and consistent ESG rules. Its implementation will be gradual, and improvements will occur rather slowly. The general consensus is that 'reason should prevail' – protecting nature is essential, but regulation should not be excessive and reflect the real possibilities of businesses and individual economies.

The next question asked about auditors' interest in verifying Sustainability Reports. The majority of auditors (57.3%) believe that they will definitely audit these reports. Only 14.6% of auditors said they definitely will not audit ESG reports. A relatively significant proportion of auditors (28%) do not yet know whether they will audit these reports, which may reflect that auditors are just starting to become familiar with this area and are unsure whether they will be able or willing to do so.

A follow-up question mapped the channels and sources from which auditors plan to obtain ESG knowledge and information for ESG report verification. Most auditors responded that their main source of information will be courses and training at the Chamber of Auditors of the Czech Republic (72 respondents, i.e., 87.8%). This is, of course, related to the fact that webinars and courses at the Chamber of Auditors of the Czech Republic are designed to cover all required areas of ESG issues, and these courses are automatically counted toward the mandatory Continuing Professional Education (CPE) that auditors must complete. A total of 58.5% of respondents also plan to choose a form of self-study. Additionally, 30.5% of auditors plan to undertake internal training within their audit firm. Furthermore, 14.6% of auditors intend to complete only the mandatory CPE and do not plan to pursue further training in this area. This percentage corresponds to the share of auditors who do not plan to audit ESG reports. Other sources of information cited by auditors include educational agencies, university courses, guidance notes for auditors, and training provided by an international network of consultancies.

The open-ended response also included the view that auditors planning to audit sustainability reports should attend ongoing training or conferences with an international focus: "Given the rapid developments and changes in this area, it will be very difficult to maintain the quality of audit reports without continuously updating information and ideally sharing different views." The supplementary question also identified the ESG issues that auditors believe should be part of education. According to Article 8 of Directive 2006/43/EC of the European Parliament and of the Council, the following should be included in auditors' training: standards for reporting Sustainability Reports, standards for verifying these reports, sustainability analysis, and due diligence procedures.

The majority of auditors (92.7%) believe that standards for verifying sustainability reports should be included in training. Additionally, 75.6% of auditors feel that training should cover standards for reporting on sustainability reports, while 61% think sustainability analysis should also be part of the training. Some auditors (43.9%) believe that training should also encompass due diligence procedures, which are regulated by the Corporate Sustainability Due Diligence Directive (CSDDD) of 13 June 2024 (EU, 2024). Member States must transpose the CSDDD into national legislation by 26 July 2026. Only a draft of this directive existed at the time of the research. However, Article 8 of Directive 2006/43/EC of the European Parliament and of the Council has already addressed this area in the mandatory training of auditors before adopting this Directive (EU, 2006).

Next, we will verify the ESG Auditor Professional Competence Matrix and Personality Assumptions. The basis is the assessment shown in Tab. 1. The distribution of relative frequencies and medians demonstrates that auditors deem all the core competencies and personality assumptions of the constructed matrix relevant. A more rigorous assessment using the test identified competencies that were not rated as important or rather important by the majority of respondents.

Based on a combination of median scores and p-values, the competencies and personality attributes of ESG auditors can be categorised into three groups based on their perceived importance and statistical significance. The core competencies that were statistically significant as necessary ($p < 0.05$) and also reached a median of 4 or 5 include adherence to ethical principles, systems thinking, adaptability and flexibility, critical thinking and problem solving, decisiveness, independence, openness to improvement, open-mindedness, the ability to perceive the specifics of the organisation, and mindfulness. These competencies are deemed essential for the ESG audit profession across the sample of respondents and should form the core profile of this new professional field.

The second group comprises competencies that, while they achieved a median score of 4, indicating they are generally considered important, had their significance not confirmed statistically ($p \geq 0.05$). These include technological competence, versatility, sensitivity to corporate culture, and diplomacy. The results indicate that these skills are not universally perceived as key but may be important depending on the context of a particular audit engagement or auditor specialisation. The third group consists of competencies that demonstrate both a lower median (3 or 3.5) and statistical insignificance ($p \geq 0.05$). Specifically, these include interpersonal skills, resilience, and the capacity to act bravely (moral courage). Respondents do not perceive these qualities as necessary and therefore do not consider them essential for pursuing the ESG auditing profession.

Overall, the results confirm that the proposed Matrix of Professional Competencies and Personal Attributes encompasses the core key skills for ESG auditors. However, they also indicate that some soft skills may not be widely perceived as necessary and should, therefore, be considered more individually. In the open response, it was expressed that the ESG auditor should also be able to outsource. Given the complexity of the ESG topic, collaboration with external experts may be necessary.

The majority of respondents are employees of the audit firm (76.8%). Among self-employed

Tab. 1: Evaluation of professional competencies and personal prerequisites needed for ESG auditors. The column Test includes p-values from the test of the sample proportion

	Importance level (%)						
Competency	**1**	**2**	**3**	**4**	**5**	**Median**	**Test**
Adherence to Ethical Principles	3.7	6.1	14.6	17.1	58.5	5	< 0.001
Systems Thinking	3.7	4.9	15.9	32.9	42.7	4	< 0.001
Adaptability and Flexibility	1.2	6.1	15.9	45.1	31.7	4	< 0.001
Critical Thinking and Problem-Solving	3.7	2.4	13.4	31.7	48.8	4	< 0.001
Technological Competence	2.4	12.2	32.9	36.6	15.9	4	0.329
Interpersonal Skills	1.2	12.2	39.0	37.8	9.8	3	0.329
Versatility	2.4	6.1	40.2	39.0	12.2	4	0.413
Resilience	6.1	9.8	40.2	32.9	11.0	3	0.135
Moral Courage	8.5	6.1	35.4	34.1	15.9	3.5	0.500
Decisiveness	2.4	3.7	22.0	40.2	31.7	4	< 0.001
Independence	2.3	8.5	23.2	42.7	32.9	4	0.002
Openness to Improvement	1.2	4.9	28.0	37.8	28.0	4	0.002
Sensitivity to Corporate Culture	6.1	11.0	31.7	37.8	13.4	4	0.413
Diplomacy	3.7	8.5	31.7	32.9	23.2	4	0.135
Open-Mindedness	1.2	3.7	19.5	41.5	34.1	4	< 0.001
Awareness of Organisational Specifics	2.4	1.2	14.6	34.1	47.6	4	< 0.001
Attentiveness	3.7	1.2	11.0	37.8	46.3	4	< 0.001

auditors, there is a significantly higher proportion of auditors who will definitely not audit ESG reports (42.1%) compared to all respondents, where this proportion was 14.6%. A total of 26.1% of self-employed auditors do not yet know whether they will audit these reports. Additionally, there is a significantly higher proportion of auditors in this group (52.6%) who believe that the ESG report is merely a formal document and has no real impact on CSR. Given the nature of the audit engagements of interest to sole auditors, it is expected that these auditors will audit Sustainability Reports to a lesser extent. Public interest entities, large entities, or small and medium-sized entities issuing securities subject to the CSRD are predominantly audited by medium and large audit firms.

When testing the dependence between the selected questions, the requirements for theoretical frequencies were consistently verified with positive results. A statistically significant relationship was identified with $p < 0.001$ between the nature of audit practice and whether auditors plan to audit ESG reports in the future. A Cramer's coefficient of 0.44 indicates a moderately strong relationship. Haberman residuals revealed that auditors employed by audit firms are more likely to plan to audit ESG reports than self-employed auditors. The association between the nature of audit practice and auditors' belief that the ESG report is merely a formal document was confirmed with $p = 0.008$. The Cramer's coefficient of 0.34 indicates a weak to moderate relationship. We can conclude that auditors who perceive the Sustainability Report as merely a formal document do not plan to audit the ESG report in the future, while auditors who believe the ESG report has a real CSR impact are inclined to audit these reports in the future.

A moderately strong relationship was also confirmed between auditors' willingness to audit ESG reports and their plan to attend only mandatory continuing professional education at the Chamber of Auditors of the Czech Republic (independence rejected with $p < 0.001$; Cramer's coefficient is 0.42). Auditors who intend to attend only mandatory continuing professional education on ESG at the

Chamber of Auditors of the Czech Republic do not plan to verify ESG reports. In contrast, those who plan to utilise multiple information channels to gain knowledge of ESG issues do intend to verify these reports. A weak to moderate dependence was confirmed regarding questions on the nature of audit practice and the formality of ESG reports (independence rejected with $p = 0.040$; Cramer's coefficient is 0.23). Self-employed auditors are more likely to view the ESG report as merely a formal document, whereas auditors employed by audit firms regard it as significant in terms of its impact on corporate social responsibility.

The distribution of respondents according to their answers was conducted using cluster analysis. The hierarchical agglomerative procedure with standardised Euclidean distance between objects and Ward's distance between clusters yielded the most reliable results. Utilising the dendrogram, four clusters of respondents were identified, as shown in Tab. 2. Cluster 4 cannot be considered relevant for the interpretation of the results, as it includes only three respondents. These respondents did not show any consistent pattern of responses; therefore, it was not possible to determine the characteristics of this group. For this reason, the fourth cluster was excluded from further analysis and interpretation.

Tab. 2: Distribution of respondents into clusters

Cluster	Count	Proportion (%)
1	54	66
2	12	15
3	13	16
4	3	4

Cluster 1 contains the vast majority of audit firm employees who place greater importance on ESG reports and recognise their real impact on corporate social responsibility. Respondents in this cluster confirmed that they consider all the skills and personal characteristics listed in the Professional Competency Matrix to be essential for the ESG audit profession. Most members of this group are actively preparing to audit ESG reports and plan to expand their expertise on ESG issues through additional information sources. They also agree that ESG auditor training should encompass all areas defined in Article 8 of Directive 2006/43/EC of the European Parliament and the Council.

Cluster 2 primarily consists of auditors operating as sole proprietors who view ESG reports as formal documents with little actual impact on corporate social responsibility. This group has the highest proportion of auditors who only intend to participate in mandatory continuing education through the Chamber of Auditors and do not plan for any additional ESG training. In terms of training program content for ESG auditors, most respondents believe that auditing standards for ESG reports should be included. Half of them also consider the inclusion of sustainability analysis to be significant, while a smaller portion of this group supports training on ESG reporting standards and due diligence procedures. Respondents in this group also affirmed that they regard all the skills and personal characteristics outlined in the professional competency matrix as important or quite important for the ESG audit profession.

Cluster 3 consists solely of auditors working for audit firms. An interesting aspect of this group is its ambivalence on specific issues. While the majority of respondents in this cluster plan to pursue extended ESG training, a notable proportion (40%) believes that the ESG report is merely a formal document with no genuine impact on corporate social responsibility. Regarding preferences for ESG auditor education, this group agrees that it should encompass assurance and reporting standards. Additionally, half of the respondents regard sustainability analysis and due diligence practices as important. These auditors, although not entirely optimistic about ESG, can be expected to participate in the verification of ESG reports due to their employment relationship. Concerning professional competencies, these respondents view most skills as quite important for the ESG audit profession. However, they are neutral about certain qualities, such as the ability to act bravely or exercise diplomacy.

4 DISCUSSION

We are aware that questionnaire surveys can have weaknesses that affect the quality and reliability of the data collected. One of these weaknesses is that many respondents do not complete the questionnaire, leading to low return rates and a potentially unrepresentative sample. To reduce the risk associated with low return rates, we have added an optional final response to the questionnaire where auditors can provide their email if they wish to receive the survey results. This option has been included to encourage auditors to complete the survey. The structure and questions in the questionnaire are designed to be understandable to all respondents, and it does not take much time to complete. To complete and submit the questionnaire, all questions must be answered except question 2b, which is logically linked to and elaborates on the previous question.

Another potential weakness is self-selection bias, where auditors with strong opinions on ESG issues are more likely to answer the questionnaire. To reduce self-selection bias, we emphasised in the introductory email the importance of having auditors who are sceptical or undecided about the issue complete the questionnaire, as well as the opportunity to gather views from other colleagues in the profession regarding its development. Professional education on ESG is part of the mandatory educational topics for all members of the Chamber of Auditors, so we believe that developments on this matter are important for all auditors, including those who will not be auditing ESG in the future. To avoid biased results, we added a question to the questionnaire to determine the nature of the respondent's activities - whether they are an employee of the audit firm or a self-employed auditor. This information will allow us to compare the composition of respondents with the structure of the audit profession in the Czech Republic, and in the case of significant deviation, we can apply data weighting. The possibility of obtaining survey results also helps to mitigate the risk of self-selection bias to some extent. The sample of auditors contacted consists of all with a published email address in the Register of Auditors, regardless of their specialisation. For this reason, the questionnaire distribution was deliberately not conducted at conferences or training sessions, where auditors with already defined positions are present. We rejected the distribution of questionnaires by post to the published addresses of auditors listed in the register. This is because the address is typically the registered office of the audit firm where the auditor is employed or the registered office of the auditor's sole proprietorship. Thus, it may not be linked to a specific auditor, and there is a risk that the respondent is not the statutory auditor but another employee. We also believe that distribution by post would result in very low returns, with costs not justifying the benefits, and this method could introduce bias in the results. The selected distribution of questionnaires via auditors' email addresses yields a representative sample that can be generalised to the entire population of auditors.

The results of the study show the diversity of opinions among auditors regarding ESG. While auditors employed by audit firms demonstrate greater interest in verifying ESG reports and recognise their importance for corporate social responsibility, self-employed auditors tend to be more sceptical and view ESG reports as more of an administrative formality. This difference may stem from the nature of the audit engagements that interest sole practitioner auditors, leading to the expectation that they will audit ESG reports to a lesser extent. Public interest entities, large entities, or small and medium-sized entities issuing securities subject to the CSRD are predominantly audited by medium or large audit firms. This assertion was affirmed by a study conducted by Bakarich et al. (2023), which examined the ESG reports of companies in the "Top 100 Sustainable Companies" rankings of The Wall Street Journal and Investor's Business Daily. They concluded that ESG verifications were performed at most international companies by BIG 4 audit firms (57%).

5 CONCLUSIONS

An important finding is that, although most auditors recognise the significance of ESG reporting, approaches to continuing education differ among groups. Those preparing to audit ESG reports often prefer broader training that covers not only auditing and reporting standards but also sustainability analysis and due diligence practices.

Many auditors working as employees of audit firms, despite planning extended training in ESG reporting and verification, along with most intending to verify ESG reports, often hold a negative view of ESG. Many believe that the ESG report serves merely as a formal document without real impact on corporate social responsibility. This group of auditors includes many who are not entirely convinced of the benefits of these reports, even though they will receive further education in this area, and most will also audit these reports. These sentiments may arise from their employment situation, wherein audit firms encourage staff to pursue extended ESG training to remain competitive and meet client demands. However, auditors may perceive ESG reporting as a tool introduced mainly for regulatory purposes rather than for its genuine value to investors or the public. Some auditors also see ESG reporting as an underdeveloped tool still in its formative stages. Consequently, they may regard it as merely a formality today, simultaneously acknowledging that their role will evolve in the future, necessitating preparation for changes within their profession.

The results of our research have highlighted the potential impacts on ESG regulators themselves, auditors and audit firms, and companies with ESG reporting obligations. ESG regulators should assess, considering the concerns of statutory auditors, whether the new requirements and mandatory reporting standards place a disproportionate administrative and financial burden on companies relative to the anticipated benefits. The most significant risk seems to be for listed SMEs, which will engage in ESG reporting in the third wave of CSRD implementation, with their first reporting period beginning in 2028 under the Omnibus I and II proposal, which postpones the original 2026 start date by two years.

For companies subject to the CSRD, mandatory ESG reporting and its verification by an auditor pose a significant challenge due to high data collection requirements, costs for staff training, and the need for personnel resources, as well as the use of external experts and modern technology. According to a survey conducted among statutory auditors in the Czech Republic, 42.1% of statutory auditors definitely will not verify ESG reports, and 26.1% of statutory auditors are still uncertain about whether they will confirm these reports. Suppose a large number of statutory auditors exit the market, and medium and large audit firms primarily handle the verification of ESG reports. In that case, competition will diminish, leading to increased prices for verification services.

In the Czech Republic and in most other EU countries that have been obliged to implement the CSRD Directive into national legislation, only statutory auditors are authorised to verify ESG reports. Thus, the verification of ESG reports presents a significant opportunity for auditors to expand their services. At the same time, the verification of ESG reports brings challenges in the form of high demands on qualifications and other skills related to the issue. Verification of ESG reports is a complex discipline that often involves specific technical areas, such as the verification of carbon footprint calculations. Additionally, auditors are required to possess specific soft skills. These skills and personal attributes have been defined based on the literature (Popelková and Svoboda, 2025), and research conducted among statutory auditors has confirmed these skills as crucial for the profession of ESG auditors. The skills and areas of learning can guide future ESG auditors on what areas to focus on in their learning and development. They can also inform professional chambers and educational institutions about including courses related to these areas and skills in ESG assurance within their training programmes.

We believe that the results of the research will contribute to filling gaps in current research and may have practical implications for audit services, ESG regulation, and the implementation of the CSRD in Europe. The study has mapped the views and attitudes of statutory auditors towards ESG reporting and assurance, and analysed their willingness to engage in the assurance of ESG reports in the context of new regulatory requirements. Identifying the key competencies and training needs of auditors concerning ESG assurance enables the professional community to be better prepared for the upcoming changes. A comparison of the approaches of auditors employed by audit firms and self-employed auditors revealed differences in their perceptions and approaches to this new area of assurance. The results of this research thus contribute to the professional discussion on the implementation of the CSRD and its impact on the audit profession in the European Union, while the specific view of the situation in the Czech Republic may inspire other Member States. The results of this study can serve as a valuable source of information for regulators, auditors, academics, professional chambers, and companies themselves as they prepare to meet the new ESG reporting requirements.

6 ACKNOWLEDGEMENTS

This research is supported by the Masaryk University internal grant No. MUNI/A/1629/2024 – ESG reporting and its verification from the perspective of a statutory auditor.

7 REFERENCES

Agresti, A. 2007. *An Introduction to Categorical Data Analysis*. 2nd ed. Hoboken: Wiley-Interscience. ISBN 978-0-471-22618-5.

Aly, A. W. N. and Badawy, H. A. E. S. 2024. External Assurance on Sustainability Reporting of Listed Companies in the Context of Egypt Vision 2030. *The Scientific Journal of Business and Finance*, 44 (2), 263–277. DOI: 10.21608/caf.2024.372939.

Asante-Appiah, B. 2020. Does the Severity of a Client's Negative Environmental, Social and Governance Reputation Affect Audit Effort and Audit Quality? *Journal of Accounting and Public Policy*, 39 (3), 106713. DOI: 10.1016/j.jaccpubpol.2019.106713.

Asante-Appiah, B. and Lambert, T. A. 2023. The Role of the External Auditor in Managing Environmental, Social, and Governance (ESG) Reputation Risk. *Review of Accounting Studies*, 28 (4), 2589–2641. DOI: 10.2139/ssrn.3864175.

Bakarich, K. M., Baranek, D. and O'Brien, P. E. 2023. The Current State and Future Implications of Environmental, Social, and Governance Assurance. *Current Issues in Auditing*, 17 (1), A1–A21. DOI: 10.2308/CIIA-2022-012.

Chung, R., Bayne, L. and Birt, J. L. 2024. Determinants of ESG Disclosure among Listed Firms under Voluntary and Mandatory ESG Disclosure Regimes in Hong Kong. *Journal of Applied Accounting Research*, 25 (4), 812–836. DOI: 10.1108/JAAR-07-2022-0179.

Czech Republic. 2009. *Act No. 93/2009 Coll., on Auditors, as Amended* [online]. Available at: `https://www.zakonyprolidi.cz/cs/2009-93`. [Accessed 2024, January 20].

de Almeida, M. G. and de Sousa Paiva, I. C. 2022. Audit Committees and its Effect on Environmental, Social, and Governance Disclosure. In *2022 17th Iberian Conference on Information Systems and Technologies (CISTI)*, 1–6. DOI: 10.23919/CISTI54924.2022.9820167.

Del Giudice, A. and Rigamonti, S. 2020. Does Audit Improve the Quality of ESG Scores? Evidence from Corporate Misconduct. *Sustainability*, 12 (14), 5670. DOI: 10.3390/su12145670.

Eulerich, M., Bonrath, A. and Lopez Kasper, V. I. 2022. Internal Auditor's Role in ESG Disclosure and Assurance: An Analysis of Practical Insights. *Corporate Ownership & Control*, 20 (1), 78–86. DOI: 10.2139/ssrn.4070755.

European Commission. 2025. *Commission Proposes to Cut Red Tape and Simplify Business Environment (Omnibus I and II Simplification Package)* [online]. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_25_614. [Accessed 2025, August 13].

European Union. 2006. *Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on Statutory Audits of Annual Accounts and Consolidated Accounts, amending Council Directives 78/660/EEC and 83/349/EEC and Repealing Council Directive 84/253/EEC* [online]. Available at: https://eur-lex.europa.eu/legal-content/CS/TXT/PDF/?uri=CELEX:32006L0043. [Accessed 2024, July 19].

European Union. 2022. *Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as Regards Corporate Sustainability Reporting (CSRD)* [online]. Available at: https://eur-lex.europa.eu/legal-content/CS/TXT/PDF/?uri=CELEX:32022L2464. [Accessed 2024, January 20].

European Union. 2023. *Commission Delegated Regulation (EU) 2023/2772 of 31 July 2023 supplementing Directive 2013/34/EU of the European Parliament and of the Council as Regards Sustainability Reporting Standards* [online]. Available at: https://eur-lex.europa.eu/legal-content/CS/TXT/PDF/?uri=OJ:L_202302772. [Accessed 2024, January 20].

European Union. 2024. *Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on Corporate Sustainability Due Diligence and amending Directive (EU) 2019/1937 and Regulation (EU) 2023/2859* [online]. Available at: https://eur-lex.europa.eu/legal-content/CS/TXT/HTML/?uri=OJ:L_202401760. [Accessed 2024, July 10].

Friske, W., Nikolov, A. N. and Morgan, T. 2024. Making the Grade: An Analysis of Sustainability Reporting Standards and Global Reporting Initiative Adherence Ratings. *Corporate Social Responsibility and Environmental Management*, 31 (3), 2098–2108. DOI: 10.1002/csr.2686.

Gajanová, L. and Nadányiová, M. 2018. Dependence of Brand Loyalty on Customer Relationship Management. *Littera Scripta*, 11 (2), 20–34. ISSN 1805-9112.

Gu, Y., Dai, J. and Vasarhelyi, M. A. 2023. Audit 4.0-based ESG Assurance: An Example of Using Satellite Images on GHG Emissions. *International Journal of Accounting Information Systems*, 50 (2), 100625. DOI: 10.1016/j.accinf.2023.100625.

Hirsch, S. and Heichl, V. 2025. Analyzing the Impact of Disclosure Format and Auditing. *Journal of Corporate Accounting & Finance*, 36 (3), 275–298. DOI: 10.1002/jcaf.22784.

IAASB. 2013. *International Standard on Assurance Engagements ISAE 3410: Assurance Engagements for Greenhouse Gas Emissions Statements* [online]. Available at: https://www.kacr.cz/file/7620/isae-3410cz-amend-isqm-20022023.pdf. [Accessed 2024, January 20].

IAASB. 2015. *International Standard on Assurance Engagements ISAE 3000 (Revised): Assurance Engagements That Are Not Audits or Reviews of Historical Financial Information* [online]. Available at: https://www.kacr.cz/file/7617/isae-3000cz-amend-isqm-20022023.pdf. [Accessed 2024, January 20].

Kammoun, I. and Khoufi, W. 2025. Sustainable Performance, Conditional Conservatism and Audit Fees. *Journal of Financial Reporting and Accounting*, 23 (6), 2484–2513. DOI: 10.1108/JFRA-10-2022-0396.

Knechel, W. R. 2021. The Future of Assurance in Capital Markets: Reclaiming the Economic Imperative of the Auditing Profession. *Accounting Horizons*, 35 (1), 133–151. DOI: 10.2308/HORIZONS-19-182.

Lamboglia, R. and Mancini, D. 2021. The Relationship between Auditors' Human Capital Attributes and the Assessment of the Control Environment. *Journal of Management and Governance*, 25, 1211–1239. DOI: 10.1007/s10997-020-09536-8.

Lee, S.-C., Su, J.-M., Tsai, S.-B., Lu, T.-L. and Dong, W. 2016. A Comprehensive Survey of Government Auditors' Self-Efficacy and Professional Development for Improving Audit Quality. *SpringerPlus*, 5, 1263. DOI: 10.1186/s40064-016-2903-0.

Martinez, W. L. and Martinez, A. R. 2016. *Computational Statistics Handbook with MATLAB*. 3rd ed. Chapham and Hall/CRC. ISBN 978-1-4665-9274-2.

Moalla, M. and Dammak, S. 2025. Do Media Coverage and Audit Quality of US Companies Affect Their Environmental, Social and Governance Transparency? *Journal of Financial Reporting and Accounting*, 23 (5), 2007–2026. DOI: 10.1108/JFRA-09-2022-0353.

Popelková, V. and Svoboda, P. 2025. Profesní kompetence a osobnostní předpoklady ESG auditorů. *Český finanční a účetní časopis*, 20 (1), 27–43. DOI: 10.18267/j.cfuc.607.

Pozzoli, M., Pagani, A. and Paolone, F. 2022. The Impact of Audit Committee Characteristics on ESG Performance in the European Union Member States: Empirical Evidence Before and During the COVID-19 Pandemic. *Journal of Cleaner Production*, 371, 133411. DOI: 10.1016/j.jclepro.2022.133411.

Rawat, P., Nanda, S. K., Rao, V. D., Pankajam, A., Rupani, J. and Dhiman, R. 2025. Sustainability Reporting and Assurance: the Role of Auditors in Verifying Corporate Environmental and Social Performance. *Journal of Informatics Education and Research*, 5 (1), 440–448. DOI: 10.52783/jier.v5i1.2017.

Rossi, R. and Hampel, D. 2024. Indirect Cost in Should Cost Calculations – How Carmaker's Cost Engineers See It. *European Journal of Business Science and Technology*, 10 (1), 96–106. DOI: 10.11118/ejobsat.2024.006.

Suttipun, M. 2021. The Influence of Board Composition on Environmental, Social and Governance (ESG) Disclosure of Thai Listed Companies. *International Journal of Disclosure and Governance*, 18 (4), 391–402. DOI: 10.1057/s41310-021-00120-6.

Umar, U. H., Firmansyah, E. A., Danlami, M. R. and Al-Faryan, M. A. S. 2024. Revisiting the Relationship Between Corporate Governance Mechanisms and ESG Disclosures in Saudi Arabia. *Journal of Accounting & Organizational Change*, 20 (4), 724–747. DOI: 10.1108/JAOC-01-2023-0011.

Vaihekoski, M. and Yahya, H. 2025. Environmental, Social, and Governance (ESG) and Firm Valuation: The Moderating Role of Audit Quality. *Journal of Risk and Financial Management*, 18 (3), 148. DOI: 10.3390/jrfm18030148.

Vasilyeva, T. A. and Makarenko, I. A. 2017. Modern Innovations in Corporate Reporting. *Marketing and Management of Innovations*, 1, 115–125. DOI: 10.21272/mmi.2017.1-10.

Wang, W., Yu, Y. and Li, X. 2022. ESG Performance, Auditing Quality, and Investment Efficiency: Empirical Evidence from China. *Frontiers in Psychology*, 13, 948674. DOI: 10.3389/fpsyg.2022.948674.

8 ANNEX: ESG QUESTIONNAIRE FOR AUDITORS

1. In your opinion, ESG should be the main focus of companies and should be subordinated to the goal of maximising value for owners/shareholders.
   - YES
   - NO
   - ESG should be at the same level of interest as value maximisation

2. In your opinion, the ESG/Sustainability Report is only a formal document with no real impact on CSR.
   - YES
   - NO
   - Other:

2b. If, according to the previous question, the ESG report is, in your opinion, only a formal document, is there any way to make it not a formal document? Please write your opinion.

3. Do you plan to audit sustainability reports in addition to financial statements in the future?
   - Definitely YES
   - Absolutely NOT
   - I don't know

4. Where do you plan to acquire the necessary knowledge for sustainability verification? (multiple check boxes)
   - Self-study
   - Webinars and courses at the Chamber of Auditors of the Czech Republic
   - Internal training within the audit company
   - I plan to take only the compulsory CPV, and I do not plan any further training in this area
   - Other:

5. Auditor training should include: (more than one option can be ticked)
   - Standards for sustainability reporting
   - Standards for verifying sustainability reports
   - Sustainability analysis
   - Due diligence procedures in relation to sustainability issues

6. In your opinion, what skills or personality traits are important for the ESG auditor profession? (Likert scale 1–5; where one means 'not definitely crucial to the profession', and five means 'definitely important to the profession')
   - Adherence to ethical principles
   - Systems Thinking
   - Adaptability and flexibility
   - Critical thinking and problem-solving skills
   - Technological capability
   - Interpersonal skills
   - Versatility
   - Toughness
   - The ability to act bravely
   - Decisiveness
   - Independence
   - Openness to improvement
   - Consideration for the company culture/corporate environment
   - Diplomacy
   - Open mind
   - Ability to perceive the specifics of the company
   - Mindfulness
7. You perform auditing activities as:
   - Self-employed
   - Employee of the auditing company
8. I am interested in receiving the results of this research and would like to receive the results of this research and would like to send them to the following email address (please specify the email address to which you would like to send the research results – optional):

AUTHOR'S ADDRESS

Veronika Popelková, Department of Finance, Faculty of Economics and Administration, Masaryk University, Lipová 41a, 602 00 Brno, Czech Republic, e-mail: 476057@mail.muni.cz (corresponding author)

David Hampel, Department of Statistics and Operations Research, Faculty of Business and Economics, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

Patrik Svoboda, Department of Finance and Accounting, Faculty of Business and Economics, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

THE IMPACT OF ENVIRONMENTAL, SOCIAL AND GOVERNANCE (ESG) PILLAR SCORES ON BANKING SECTOR STOCK RETURNS: AN EMPIRICAL ANALYSIS OF BANKS IN THE MSCI EMERGING MARKET INDEX

Hüseyin Öcal[1], Tarık Yılmaz[2], Anton Abdulbasah Kamil[1]✉

[1] *Istanbul Gelişim University, Türkiye*
[2] *Marmara University, Istanbul, Türkiye*

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11 Issue 2
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

This article examines whether investing in ESG impacts banks' stock returns, aiming to illustrate the value generated by ESG investment in the MSCI Emerging Markets Index. The fiscal year-end data of thirty-five financial companies within the Index, covering the period from December 31, 2015, to December 31, 2022, have been utilised. The analysis employs a pooled panel regression model utilising robust least squares estimation. Firm-specific and market-specific variables are used as independent variables. We have observed a significant positive direct relationship between the social pillar score and stock returns. Banks may initiate investments in social pillars in the Index. In addition, firm-specific variables such as market capitalisation, return on equity, capital adequacy, and price-earnings ratio influence the relationship between ESG pillar scores and stock returns. We recommend that portfolio managers closely monitor improvements in ESG pillar scores alongside firm-specific variables to predict banks' stock returns in the index.

KEY WORDS

financial ratios, stock return, portfolio investment, banking, MSCI emerging market index, ESG

JEL CODES

C100, C510, G210, O160, Q500, Q560

1 INTRODUCTION

Since the implementation of the Paris Agreement, there has been a discernible upward trajectory in environmental, social, and governance (ESG) investments. Corporations are encouraged to pursue both financial and non-financial objectives, anticipating long-term benefits for investors and promoting societal welfare through their influence on corporate practices and conduct.

ESG-based bank governance closely aligns with the "stakeholder" perspective introduced by Freeman (1984), which suggests it should

ÖCAL, Hüseyin, YILMAZ, Tarık, and KAMIL, Anton Abdulbasah. 2025. The Impact of Environmental, Social and Governance (ESG) Pillar Scores on Banking Sector Stock Returns: An Empirical Analysis of Banks in the MSCI Emerging Market Index. *European Journal of Business Science and Technology,* 11 (2): 163–181. ISSN 2694-7161, DOI 10.11118/ejobsat.2025.010.

enhance stakeholder satisfaction, improve financial performance, and increase firm value. However, investing in ESG entails associated costs. Therefore, a delicate balance between costs and benefits should be maintained. Otherwise, overinvestment in ESG reduces profitability and detracts from firm value by diverting limited resources away from investment (Alexander and Buchholz, 1978; Barnea and Rubin, 2010). Banks, a pivotal entity within the financial sector, assume an essential role in sustainable development. Therefore, investors must prioritise sustainable and responsible investment practices by analysing corporate social responsibility, corporate governance frameworks, and environmental concerns when making decisions regarding investments in banking stocks (Nizam et al., 2019). Furthermore, sustainability reporting is increasingly being recognised on a global scale, as stakeholders express a heightened demand for transparency concerning environmental, social, and governance (ESG) issues (Buallay, 2019). Sustainable firms strive to enhance their financial results while also meeting their environmental and social obligations (Pedersen et al., 2021). Although environmental and social responsibility do not have a direct correlation with corporate financial outcomes, they connect firms with essential stakeholders (Feng et al., 2022). Meeting ESG responsibilities can help build positive stakeholder relationships (Raghunandan and Rajgopal, 2022). Investors who adopt the value investing philosophy are particularly concerned with corporate sustainability prospects, as they view firms that surpass in ESG performance as possessing greater potential for value increase (Albuquerque et al., 2018).

A relevant question concerns the ESG investment expectations we have of banks as a key driver of growth within emerging markets. Green banking encompasses sustainable banking practices, with a particular emphasis on environmental concerns. It is also closely linked to sustainability or ESG (environmental, social, and governance) factors, which banks are increasingly emphasising. Climate change remains the most prominent goal integrated into banking institutions' sustainability strategies. Banks are increasingly incorporating environmental sustainability considerations into their services, including lending, investment, and portfolio management, notably through financing renewable energy projects and issuing green bonds. This does not mean that financial institutions are abandoning profit maximisation; instead, they seek to optimise profits while prioritising environmental sustainability (Statista, 2024a). Since ESG investment incurs costs, it should also create value. To serve this purpose, our study examines the impact of ESG pillar scores on the stock returns of banks in the emerging market index.

Furthermore, ESG investments should be financed in the same manner as other long-term investments. To this end, corporations have issued green and social bonds. Green bonds are fixed-income instruments specifically created to fund climate and environmental initiatives. The capital required to finance ESG initiatives leads to an increase in the issuance of green and social bonds. In 2023, China issued over 83 billion U.S. dollars in green bonds, making it the leading country in the world. Germany was second with 67 billion U.S. dollars, followed by the United States with 60 billion U.S. dollars. The United Kingdom ranked fourth, with green bonds worth 33 billion U.S. dollars, and Italy was fifth, with green bonds worth 30 billion U.S. dollars (Statista, 2024b). From 2012 to 2023, China emerged as the primary emerging market for green bond issuance, with nearly $300 billion issued. India, Brazil, Chile, and the United Arab Emirates ranked as the subsequent largest issuers following China (Statista, 2025). Social bond issuance, in terms of value, is not as high as that of green bonds.

This empirical study examines the impact of ESG pillar scores on the stock returns of banks within the MSCI Emerging Market Index, controlling for banking financial ratios. Moreover, market-specific factors such as interest rates, exchange rates, and the Dow Jones Banking Index are considered as independent variables. The objective is to establish whether each ESG pillar score has a positive correlation with stock returns, thereby demonstrating the value created by ESG investments. If the hypothesis

holds, investing in ESG pays back the firm, and investors can reap the benefits of sustainable stocks. Investors in emerging markets can monitor changes in banks' ESG pillar scores and utilise this information to forecast future shifts in banks' market value.

The following section explores the literature, section three introduces the data, section four includes the empirical study, section five discloses the findings, and section six concludes the paper.

2 LITERATURE REVIEW

2.1 Theoretical Framework on ESG Investments

In the prior literature, several theories have examined the impact of ESG scores on stock returns. Two main theories forecast the link between ESG and a company's financial performance: stakeholder theory and trade-off theory. These theories present contrasting predictions, each backed by empirical evidence. The resource-based view of the firm and stewardship theory fall under the umbrella of stakeholder theory, yielding similar predictions. Agency theory offers predictions comparable to those found in trade-off theory.

Stakeholder theory examines the link between firm performance, such as stock returns, and ESG scores. In recent years, investors have raised their expectations of businesses, seeking outcomes beyond mere monetary gains (Abrams et al., 2021). The stakeholder theory highlights that businesses bear responsibilities not only to their shareholders but also to various other stakeholders. To build a sustainable firm, enterprises must fulfil their responsibilities to stakeholders. If they do so, the firm's stakeholders will support it because it adopts a stakeholder approach (Yin et al., 2023). Firms can develop stronger relationships with stakeholders and foster trust more efficiently by providing high ESG performance (Hwang et al., 2021).

The resource-based view suggests that ESG initiatives are strategic investments. These investments enable a firm to achieve a competitive advantage by developing unique skills that are hard to imitate (Russo and Fouts, 1997). El Khoury et al. (2023) noted that sustainable practices that mitigate adverse environmental impacts are regarded as valuable resources for banks to invest in, consequently enhancing their competitive advantage and improving financial performance (FP). Consequently, enhancing ESG is likely to lead to improved financial performance (Ruf et al., 2001).

Stewardship theory views managers as stewards of the firm, committed to maximising its long-term value while addressing the diverse interests of all stakeholders. Managers participate in ESG initiatives to enhance relationships among various stakeholders, including employees, customers, suppliers, and communities, thereby fostering positive business environments (Barnett, 2007; Jo and Harjoto, 2011). The primary objective of a business is to enhance profitability while concurrently addressing its societal responsibilities. Adikaram and Holcomb (2024) propose that financial institutions with a comprehensive focus on social practices attain superior financial performance, attributable to a stronger competitive advantage and an augmented corporate reputation.

Barak and Sharma (2024) state that financial institutions are deemed "knowledge-intensive" due to their increased dependence on intangible assets, such as customer trust, employee capabilities, and connections. This intellectual capital empowers organisations to create value and bolster their competitive advantage. Harjoto and Jo (2011) have examined firms within the Russell 2000, S&P 500, and Domini 400 indices from 1993 to 2004. Researchers' results revealed that effective corporate governance mitigates conflicts of interest between managers and both investing and non-investing stakeholders. This improvement in governance subsequently enhances the firm's operating financial performance and increases its overall

value. Heightened ESG activity is expected to enhance the firm's value.

Furthermore, investors show a stronger inclination to invest in stocks with high ESG scores, likely influenced by institutional mandates (Chava, 2014) and an increasing interest in integrating ESG considerations into investment strategies. As a result, equities with low ESG scores are more likely to be overlooked, whereas those with strong ESG scores might attract greater interest (Chen et al., 2020). In simpler terms, stock returns do not solely dictate portfolio decisions.

The trade-off theory considers ESG initiatives as a potentially inefficient allocation of resources. Funds directed towards ESG initiatives might have been utilised more efficiently by the firm. This perspective contends that managers should maximise the firm's value and refrain from considering societal well-being (Friedman, 1970). Agency theory provides predictions similar to those of trade-off theory. As representatives of shareholders, firm executives are often inclined to prioritise their interests, such as funding expensive ESG initiatives to enhance their status according to the principal-agent theory (Jensen and Meckling, 1976). Consequently, stock returns may decline as a firm diverts its attention from shareholder value to self-interest. In this context, ESG practices are found to be negatively correlated with firm value (Yin et al., 2023).

2.2 ESG Investment and Bank Value

In emerging markets, the banking sector plays a significant role in fostering economic growth by effectively mediating between capital suppliers and demanders (Levine, 2005). Banks require considerably more resources compared to non-financial firms, leading to increased expectations for them to provide societal advantages. In cases of insolvency, banks are more likely to receive government bailouts, which taxpayers often finance. As a result, their operations are typically subject to heightened monitoring from regulators, the public, and the media.

Nonetheless, we presently possess only a limited understanding of how investors assess banks' ESG initiatives. Buallay (2019) highlights a favourable link between the ESG activities of European banks and their value. Finger et al. (2018) investigate the relationship between the Equator Principles and bank performance, pointing out that banks in developing nations adopt the Equator Principles for strategic reasons. ESG initiatives can enhance value by strengthening the connection between a bank and its stakeholders, while also increasing transparency. Banks that achieve higher ESG ratings may be perceived as lower risk (Broadstock et al., 2021) and could outperform the market during times of crisis (Takahashi and Yamada, 2021). Conversely, if a bank participates in few ESG activities, it may inadvertently convey its quality to prospective minority shareholders and bondholders. This idea aligns with stakeholder theory. Bhaskaran et al. (2023) have addressed the role of governance and social initiatives on value creation in banking sector firms. The study covered 472 global banks. The study has demonstrated that intense social and governance activities have a positive influence on market valuations. Well-capitalised banks are more likely to invest in social initiatives.

Investing excessively in ESG initiatives may diminish a bank's value due to the opportunity costs associated with it. After high-net-present-value projects are fully utilised, each subsequent ESG effort is likely to yield decreasing returns (Wang et al., 2008; Haans et al., 2016). This notion supports the trade-off theory. The association between ESG and bank performance is non-linear.

2.3 ESG Investment Transmission Mechanism for Banks

ESG initiatives can impact bank performance through three primary channels, including the cost of capital, cash flow, and operational efficiency.

Firstly, the implementation of ESG initiatives can impact the cost of capital. ESG initiatives ought to lessen conflicts among stakeholders and alleviate information asymmetry (Perrini et al., 2011). This expectation is further supported

by Healy and Palepu (2001), who show that companies participating in ESG activities incur lower monitoring expenses. Cui et al. (2018) highlight a negative correlation between ESG and information asymmetry. Reducing information asymmetry is expected to boost demand for the bank's shares or bonds (Merton, 1987; Heinkel et al., 2001; El Ghoul et al., 2011). Reducing capital costs can help offset the expenses associated with ESG activities. El Ghoul et al. (2011) emphasise the inverse relationship between sustainability reporting and the cost of capital. Dinçer et al. (2014) analysed banks traded on the Borsa Istanbul. Researchers have found that corporate governance lowers the cost of capital because it minimises uncertainties and reduces resource costs.

Secondly, implementing ESG initiatives can affect cash flow. A bank's financial constraints often stem from its inability to secure favourable borrowing rates or a lack of incentives for individuals to deposit their money. When facing significant financial limitations, a bank is forced to forgo profitable opportunities. Conversely, a bank with minimal or no capital constraints can invest in any projects that generate positive NPVs (Cheng et al., 2014). As a result, this boost in investment towards positive NPV projects is expected to enhance the bank's cash flow. Implementing strategies aimed at alleviating financial constraints may boost the funds available for investment. Hennessy and Whited (2007) suggest that minimising information asymmetry can further alleviate a bank's financial barriers. Consequently, this allows banks to extend more loans, resulting in increased cash flow (Chauhan and Kumar, 2018). Shakil et al. (2019) have analysed how ninety-three banks' ESG performance influenced their financial outcomes in emerging markets from 2015 to 2018. Researchers' findings reveal a positive correlation between banks' environmental, social performance and financial performance. However, governance performance has no apparent effect. Researchers attribute the lack of impact from the governance component to the weak corporate governance practices prevalent among emerging market banks and the insufficient legal and regulatory pressure from oversight bodies. Additionally, they recommend that top management prioritise investments in the environmental and social aspects, which could enhance the banks' future cash flow. Jo et al. (2015) examined the link between environmental risk investments and operational performance improvements in the banking sector across twenty-nine countries from 2002 to 2011. They found that mitigating environmental risk typically takes one to two years before it has a positive impact on return on assets. Essentially, investing in environmental initiatives leads to a return on investment. Moreover, this reduction has a more immediate positive effect on banks in well-developed financial markets, such as North America, compared to those in less-developed markets, such as the Asia Pacific. According to Tian et al. (2025), green financing enhances banks' market valuation by lowering credit risk and boosting prospects for future cash flows. Ultimately, their study demonstrated that green credit is a valuable tool for financial institutions operating in developing countries, such as China, where legal frameworks and environmental regulations may not be as well-developed as those in more advanced nations.

Ultimately, the bank's efficiency may be influenced by its adoption of ESG initiatives. Porter (1991) suggests that companies participating in ESG endeavours are likely to experience reduced expenses stemming from forthcoming regulations. Garriga and Melé (2004) ascertain that sustainable companies that pursue heightened product and strategic innovation can decrease costs. These insights indicate that engagement with ESG practices may augment the operating margin. Ahmad et al. (2024) examined whether an ESG policy boosts the innovation capacity, innovative activities, value creation, and financial performance of companies. The researchers found a significantly positive relationship between social and environmental performance and business sustainability, indicating that a business's economic performance and its ability to create societal value are closely intertwined.

The literature investigates the relationship between market-specific variables and banking stock returns, as well as firm-specific variables.

The association between stock prices and nominal interest rates highlights how investors adjust their portfolios between stocks and bonds. When interest rates rise, investors are incentivised to shift their portfolios toward bonds, and the opposite occurs when interest rates fall. Consequently, an increase in interest rates typically leads to a decrease in stock prices (Hashemzadeh and Taylor, 1988). On the other hand, studies have found a positive relationship between interest rates and stock prices. Asprem (1989) attributes a positive relationship between interest rates and stock returns to small, illiquid financial markets, which are often observed in the stock exchanges of emerging countries. Barsky (1989) elucidates the positive relationship between interest rates and stock prices, referring to the concept of a changing risk premium. For instance, a reduction in interest rates may occur due to increased risk, leading investors to substitute risky assets, such as stocks, for less risky assets, such as bonds or real estate. Hashmi and Chang (2023) found that, over time, foreign direct investment (FDI), the trade balance, and the industrial production index (IPI) significantly influence emerging stock indices. In the short term, the effects of FDI, the consumer price index, interest rates, and the exchange rate vary under bullish, bearish, and normal conditions in emerging stock markets.

Branson and Henderson (1985) stated that the relationship between exchange rates and stock returns is well-established within theoretical frameworks. The Portfolio Balance Theory posits a negative correlation between the two, attributed predominantly to investor behaviour focused on achieving international portfolio diversification. Investors typically reallocate their assets from countries with lower stock returns to those with higher returns. As a result, exchange rate appreciation frequently signifies lower stock returns, whereas exchange rate depreciation implies higher-yielding stocks.

A notable trend toward liberalisation has accelerated the integration of global financial markets. Syllignakis and Kouretas (2010) have analysed the long-term relationships between emerging European stock markets and two established markets: Germany and the United States. The findings demonstrate that the financial interconnections between these emerging and global markets have intensified.

Bai et al. (2023) analysed the global financial market sentiment concerning stock returns during the COVID-19 pandemic. Researchers indicated that an escalation of the epidemic negatively impacted the stock market. Conversely, an increase in financial market sentiment is associated with improved stock market returns, even amidst the most severe phases of the pandemic.

This study advances the current literature by providing a detailed analysis of how investments in Environmental, Social, and Governance (ESG) factors influence banks' stock returns within the MSCI Emerging Markets Index.

3 DATA

This empirical paper uses environmental, social, and governance (ESG) pillar scores (E score, S score, G score) of thirty-five banks in the MSCI Emerging Markets Index between 2015 and 2021. The one-year lag of ESG pillar data of banks is used as the independent variable since the score's contribution to financial performance is more noticeable (Xu and Zhu, 2024). The MSCI Emerging Markets Index includes banks from the Czech Republic, Egypt, Greece, Hungary, Kuwait, Poland, Qatar, Saudi Arabia, South Africa, Türkiye, and the United Arab Emirates. Stock returns were used as dependent variables for banks between 2016 and 2022. We used the following formula to compute the return. Return of an asset:

$$\frac{P_{t+1} - P_t}{P_t}, \tag{1}$$

where P_{t+1} is the price of the asset at time $t+1$ and P_t is the price of the asset at time t.

Between 2016 and 2022, non-performing assets to total loans (NPL), efficiency (ER), capital adequacy (CAR), return on equity (ROE), price-to-book (P/B), price-earnings (P/E) ratios, and market capitalisation (MCAP) for banks are used as firm-specific control variables. Country interest rates (I), exchange rates (EXR), and the Dow Jones banking index (DJ) are used as market-specific independent variables for the same period. For bank valuation, the most frequently used ratios in academic studies and practice are P/B, ROE, ER, CAR, and the NPL ratio. These jointly measure profitability, risk, and capital strength—key drivers of the bank market value. Researchers used the same firm-specific ratios are Louzis et al. (2012); Čihák and Hesse (2010); Staikouras and Wood (2004); Fiordelisi (2007); Mamatzakis and Bermpei (2014); Berger et al. (2009); Demirgüç-Kunt et al. (2013); Berger and Humphrey (1997); Athanasoglou et al. (2008); Demirgüç-Kunt and Huizinga (1999). Researchers utilised the same market-specific variables include Demirgüç-Kunt and Huizinga (1999), Altunbas et al. (2018), Borio et al. (2017), García-Herrero et al. (2009), Tan and Floros (2012), and Athanasoglou et al. (2008). Dummy variables are also considered independent variables. Moreover, the research highlights the transformative effects of the recent pandemic on the relationship between ESG pillar scores and stock performance. Furthermore, we have thoughtfully divided the banks into two distinct groups—EU and non-EU—enabling a deeper examination of potential disparities and legislative differences that may impact their performance.

Daily data have been retrieved from `investing.com` and the Bloomberg database.

4 EMPIRICAL STUDY

This study employs pooled regression, a modelling technique useful when detailed monitoring at various levels is required. Pooling increases the number of observations, which enhances the robustness of estimates and makes it feasible to analyse regionally oriented activities. However, pooled regression assumes that the average of stacked regions is the same, an assumption that may not always hold in practice. To address issues that may compromise the reliability of ordinary least squares (OLS) estimators, such as the presence of outliers, non-normal error terms, or heteroskedasticity, we employ robust regression techniques, specifically M-estimators. These estimators reduce the influence of extreme observations that could disproportionately impact standard regression estimates. Our dataset, which includes ESG indicators and financial variables for EU and non-EU firms across both pandemic and non-pandemic years, features several variables (e.g., ROE, MCAP, NPL) susceptible to outliers or skewed distributions. Furthermore, the model comprises multiple interaction terms and lagged variables, increasing the likelihood of multicollinearity and estimation sensitivity. In such contexts, robust regression provides more stable and reliable coefficient estimates than traditional OLS.

4.1 Robust Regression with M-Estimators

M-estimators form a class of robust regression techniques that minimise the sum of a chosen function $\theta(\cdot)$ applied to residuals. This technique reduces the impact of outliers by assigning them lower weights in the estimation process.

Formally, the goal is to estimate the parameter θ of the distribution P of observations $X_1, \ldots, X_n$.

A criterion $\theta \to M_n(\theta)$ is defined in terms of functions $m_\theta : X \to \mathbb{R}$:

$$M_n(\theta) = P_n m_\theta \tag{2}$$

The M-estimator is then defined as:

$$\hat{\theta} = \arg\max_{\theta \in \Theta} M_n(\theta) \tag{3}$$

This approach improves the robustness of coefficient estimates in the presence of deviations from standard regression assumptions.

4.2 Model Specification

The empirical model estimates the relationship between stock returns and ESG performance, controlling for key financial indicators and macroeconomic variables. We specify a pooled regression with interaction terms to capture how financial performance moderates the impact of ESG dimensions:

$$\begin{aligned} \mathrm{SR}_{it} = \beta_0 &+ \sum_{j=1}^{3} \beta_j \cdot \mathrm{ESG}_{i,t-1}^{(j)} + \\ &+ \sum_{j=1}^{3}\sum_{k=1}^{7} \gamma_{jk} \cdot \mathrm{ESG}_{i,t-1}^{(j)} \cdot \mathrm{FIN}_{it}^{k} + \\ &+ \theta' \cdot \mathrm{MACRO}_t + \\ &+ \lambda_1 \cdot \mathrm{D}_1 + \lambda_2 \cdot \mathrm{D}_2 + \epsilon_{it}, \end{aligned} \tag{4}$$

where:

- SR_{it} denotes the stock return for firm i at time t,
- $\mathrm{ESG}_{i,t-1}^{(j)}$ includes the lagged Environmental, Social, and Governance scores (with $j = 1, 2, 3$ representing ENV, SOC, and GOV, respectively),
- FIN_{it}^{k} represents six firm-level financial characteristics: the price-to-book ratio (PB), efficiency ratio (ER), return on equity (ROE), non-performing loans to total loans (NPL), capital adequacy ratio (CAR), the price-earnings ratio (PE), and market capitalisation (MCAP).
- MACRO_t is a vector of macroeconomic control variables: the interest rate (I), exchange rate (EXR), and Dow Jones Banking Index (DJ),
- D_1 is a dummy variable equal to 1 for EU corporations and 0 otherwise,
- D_2 is a dummy variable equal to 1 for pandemic years and 0 for non-pandemic years,
- ϵ_{it} is the error term.

4.3 Variable Descriptions

The financial ratios used as control variables are defined as follows.

The non-performing assets to total loans (NPL) ratio measures a bank's health and efficiency. It helps identify problems with asset quality in the loan portfolio. Bloomberg calculates the ratio as:

$$\frac{\text{Non-performing Assets}}{\text{Total Loans}} \cdot 100.$$

The efficiency ratio (ER) measures costs compared to revenues. Bloomberg calculates the efficiency ratio of banks as:

$$\frac{\text{Operating Expenses}}{\begin{array}{c}\text{Net Interest Income}\\ +\ \text{Commissions \& Fees Earned}\\ +\ \text{Other Operating Income (Losses)}\\ +\ \text{Trading Account Profits (Losses)}\\ +\ \text{Gain/Loss on Investments/Loans}\\ +\ \text{Other Income (Loss)}\\ -\ \text{Commissions \& Fees Paid}\\ +\ \text{Taxable Equivalent Adjustment}\\ \text{or Net Revenue}\\ -\ \text{Net of Commissions Paid}\end{array}} \cdot 100.$$

The total risk-based capital ratio also called the capital adequacy ratio (CAR), protects a bank from insolvency. It is calculated by dividing the total risk-based capital by risk-weighted assets. The Bank of International Settlements in Basel requires a minimum total capital ratio of 8%. The Return on Common Equity (ROE) reveals how much profit a company generates with the money shareholders have invested. Bloomberg calculates the ratio as:

$$\frac{\begin{array}{c}\text{Net Income Available}\\ \text{for Common Shareholders}\end{array}}{\text{Average Total Common Equity}} \cdot 100.$$

The price-to-book ratio (P/B) analyses the market value of the firm's investments with their cost. Book value per share reflects historical costs. To calculate the P/B ratio, Bloomberg divides the last market value per share by the book value per share. The Price-Earnings Ratio (P/E) is a crucial metric that showcases the market's willingness to pay for every unit

of current earnings. A higher P/E ratio is usually indicative of a company's immense growth potential in the future. Nevertheless, a price-earnings ratio (PE) that is too high may not be attractive for investors because the possibility of capital gains will be smaller. To calculate the P/E ratio, Bloomberg divides the last price per share by the earnings per share. Furthermore, the earnings per share is computed by dividing the net income by the outstanding shares. Market capitalisation (MCAP) is the total current market value of a company's outstanding shares, stated in the pricing currency. Capitalisation is a measure of corporate size. Current market capitalisation is calculated as:

$$\text{Current Shares Outstanding} \cdot \text{Last Price}.$$

The Dow Jones Banking Index is designed to measure the performance of U.S. companies in the banking sector.

5 FINDINGS

Tab. 1: Regression result (dependent variable: SR)

Variable	Coefficient	Std. error	*p*-value
Intercept (C)	−0.010259	0.042202	0.8079
ESG Pillar Scores			
ENV	0.628324	0.322857	0.0516*
SOC	0.109246	0.055343	0.0484**
GOV	−0.058346	0.035572	0.1010
Interaction Terms: ENV			
ENV×PB	−0.206780	0.044813	0.0000***
ENV×ER	−0.002384	0.002487	0.3377
ENV×ROE	0.016849	0.001838	0.0000***
ENV×NPL	−0.003533	0.005239	0.5000
ENV×CAR	−0.027033	0.014266	0.0581*
ENV×PE	0.001698	0.004252	0.6897
ENV×MCAP	−0.199567	0.046924	0.0000***
Interaction Terms: SOC			
SOC×PB	0.003628	0.008958	0.6855
SOC×ER	−0.000498	0.000545	0.3601
SOC×ROE	−0.002111	0.000923	0.0222**
SOC×NPL	0.000572	0.001186	0.6295
SOC×CAR	−0.004090	0.002068	0.0479**
SOC×PE	5.98e−05	0.000419	0.8865
SOC×MCAP	0.063603	0.015498	0.0000***
Interaction Terms: GOV			
GOV×PB	−0.003245	0.005712	0.5700
GOV×ER	0.000202	0.000367	0.5825
GOV×ROE	0.001216	0.000612	0.0468**
GOV×NPL	−0.000301	0.000550	0.5838
GOV×CAR	0.002030	0.001338	0.1293
GOV×PE	−6.37e−05	0.000228	0.7795
GOV×MCAP	0.096346	0.010604	0.0000***
Macro-level Terms			
I	0.883022	0.263343	0.0008***
EXR	−0.613444	0.126355	0.0000***
DJ	0.085103	0.043291	0.0493**
D_1 (Dummy)	−0.000820	0.032365	0.9798
D_2 (Dummy)	0.051802	0.023399	0.0268**
Model Statistics			
R-squared	0.576905		
Rw-squared	0.845829		

Note: Coefficients are reported with standard errors in parentheses below. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Based on Eq. 1, the results of the regression in Tab. 1 are discussed below.

5.1 The Baseline Effect of the ESG Pillar on Stock Returns

The regression results demonstrate a significant direct positive relationship between the environmental pillar score (ENV) at the 10% level, the social pillar score (SOC) at the 5% level, and the stock return (SR). However, there is no significant direct relationship between the governance pillar score (GOV) and the stock return (SR). The findings for the social, environmental, and governance pillar scores align with Shakil et al. (2019) and Ahmad et al. (2024) in the literature section. Shakil et al. (2019) have analysed the ESG performance of banks in emerging markets. Their findings reveal a positive correlation between banks'

environmental and social performance and their financial outcomes. However, governance performance appears to have no significant effect. The researchers attribute the absence of impact from the governance component to the weak corporate governance practices common among banks in emerging markets, as well as the insufficient legal and regulatory pressures exerted by oversight bodies. Furthermore, they recommend that top management prioritise investments in environmental and social initiatives, which could potentially enhance the banks' future cash flows. Ahmad et al. (2024) examined whether an ESG policy improves a company's innovation capacity, innovative activities, value creation, and financial performance. The researchers identified a markedly positive relationship between social and environmental performance and business sustainability, indicating that a company's economic results are closely linked to its capacity to generate societal value.

5.2 The Relationship Between the ESG Pillar and Stock Returns with Control Variables

When the market capitalisation (MCAP) effect is removed from the social capital (SOC) pillar concerning stock returns, the positive relationship between the social pillar and stock returns becomes more significant compared to the direct relationship between the social pillar and stock returns. However, the impact of the social pillar on stock returns is slightly less pronounced than the direct relationship. Businesses with high market capitalisation are more liquid and can invest in sustainability-related initiatives. When we exclude the impact of market capitalisation, the costs of ESG initiatives for firms become apparent. This result aligns with those of Friedman (1970), Jensen and Meckling (1976) and Yin et al. (2023) in the literature.

Friedman (1970) asserted that the principal obligation of managers is to serve the interests of shareholders. Participation in "socially responsible" initiatives (for example, pollution reduction and charitable contributions) is deemed justified solely when such actions also enhance long-term shareholder value. Otherwise, managers are essentially "taxing" shareholders, employees, or customers without their approval. Today, this idea remains central, but is challenged by stakeholder theory and ESG-driven perspectives. As representatives of shareholders, corporate executives often tend to prioritise their own interests, such as allocating funds to costly ESG initiatives to elevate their status, in accordance with the principal-agent theory (Jensen and Meckling, 1976). Consequently, stock returns may decline as a firm shifts its focus from shareholder value to self-interest. Within this context, ESG practices are demonstrated to have a negative correlation with firm value (Yin et al., 2023).

When the capital adequacy (CAR) and return on equity (ROE) effects are removed from the social pillar (SOC) regarding stock returns, the previously positive association between the social pillar score and stock returns shifts to a negative one. This could be attributed to well-capitalised banks being more likely to invest in social initiatives. This result is similar to that of Bhaskaran et al. (2023) in the literature section. CAR protects a bank from insolvency during economic downturns. Banks with a high Capital Adequacy Ratio are better positioned to withstand various forms of risk. Well-capitalised banks are more likely to invest in social initiatives. When the influence of CAR is excluded from consideration, the costs associated with banks' social initiatives become evident.

When the effects of the price-to-book ratio (P/B) and market capitalisation (MCAP) are excluded from the environmental pillar score concerning stock returns, the previously positive association between the environmental pillar score and stock return shifts to a negative one, and this change is statistically more significant. The observed finding may be attributed to the short-term costs associated with investing in environmental initiatives. This finding aligns with the work of Friedman (1970) and Yin et al. (2023) in the literature. When the impact of the return on equity (ROE) is neutralised from the environmental pillar score in relation to stock return, the relationship between the

environmental score and stock return is slightly lower but still positive and significantly stronger compared to the direct relationship between return and environmental score. The finding may stem from reduced environmental risks, positively impacting ROE, as noted by Jo et al. (2015) in the literature section. Consequently, investors value this development, leading to an increase in stock prices. Jo et al. (2015) found that mitigating environmental risk typically requires a period of one to two years before yielding a positive effect on the return on equity. Fundamentally, investments in environmental initiatives generate a return on equity. Moreover, this risk mitigation exerts a more rapid positive influence on banks operating within well-developed financial markets relative to those in less developed markets.

As mentioned before, the regression results show no significant direct relationship between the governance pillar score (GOV) and the stock return (SR). However, when the effects of market capitalisation (MCAP) and return on equity (ROE) are controlled for the GOV score concerning stock returns, there is a statistically significant positive relationship between the governance pillar score and stock returns. These findings resemble those of Wang et al. (2008) and Haans et al. (2016) in the literature section. As stated by Wang et al. (2008) and Haans et al. (2016), the relationship may stem from investing excessively in ESG initiatives, which could reduce a bank's value due to opportunity costs. After high-net-present-value projects are fully utilised, each additional ESG effort is likely to generate diminishing returns.

5.3 The Relationship Between the Macro Variables and Stock Returns

The regression result also includes the impact of market-specific variables on banking stock returns. The interest rate and the stock return have a significant positive relationship. This finding is similar to those of Asprem (1989), Hashmi and Chang (2023) and Barsky (1989) in the literature section.

Asprem (1989) links a positive relationship between interest rates and stock returns to small, illiquid financial markets, which are often found in the stock exchanges of emerging countries. Meanwhile, Barsky (1989) explains the positive correlation between interest rates and stock prices by examining fluctuations in risk premiums. For instance, a decline in interest rates may occur due to increased risk, leading investors to shift from riskier investments, such as stocks, to safer assets, like bonds or real estate.

The exchange rate and the stock return have a significant negative relationship. The finding is associated with Portfolio Balance Theory and is similar to that of Branson and Henderson (1985) in the literature section. As Branson and Henderson (1985) state, investors usually reallocate their assets from countries with lower stock returns to those with higher returns. As a result, exchange rate appreciation often indicates lower stock returns, while exchange rate depreciation suggests higher-yielding stocks.

The Dow Jones banking index and stock returns have a significant positive relationship. This finding is similar to Syllignakis and Kouretas (2010) in the literature section, and due to a notable trend toward liberalisation, has accelerated the integration of global financial markets.

5.4 The Relationship Between the Dummy Variables and Stock Returns

In our regression model, we have incorporated two dummy variables. One variable assesses the influence of pandemic and non-pandemic periods. At the same time, the other examines potential disparities between EU and non-EU companies to encompass any regulatory distinctions that could impact the correlation between ESG pillar score and stock returns. The regression result indicates a significant positive relationship between the pandemic years and stock returns. This finding aligns with Bai et al. (2023) in the literature. The regression results do not indicate a significant relationship between EU and non-EU stock returns.

The coefficient of determination of the Robust least squares (R-squared) in our model indicates that when the control variables are included, the independent variables (E, S, G, I, EXR, DJ, and dummy variables) can explain 0.84 of the variation in the stock return.

6 CONCLUSIONS

This article aims to assess whether each ESG pillar score has a positive relationship with stock returns for banks across the MSCI Emerging Markets Index, thereby demonstrating the value generated by investing in ESG. Additionally, the study examines the impact of market-specific variables on the returns of banking stocks. Moreover, the research highlights the transformative effects of the recent pandemic on the relationship between ESG pillar scores and stock performance. Finally, we have thoughtfully divided the banks into two distinct groups—EU and non-EU—enabling a deeper examination of potential disparities and legislative differences that may impact their performance.

The regression results demonstrate a significant direct positive relationship between the environmental pillar score (ENV), the social pillar score (SOC), and the stock returns (SR). Banks might pursue investments in social initiatives, as the advantages of investing in the social pillar outweigh the associated costs. Additionally, banks should evaluate market capitalisation, capital adequacy, and return on equity metrics before engaging in social pillar investments. Investors may recognise social initiatives, and as a result, increase their demand for the stock, since banks rely on intangible assets such as customer trust, employee skills, and professional relationships with clients. While banks are considered among the most environmentally conscious industries, they could also invest in eco-friendly initiatives as a secondary option. Furthermore, banks should evaluate the price-to-book ratio, market capitalisation, and return on equity metrics before investing in such initiatives, as these metrics influence the sign of the relationship between each ESG pillar and stock returns.

There is a statistically significant indirect positive relationship between the governance pillar score and stock returns. Banks should evaluate the market capitalisation and return on equity metrics before investing in the governance pillar, as these metrics influence the sign of the relationship between each ESG pillar and stock returns.

Furthermore, the study examines market-specific factors that may impact stock returns. The regression results reveal a significant positive relationship between interest rates and stock returns. This could be due to the illiquid financial markets often observed in the stock exchanges of emerging countries. Additionally, a decline in interest rates may occur as a result of increased risk, prompting investors to shift from riskier assets like stocks to safer assets such as bonds or property. The relationship between exchange rates and stock returns is notably negative. This finding aligns with the portfolio balance theory. Moreover, there is a significant positive correlation between the Dow Jones Banking Index and stock returns. This may be attributed to the ongoing trend of liberalisation, which has considerably accelerated the integration of global financial markets.

The regression findings do not indicate a regulatory disparity between EU and non-EU banks that could influence the correlation between ESG pillar scores and stock returns. However, the regression results indicate a significant positive relationship between the ESG pillar score and stock returns during the pandemic.

Consequently, we have observed a significant positive direct relationship between the social pillar score and stock returns. Banks may initiate investments in social pillars in the MSCI Emerging Markets Index. In addition, firm-specific variables such as market capitalisation, return on equity, capital adequacy, and price-earnings ratio influence the relationship between ESG pillar scores and stock returns. We recommend that portfolio managers monitor ESG pillar score improvements closely to predict banks' stock returns in the index.

7 REFERENCES

Abrams, R., Han, S. and Hossain, M. T. 2021. Environmental Performance, Environmental Management and Company Valuation. *Journal of Global Responsibility*, 12 (4), 400–415. DOI: 10.1108/JGR-10-2020-0092.

Adikaram, R. and Holcomb, A. 2024. Exploring the Role of Analysts in Identifying and Communicating the Value of Bank CSR Activity. *International Journal of Bank Marketing*, 42 (4), 794–817. DOI: 10.1108/IJBM-12-2022-0557.

Ahmad, H., Yaqub, M. and Lee, S. H. 2024. Environmental-, Social-, and Governance-Related Factors for Business Investment and Sustainability: A Scientometric Review of Global Trends. *Environment, Development and Sustainability*, 26 (2), 2965–2987. DOI: 10.1007/s10668-023-02921-x.

Albuquerque, R. A., Koskinen, Y. and Zhang, C. 2018. Corporate Social Responsibility and Firm Risk: Theory and Empirical Evidence. *Management Science*, 65 (10), 4451–4469. DOI: 10.1287/mnsc.2018.3043.

Alexander, G. J. and Buchholz, R. A. 1978. Corporate Social Responsibility and Stock Market Performance. *The Academy of Management Journal*, 21 (3), 479–486. DOI: 10.5465/255728.

Altunbas, Y., Binici, M. and Gambacorta, L. 2018. Macroprudential Policy and Bank Risk. *Journal of International Money and Finance*, 81, 203–220. DOI: 10.1016/j.jimonfin.2017.11.012.

Asprem, M. 1989. Stock Prices, Asset Portfolios and Macroeconomic Variables in Ten European Countries. *Journal of Banking & Finance*, 13 (4–5), 589–612. DOI: 10.1016/0378-4266(89)90032-0.

Athanasoglou, P. P., Brissimis, S. N. and Delis, M. D. 2008. Bank-Specific, Industry-Specific and Macroeconomic Determinants of Bank Profitability. *Journal of International Financial Markets, Institutions and Money*, 18 (2), 121–136. DOI: 10.1016/j.intfin.2006.07.001.

Bai, C., Duan, Y., Fan, X. and Tang, S. 2023. Financial Market Sentiment and Stock Return During the COVID-19 Pandemic. *Finance Research Letters*, 54, 103709. DOI: 10.1016/j.frl.2023.103709.

Barak, M. and Sharma, R. K. 2024. Does Intellectual Capital Impact the Financial Performance of Indian Public Sector Banks? An Empirical Analysis using GMM. *Humanities and Social Sciences Communications*, 11, 208. DOI: 10.1057/s41599-024-02702-5.

Barnea, A. and Rubin, A. 2010. Corporate Social Responsibility as a Conflict Between Shareholders. *Journal of Business Ethics*, 97 (1), 71–86. DOI: 10.1007/s10551-010-0496-z.

Barnett, M. L. 2007. Stakeholder Influence Capacity and the Variability of Financial Returns to Corporate Social Responsibility. *Academy of Management Review*, 32 (3), 794–816. DOI: 10.5465/AMR.2007.25275520.

Barsky, R. B. 1989. Why Don't the Prices of Stocks and Bonds Move Together? *The American Economic Review*, 79 (5), 1132–1145.

Berger, A. N. and Humphrey, D. B. 1997. Efficiency of Financial Institutions: International Survey and Directions for Future Research. *European Journal of Operational Research*, 98 (2), 175–212. DOI: 10.1016/S0377-2217(96)00342-6.

Berger, A. N., Klapper, L. F. and Turk-Ariss, R. 2009. Bank Competition and Financial Stability. *Journal of Financial Services Research*, 35 (2), 99–118. DOI: 10.1007/s10693-008-0050-7.

Bhaskaran, R. K., Sujit, K. S. and Mongia, S. 2023. Linkage between Performance and Sustainability Initiatives in Banking Sector–An Empirical Examination. *International Journal of Productivity and Performance Management*, 72 (1), 200–225. DOI: 10.1108/IJPPM-07-2020-0385.

Borio, C., Gambacorta, L. and Hofmann, B. 2017. The Influence of Monetary Policy on Bank Profitability. *International Finance*, 20 (1), 48–63. DOI: 10.1111/infi.12104.

Branson, W. H. and Henderson, D. W. 1985. The Specification and Influence of Asset Markets. In Jones, R. W. and Kenen, P. B. (eds.). *Handbook of International Economics*, Vol. 2, Chapter 15, pp. 749–805.

Broadstock, D. C., Chan, K., Cheng, L. T. and Wang, X. 2021. The Role of ESG Performance During Times of Financial Crisis: Evidence from COVID-19 in China. *Finance Research Letters*, 38, 101716. DOI: 10.1016/j.frl.2020.101716.

Buallay, A. 2019. Is Sustainability Reporting (ESG) Associated with Performance? Evidence from the European Banking Sector. *Management of Environmental Quality: An International Journal*, 30 (1), 98–115. DOI: 10.1108/MEQ-12-2017-0149.

Chauhan, Y. and Kumar, S. B. 2018. Do Investors Value the Nonfinancial Disclosure in Emerging Markets? *Emerging Markets Review*, 37, 32–46. DOI: 10.1016/j.ememar.2018.05.001.

Chava, S. 2014. Environmental Externalities and Cost of Capital. *Management Science*, 60 (9), 2223–2247. DOI: 10.1287/mnsc.2013.1863.

Chen, T., Dong, H. and Lin, C. 2020. Institutional Shareholders and Corporate Social Responsibility. *Journal of Financial Economics*, 135 (2), 483–504. DOI: 10.1016/j.jfineco.2019.06.007.

Cheng, B., Ioannou, I. and Serafeim, G. 2014. Corporate Social Responsibility and Access to Finance. *Strategic Management Journal*, 35 (1), 1–23. DOI: 10.1002/smj.2131.

Cui, J., Jo, H. and Na, H. 2018. Does Corporate Social Responsibility Affect Information Asymmetry? *Journal of Business Ethics*, 148 (3), 549–572. DOI: 10.1007/s10551-015-3003-8.

Čihák, M. and Hesse, H. 2010. Islamic Banks and Financial Stability: An Empirical Analysis. *Journal of Financial Services Research*, 38 (2–3), 95–113. DOI: 10.1007/s10693-010-0089-0.

Demirgüç-Kunt, A. and Huizinga, H. 1999. Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence. *The World Bank Economic Review*, 13 (2), 379–408. DOI: 10.1093/wber/13.2.379.

Demirgüç-Kunt, A. Detragiache, E. and Merrouche, O. 2013. Bank Capital: Lessons from the Financial Crisis. *Journal of Money, Credit and Banking*, 45 (6), 1147–1164. DOI: 10.1111/jmcb.12047.

Dinçer, H., Çelik, I. E., Yilmaz, R. and Hacioğlu, Ü. 2014. The Financial Implications of Corporate Social Responsibility in the Banking Sector. In Hacioğlu, Ü. and Dinçer, H. (eds.). *Managerial Issues in Finance and Banking: A Strategic Approach to Competitiveness*, Chapter 16, pp. 197–207. DOI: 10.1007/978-3-319-01387-9_16.

El Ghoul, S., Guedhami, O., Kwok, C. C. Y. and Mishra, D. R. 2011. Does Corporate Social Responsibility Affect the Cost of Capital? *Journal of Banking & Finance*, 35 (9), 2388–2406. DOI: 10.1016/j.jbankfin.2011.02.007.

El Khoury, R., Nasrallah, N. and Alareeni, B. 2023. ESG and Financial Performance of Banks in the MENAT Region: Concavity–Convexity Patterns. *Journal of Sustainable Finance & Investment*, 13 (1), 406–430. DOI: 10.1080/20430795.2021.1929807.

Feng, J., Goodell, J. W. and Shen, D. 2022. ESG Rating and Stock Price Crash Risk: Evidence from China. *Finance Research Letters*, 46 (B), 102476. DOI: 10.1016/j.frl.2021.102476.

Finger, M., Gavious, I. and Manos, R. 2018. Environmental Risk Management and Financial Performance in the Banking Industry: A Cross-Country Comparison. *Journal of International Financial Markets, Institutions and Money*, 52, 240–261. DOI: 10.1016/j.intfin.2017.09.019.

Fiordelisi, F. 2007. Shareholder Value Efficiency in Banking. *Journal of Banking & Finance*, 31 (7), 2151–2171. DOI: 10.1016/j.jbankfin.2006.10.021.

Freeman, R. E. 1984. *Strategic Management: A Stakeholder Approach*. Boston: Pitman Publishing.

Friedman, M. 1970. A Theoretical Framework for Monetary Analysis. *Journal of Political Economy*, 78 (2), 193–238. DOI: 10.1086/259623.

García-Herrero, A., Gavilá, S. and Santabárbara, D. 2009. What Explains the Low Profitability of Chinese Banks? *Journal of Banking & Finance*, 33 (11), 2080–2092. DOI: 10.1016/j.jbankfin.2009.05.005.

Garriga, E. and Melé, D. 2004. Corporate Social Responsibility Theories: Mapping the Territory. *Journal of Business Ethics*, 53 (1–2), 51–71. DOI: 10.1023/B:BUSI.0000039399.90587.34.

Haans, R. F. J., Pieters, C. and He, Z.-L. 2016. Thinking About U: Theorizing and Testing U- and Inverted U-Shaped Relationships in Strategy Research. *Strategic Management Journal*, 37 (7), 1177–1195. DOI: 10.1002/smj.2399.

Harjoto, M. A. and Jo, H. 2011. Corporate Governance and CSR Nexus. *Journal of Business Ethics*, 100 (1), 45–67. DOI: 10.1007/s10551-011-0772-6.

Hashemzadeh, N. and Taylor, P. 1988. Stock Prices, Money Supply, and Interest Rates: the Question of Causality. *Applied Economics*, 20 (12), 1603–1611. DOI: 10.1080/00036848800000091.

Hashmi, S. M. and Chang, B. H. 2023. Asymmetric Effect of Macroeconomic Variables on the Emerging Stock Indices: A Quantile ARDL Approach. *International Journal of Finance & Economics*, 28 (1), 1006–1024. DOI: 10.1002/ijfe.2461.

Healy, P. M. and Palepu, K. G. 2001. Information Asymmetry, Corporate Disclosure, and the Capital Markets: A Review of the Empirical Disclosure Literature. *Journal of Accounting and Economics*, 31 (1–3), 405–440. DOI: 10.1016/S0165-4101(01)00018-0.

Heinkel, R., Kraus, A. and Zechner, J. 2001. The Effect of Green Investment on Corporate Behavior. *Journal of Financial and Quantitative Analysis*, 36 (4), 431–449. DOI: 10.2307/2676219.

Hennessy, C. A. and Whited, T. M. 2007. How Costly is External Financing? Evidence from a Structural Estimation. *The Journal of Finance*, 62 (4), 1705–1745. DOI: 10.1111/j.1540-6261.2007.01255.x.

Hwang, J., Kim, H. and Jung, D. 2021. The Effect of ESG Activities on Financial Performance during the COVID-19 Pandemic—Evidence from Korea. *Sustainability*, 13 (20), 11362. DOI: 10.3390/su132011362.

Jensen, M. C. and Meckling, W. H. 1976. Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3 (4), 305–360. DOI: 10.1016/0304-405X(76)90026-X.

Jo, H. and Harjoto, M. A. 2011. Corporate Governance and Firm Value: The Impact of Corporate Social Responsibility. *Journal of Business Ethics*, 103 (3), 351–383. DOI: 10.1007/s10551-011-0869-y.

Jo, H., Kim, H. and Park, K. 2015. Corporate Environmental Responsibility and Firm Performance in the Financial Services Sector. *Journal of Business Ethics*, 131 (2), 257–284. DOI: 10.1007/s10551-014-2276-7.

Levine, R. 2005. Finance and Growth: Theory and Evidence. In Aghion, P. and Durlauf, S. (eds.). *Handbook of Economic Growth*, Vol. 1, Part A, Chapter 12, pp. 865–934. DOI: 10.1016/S1574-0684(05)01012-9.

Louzis, D. P., Vouldis, A. T. and Metaxas, V. L. 2012. Macroeconomic and Bank-Specific Determinants of Non-Performing Loans in Greece: A Comparative Study of Mortgage, Business and Consumer Loan Portfolios. *Journal of Banking & Finance*, 36 (4), 1012–1027. DOI: 10.1016/j.jbankfin.2011.10.012.

Mamatzakis, E. and Bermpei, T. 2014. What Drives Investment Bank Performance? The Role of Risk, Liquidity and Fees Prior to and during the Crisis. *International Review of Financial Analysis*, 35, 102–117. DOI: 10.1016/j.irfa.2014.07.012.

Merton, R. C. 1987. A Simple Model of Capital Market Equilibrium with Incomplete Information. *The Journal of Finance*, 42 (3), 483–510. DOI: 10.1111/j.1540-6261.1987.tb04565.x.

Nizam, E., Ng, A., Dewandaru, G., Nagayev, R. and Nkoba, M. A. 2019. The Impact of Social and Environmental Sustainability on Financial Performance: A Global Analysis of the Banking Sector. *Journal of Multinational Financial Management*, 49, 35–53. DOI: 10.1016/j.mulfin.2019.01.002.

Pedersen, L. H., Fitzgibbons, S. and Pomorski, L. 2021. Responsible Investing: The ESG-Efficient Frontier. *Journal of Financial Economics*, 142 (2), 572–597. DOI: 10.1016/j.jfineco.2020.11.001.

Perrini, F., Russo, A., Tencati, A. and Vurro, C. 2011. Deconstructing the Relationship between Corporate Social and Financial Performance. *Journal of Business Ethics*, 102 (1), 59–76. DOI: 10.1007/s10551-011-1194-1.

Porter, M. E. 1991. Towards a Dynamic Theory of Strategy. *Strategic Management Journal*, 12 (S2), 95–117. DOI: 10.1002/smj.4250121008.

Raghunandan, A. and Rajgopal, S. 2022. Do ESG Funds Make Stakeholder-Friendly Investments? *Review of Accounting Studies*, 27 (3), 822–863. DOI: 10.1007/s11142-022-09693-1.

Ruf, B. M., Muralidhar, K., Brown, R. M., Janney, J. J. and Paul, K. 2001. An Empirical Investigation of the Relationship between Change in Corporate Social Performance and Financial Performance: A Stakeholder Theory Perspective. *Journal of Business Ethics*, 32 (2), 143–156. DOI: 10.1023/A:1010786912118.

Russo, M. V. and Fouts, P. A. 1997. A Resource-Based Perspective on Corporate Environmental Performance and Profitability. *Academy of Management Journal*, 40 (3), 534–559. DOI: 10.2307/257052.

Shakil, M. H., Mahmood, N., Tasnia, M. and Munim, Z. H. 2019. Do Environmental, Social and Governance Performance Affect the Financial Performance of Banks? A Cross-Country Study of Emerging Market Banks. *Management of Environmental Quality: An International Journal*, 30 (6), 1331–1344. DOI: 10.1108/MEQ-08-2018-0155.

Staikouras, C. K. and Wood, G. E. 2004. The Determinants of European Bank Profitability. *International Business & Economics Research Journal*, 3 (6), 57–68. DOI: 10.19030/iber.v3i6.3699.

Statista. 2024a. *Green Banking – Statistics & Facts* [online]. Statista Research Department. Available at: `https://www.statista.com/topics/9069/green-banking/#topicOverview`. [Accessed 2025, June 25].

Statista. 2024b. *Leading Countries in Terms of Value of Green Bonds Issued Worldwide in 2023* [online]. Statista Research Department. Available at: `https://www.statista.com/study/108882/green-bonds-worldwide/`. [Accessed 2025, June 25].

Statista. 2025. *Cumulative Value of Emerging Market Green Bond Issuance 2012–2023, by Country* [online]. Statista Research Department. Available at: `https://www.statista.com/statistics/1290909/emerging-market-green-bond-issuance-by-country/`. [Accessed 2025, June 25].

Syllignakis, M. N. and Kouretas, G. P. 2010. German, US and Central and Eastern European Stock Market Integration. *Open Economies Review*, 21 (4), 607–628. DOI: 10.1007/s11079-009-9109-9.

Takahashi, H. and Yamada, K. 2021. When the Japanese Stock Market Meets COVID-19: Impact of Ownership, China and US Exposure, and ESG Channels. *International Review of Financial Analysis*, 74, 101670. DOI: 10.1016/j.irfa.2021.101670.

Tan, Y. and Floros, C. 2012. Bank Profitability and GDP Growth in China: A Note. *Journal of Chinese Economic and Business Studies*, 10 (3), 267–273. DOI: 10.1080/14765284.2012.703541.

Tian, G., Wang, K. T. and Wu, Y. 2025. Does the Market Value the Green Credit Performance of Banks? Evidence from Bank Loan Announcements. *The British Accounting Review*, 57 (5), 101282. DOI: 10.1016/j.bar.2023.101282.

Wang, H., Choi, J. and Li, J. 2008. Too Little or Too Much? Untangling the Relationship between Corporate Philanthropy and Firm Financial Performance. *Organization Science*, 19 (1), 143–159. DOI: 10.1287/orsc.1070.0271.

Xu, Y. and Zhu, N. 2024. The Effect of Environmental, Social, and Governance (ESG) Performance on Corporate Financial Performance in China: Based on the Perspective of Innovation and Financial Constraints. *Sustainability*, 16 (8), 3329. DOI: 10.3390/su16083329.

Yin, X.-N., Li, J.-P. and Su, C.-W. 2023. How Does ESG Performance Affect Stock Returns? Empirical Evidence from Listed Companies in China. *Heliyon*, 9 (5), e16320. DOI: 10.1016/j.heliyon.2023.e16320.

8 ANNEX

The results of the descriptive analysis are presented in Tab. 2.

The CAR has a mean of 18.73%, with a standard deviation of 3.57, indicating moderate variability. Banks' CAR exceeds 8% which Basel Act III mandates. DJ values are low and have a wide range. Many values are zero (Median = 0), with most entities exhibiting low or zero scores on the environmental pillar variable. Additionally, some outliers contribute to an upward bias in the mean. ER exhibits high variability (Std. Dev = 16.23) and a wide range (Min = 17.74, Max = 174.36). EXR has a minimal average (Mean = 0.021), but a wide range from −0.14 to 0.44. Although the average risk is low, some institutions may have faced significant exchange rate fluctuations. The quality of the governance pillar remains relatively consistent across banking institutions, exhibiting minimal variability. MCAP has a wide dispersion, meaning that a few banks may have dominated the market. NPL shows significant variation in loan quality, indicating that some banks may have encountered a high number of non-performing loans. The P/B ratio varied significantly across banks. Similarly, the P/E ratio exhibited a wide variation in investor expectations and valuations. ROE has a negative minimum value (−46.81), indicating that some banks may have suffered significant losses, and profits fluctuate considerably. The SOC varies, but values remain modest overall. SR has a skewed distribution with some notable positive and negative values.

The correlation coefficients among firm-specific and market-specific variables are presented in Tab. 3.

CAR has a strong positive relationship with P/B (0.59), suggesting that banks with higher capital are capable of granting more loans, which in turn boosts the price-to-book ratio. Furthermore, CAR has a moderate positive relationship with ROE (0.31).

MCAP and SR have a strong positive correlation (0.77), indicating that banks with higher MCAP tend to have better SR.

OE and P/B demonstrate a moderate positive correlation (0.39), indicating that bank shares with high ROE tend to trade at a premium over their book value. ROE and SR also have a moderately positive correlation; banks with high ROE tend to offer better stock returns.

NPL and ROE have a moderate negative correlation (−0.40), indicating that banks with higher levels of bad loans generally exhibit lower profitability. NPL and P/B also exhibit a moderate negative correlation (−0.40), indicating that a higher credit risk (more NPLs) is associated with a lower market price of the stock.

ENV and ROE have a moderate positive correlation (0.48), meaning that better environmental scores are associated with higher profitability.

Tab. 2: Descriptive analysis

	CAR	DJ	ENV	ER	EXR	GOV	I
Mean	18.725140	0.049852	0.112905	43.098490	0.021153	4.193952	0.046464
Median	18.100000	0.005470	0.000000	41.159000	0.000000	4.060000	0.027500
Max	36.700000	0.347847	1.930000	174.357900	0.442611	7.770000	0.270400
Min	13.370000	−0.205466	0.000000	17.745700	−0.144578	1.620000	0.000000
Std. Dev	3.565751	0.242030	0.260242	16.226780	0.097362	1.313763	0.058567
	MCAP	**NPL**	**P/B**	**P/E**	**ROE**	**SOC**	**SR**
Mean	0.173987	6.018485	1.571181	14.567110	11.927010	2.088762	0.104171
Median	0.112385	4.062900	1.385900	12.025350	12.751200	1.740000	0.044101
Max	2.597259	46.619000	6.994200	158.730200	55.594300	7.270000	2.888982
Min	−0.996695	0.534200	0.049600	0.000000	−46.808500	0.000000	−0.999999
Std. Dev	0.485041	8.271193	1.117947	15.810460	10.317270	1.736791	0.433174

Notes: All variables are expressed as averages of firm-level data over the study period. Std. Dev denotes standard deviation.

Tab. 3: Correlation analysis

	CAR	DJ	ENV	ER	EXR	GOV	I	MCAP	NPL	PB	PE	ROE	SOC	SR
CAR	1	−0.01	−0.15	−0.24	−0.02	−0.05	0.08	0.07	−0.18	0.59	0.11	0.31	−0.04	0.07
DJ	−0.01	1	−0.11	0.05	−0.12	−0.04	−0.06	0.30	0.00	0.06	−0.06	−0.06	−0.07	0.29
ENV	−0.15	−0.11	1	0.17	0.15	0.51	0.12	0.10	0.09	−0.18	−0.15	0.04	0.27	0.06
ER	−0.24	0.05	0.17	1	0.02	0.55	−0.05	−0.06	0.22	−0.25	−0.08	−0.48	0.27	−0.03
EXR	−0.02	−0.12	0.15	0.02	1	0.09	0.67	0.15	−0.14	−0.16	−0.15	0.25	0.20	0.14
GOV	−0.05	−0.04	0.51	0.55	0.09	1	0.08	−0.02	0.13	−0.05	−0.05	−0.11	0.33	−0.04
I	0.08	−0.06	0.12	−0.05	0.67	0.08	1	0.21	−0.19	−0.05	−0.18	0.45	0.18	0.28
MCAP	0.07	0.30	0.10	−0.06	0.15	−0.02	0.21	1	0.02	0.06	−0.03	0.16	−0.04	0.77
NPL	−0.18	0.00	0.09	0.22	−0.14	0.13	−0.19	0.02	1	−0.40	−0.12	−0.40	−0.09	−0.04
PB	0.59	0.06	−0.18	−0.25	−0.16	−0.05	−0.05	0.06	−0.40	1	0.27	0.39	−0.12	0.10
PE	0.11	−0.06	−0.15	−0.08	−0.15	−0.05	−0.18	−0.03	−0.12	0.27	1	−0.05	−0.07	−0.02
ROE	0.31	−0.06	0.04	−0.48	0.25	−0.11	0.45	0.16	−0.40	0.39	−0.05	1	0.04	0.35
SOC	−0.04	−0.07	0.27	0.27	0.20	0.33	0.18	−0.04	−0.09	−0.12	−0.07	0.04	1	−0.03
SR	0.07	0.29	0.06	−0.03	0.14	−0.04	0.28	0.77	−0.04	0.10	−0.02	0.35	−0.03	1

Notes: The table reports Pearson correlation coefficients. Correlation values close to +1 (−1) indicate strong positive (negative) linear relationships.

The variance inflation factor (VIF) analysis used to detect multicollinearity among independent variables in the regression is presented in Tab. 4.

DJ, D_1, D_2, interaction of ENV×PE, and ENV×MCAP are considered suitable for inclusion in the regression analysis, as their respective values are below 5. Additionally, ENV×ROE, ENV×ER, and SOC×MCAP may lead to moderate inflation in standard errors. It remains appropriate to include them with caution.

The remaining variables are highly collinear with each other. ENV has a centred VIF of 254.6, which is extremely high, indicating that ENV is almost a linear combination of other predictors. Although ENV exhibits high multicollinearity, it remains in the regression due to its conceptual importance in assessing the environmental commitment of banks. Omitting this aspect would neglect a crucial component of sustainability performance. Although multicollinearity may increase the standard errors, the ENV variable is retained for the sake of theoretical completeness and policy relevance.

Tab. 4: Variance inflation factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	0.002969	26.514910	NA
ENV	0.422869	302.695300	254.553600
SOC	0.005110	336.113300	137.004400
GOV	0.002067	356.346100	31.704340
ENV×PB	0.009303	10.115420	8.785265
ENV×ER	2.03e−05	33.787030	28.157420
ENV×ROE	4.29e−05	13.379710	12.571260
ENV×NPL	7.17e−05	5.787521	5.293802
ENV×CAR	0.001093	240.307300	202.149400
ENV×PE	0.000122	9.098160	7.913300
ENV×MCAP	0.011554	4.334583	4.226029
SOC×PB	0.000184	32.381770	16.995820
SOC×ER	3.87e−07	69.688140	36.766290
SOC×ROE	1.70e−06	31.028920	21.110990
SOC×NPL	3.42e−06	10.407780	6.564127
SOC×CAR	7.68e−06	177.372500	73.736270
SOC×PE	5.62e−07	21.177310	17.069430
SOC×MCAP	0.000321	5.572999	5.264699
GOV×PB	4.77e−05	31.682830	13.625830
GOV×ER	1.90e−07	86.456510	23.734820
GOV×ROE	5.46e−07	23.828950	12.340560
GOV×NPL	5.01e−07	9.648464	6.484372
GOV×CAR	2.62e−06	163.176200	19.871190
GOV×PE	1.97e−07	16.845090	10.493040
GOV×MCAP	0.000119	5.600511	5.057085
I	0.102542	5.103367	3.126302
EXR	0.025947	2.289869	2.186184
DJ	0.002438	1.323651	1.269531
D_1	0.001439	4.038297	2.769118
D_2	0.000701	2.088290	1.392193

Notes: VIF = Variance Inflation Factor, C denotes the intercept term.

The inclusion of interaction terms demonstrates that the financial and ESG pillars do not operate in isolation. The influence of ESG pillars on performance outcomes, such as stock returns, is often interconnected and context-sensitive. For example, the impact of ENV on stock returns may differ depending on the level of ROE or MCAP. Interaction terms are incorporated to examine these moderation effects rigorously. For example, ENV×ROE assesses whether the influence of environmental performance is contingent upon profitability. In financial systems characterised by diverse institutional, regulatory, and operational contexts, interaction effects facilitate the consideration of the conditional nature inherent in variable relationships. For instance, within emerging markets, the impact of ESG scores on performance may differ across various capital levels of banks.

The interaction terms enhance the model's ability to capture non-additive effects, where the combined influence of two variables differs from the sum of their individual impacts. This is especially relevant when variables like SOC, GOV, ENV, and financial ratios are conceptually linked.

In regression analysis, the inclusion of interaction terms leads to enhancements in R-squared and Rw-squared metrics. The model integrates multiple interaction terms to address prospective moderation effects between ESG indicators and financial variables. These interactions are founded on theoretical premises, predicated on the expectation that the impact of ESG performance is not uniform but varies by firm-specific factors such as profitability, risk, or market size. Incorporating these terms augments the model's proficiency in representing complex dynamics within emerging markets, thereby aligning with the multidimensional characteristics of corporate sustainability and performance.

Despite the relatively limited sample size, the model is meticulously specified to emphasise theory-driven interactions rather than exploratory ones. To address this, we estimate the regression using robust least squares. Although incorporating several interaction terms in a model with a limited sample size may raise concerns regarding degrees of freedom and statistical power, these terms are retained due to their theoretical significance and the need to consider the interdependent effects of ESG and financial variables.

AUTHOR'S ADDRESS

Hüseyin Öcal, Faculty of Economics, Administrative and Social Sciences, Istanbul Gelişim University, Cihangir Neighborhood, Petrol Ofisi Cd., 34310 Avcılar/Istanbul, Türkiye, e-mail: hocal@gelisim.edu.tr

Tarık Yılmaz, Faculty of Financial Sciences, Marmara University, Recep Tayyip Erdoğan Social Complex, Aydınevler Neighborhood, Uyanık Street 6, B1 Block, 34854, Maltepe/Istanbul, Türkiye, e-mail: tarik.yilmaz@marmara.edu.tr

Anton Abdulbasah Kamil, Faculty of Economics, Administrative and Social Sciences, Istanbul Gelişim University, Cihangir Neighborhood, Petrol Ofisi Cd., 34310 Avcılar/Istanbul, Türkiye, e-mail: akamil@gelisim.edu.tr (corresponding author)

EMOTIONAL INTELLIGENCE OF GENERATION Z AND ITS RELATION TO ALCOHOL CONSUMPTION

Barbora Pánková[1,2]✉, Renata Bašová[2], Šimon Všetička[2]

[1] *Charles University, Prague, Czech Republic*
[2] *NEWTON University, Prague, Czech Republic*

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11 Issue 2
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

This study explores the correlation between emotional intelligence (EI) and alcohol consumption patterns among Generation Z, with a focus on university students and graduates with backgrounds in economics and management. The present study explores emotional intelligence as a personal trait that potentially influences risky alcohol behaviors. These behaviors are assessed using the AUDIT (Alcohol Use Disorders Identification Test) and the TEIQue-SF (Trait Emotional Intelligence Questionnaire – Short Form). A sample of 128 respondents, recruited through online platforms, completed these standardized questionnaires. A comprehensive statistical analysis was conducted, encompassing the utilization of Spearman's correlation coefficient and *t*-tests. This analysis yielded a negative correlation between emotional intelligence (EI) and the consumption of alcohol in a risky manner. The findings indicated that individuals with lower EI levels exhibited an elevated propensity for alcohol-related risks. Furthermore, gender disparities have been identified as a contributing factor to heightened alcohol consumption risk among males compared to females. While the findings of the present study confirm the association between emotional intelligence (EI) and alcohol risk, they also suggest the presence of complex underlying factors in alcohol consumption behaviors that extend beyond EI. This research contributes to the understanding of the role of emotional intelligence in managing alcohol use, with implications for developing intervention strategies aimed at promoting emotional awareness and healthier coping mechanisms within Generation Z. Our results not only confirm older models (e.g. Kun et al., 2019; Kun and Demetrovics, 2010; Bar-On, 2006), but also reveal generation-specific nuances—e.g., a lower overall rate of risky drinking, but a persistent gender difference and the fundamental importance of self-control.

KEY WORDS

emotional intelligence, alcohol consumption, generation Z, risky drinking behavior

JEL CODES

I12, I31, J10, J13, M52, M53

PÁNKOVÁ, Barbora, BAŠOVÁ, Renata, and VŠETIČKA, Šimon. 2025. Emotional Intelligence of generation Z and Its Relation to Alcohol Consumption. *European Journal of Business Science and Technology,* 11 (2): 182–205. ISSN 2694-7161, DOI 10.11118/ejobsat.2025.008.

1 INTRODUCTION

Alcohol consumption persists as a preeminent public health concern, particularly among young adults and college students, where prevalence rates are notably elevated (Menagi et al., 2008; Stone et al., 2012). While the social and developmental factors influencing alcohol use are well-documented, there is an increasing interest in understanding the psychological mechanisms that contribute to problematic drinking behaviors. Among these factors, emotional intelligence (EI) has emerged as a crucial factor in determining an individual's capacity to manage emotions, cope with stress, and resist peer pressure related to substance use (Goleman, 2011; Trinidad and Johnson, 2002). A corpus of research has identified a correlation between low emotional intelligence (EI) and a variety of maladaptive behaviors, including substance abuse. This phenomenon can be attributed, in part, to the tendency of individuals with weaker emotional regulation skills to utilize alcohol as a coping mechanism (see Janati et al., 2012; Mohagheghi et al., 2015). Recent intervention studies have demonstrated that emotion regulation workshops can significantly reduce craving beliefs in individuals with substance use disorders, highlighting the potential of targeted emotional skill-building to mitigate risky drinking behaviors (Choopan et al., 2016).

Conventional research has predominantly centered on the demographic and social determinants of alcohol consumption. However, there is a paucity of studies that have systematically examined the role of emotional intelligence, particularly within the context of the emerging adult Generation Z, who differ markedly from previous cohorts in their psychological development, socialization patterns, and digital media exposure (Muli and Lagan, 2017). The distinctive manner in which Generation Z engages with digital environments, wherein alcohol-related behaviors are frequently normalized and promoted, has the potential to accentuate vulnerabilities associated with emotional regulation and peer influence. Furthermore, young adults aged 18–29 are at a critical developmental stage where behavioral patterns, including alcohol use, are established and often persist into later life. This period is of particular significance for interventions aimed at enhancing emotional intelligence.

Despite the mounting evidence from research linking EI to substance use, there remains a significant gap in understanding how emotional intelligence correlates specifically with alcohol consumption patterns among Generation Z college students, including potential gender-specific differences. A review of extant studies reveals a tendency to either aggregate young adults across generational cohorts or to neglect the potential moderating influence of gender. The present study endeavors to address this lacuna by focusing exclusively on Generation Z and by systematically examining gender as a moderating variable in the relationship between EI and alcohol use.

This present study contributes to the theoretical understanding of emotional intelligence (EI) and its relationship to alcohol consumption by focusing on specific subcomponents of EI—notably self-control—and by situating these relationships within the unique context of Generation Z higher education students. Recent research, such as the Hungarian cohort study (Kun et al., 2019), has shown that difficulties in stress management and self-regulation are significant predictors of substance use, highlighting the importance of examining EI not only as a global trait but also through its distinct facets. By analyzing how different aspects of EI, including self-control, well-being, emotionality, sociability, adaptation, and motivation, are associated with patterns of risky alcohol consumption, this study extends existing models that have often treated EI as a unitary construct (Kun and Demetrovics, 2010).

Moreover, the study focuses on Generation Z students, a cohort characterized by challenges such as academic pressures, peer influences, and increased autonomy. This focus is supported by previous research, such as that by Guo et al. (2010), which demonstrates that programs targeting emotional intelligence and coping skills within educational settings can be effective in

reducing substance use among young people. The findings suggest that interventions tailored to the unique psychosocial dynamics of this generation, particularly in higher education environments, may offer greater potential for prevention and harm reduction.

Finally, the study explores gender differences in the relationship between EI and alcohol consumption, building on evidence that socialization patterns shape how males and females regulate emotions and respond to stress (Kun et al., 2019; Goudarzian et al., 2017). The study based on research confirmed the current state of knowledge, and its results are consistent with the findings of earlier works (e.g. Kun et al., 2019; Kun and Demetrovics, 2010; Bar-On, 2006).

2 LITERATURE REVIEW

The notion of emotional intelligence has garnered considerable attention in both academic and popular discourse. A considerable number of training programs designed to enhance emotional intelligence have been implemented in a variety of settings, including organizations, academic institutions, and educational environments on a global scale. Emotional intelligence, akin to other psychological constructs such as intelligence, leadership, and personality, is subject to varying interpretations and measurement methodologies. Emotional intelligence, in its fundamental sense, is defined as the capacity to discern and modulate one's own emotions as well as those of others (Goleman, 1998). The conceptual origins of this theory can be traced to Thorndike's (1920 in Goleman, 1998) theory of social intelligence, defined as "the ability to understand men and women, boys and girls, and so to direct—to act wisely in human relationships." Salovey and Mayer (1990) formally introduced the term "emotional intelligence," defining it as a set of skills that enable individuals to accurately perceive, express, regulate, and utilize emotions for motivation and goal achievement. Goleman (1998) further popularized the construct by proposing that emotional intelligence plays a more critical role in success than traditional cognitive intelligence (IQ). This proposal had the effect of reshaping perspectives on human intelligence and achievement.

2.1 Trait Emotional Intelligence

Trait emotional intelligence is defined as a constellation of emotional perceptions situated at the lower levels of the personality hierarchy (Petrides et al., 2007). This construct encompasses self-perceived emotional abilities, often referred to as emotional self-efficacy. In essence, it captures the affective components of personality.

Personality, in its broadest sense, is an expansive domain encompassing a multitude of characteristics, including motives, interests, values, emotional traits, social characteristics, and numerous others (Funder, 2015). Conventionally, the affective dimensions of personality are dispersed across the five factors of the Big Five model, impeding the capacity to study them in a comprehensive manner. Trait emotional intelligence integrates these facets into a unified model comprising 15 distinct components. Factor analysis (Petrides, 2009) has demonstrated that two facets emerge as distinct entities, while the remaining 13 comprise four overarching factors (well-being, self-control, emotionality, and sociability). These factors, in turn, give rise to the global trait of emotional intelligence, which occupies a predominant position within the hierarchy of emotion-related personality traits. The facets are divided into domains as follows:

1. Well-being – self-esteem, the quality of happiness and optimism.

2. Self-control – working with stress, low impulsivity, regulating emotions.

3. Emotionality – the quality of empathy, emotional perception, emotional expression, relational competence.
4. Sociability – emotion management, assertiveness, social awareness.
5. Separate aspects – self-motivation and adaptability.

It is imperative to acknowledge the distinction between emotional intelligence as a skill and emotional intelligence as a trait. These two concepts are measured differently (Petrides and Furnham, 2001). The assessment of skills-based emotional intelligence is typically conducted through performance-based methods, whereas the measurement of trait emotional intelligence is generally achieved by means of self-reports.

2.2 Alcohol Addiction

Alcohol consumption is a significant contributor to the global health burden and a prominent public health concern in Europe. In the European Union, where alcohol consumption rates are among the highest in the world, alcohol-related deaths account for approximately 14% of all male deaths and 8% of all female deaths between ages 15 and 64 (Rehm and Shield, 2012 in Šebeňa, 2022). These figures are particularly high among young adults aged 18 to 26, especially college students. A multitude of studies have demonstrated that the prevalence of alcohol use among college students reaches its zenith (Menagi et al., 2008; Stone et al., 2012). The onset of alcohol consumption typically occurs during high school, and its intensity increases upon entry into college. This pattern of escalating alcohol use typically reaches its peak in this environment. Upon entering college, students undergo a significant transition in their lives, marked by an increase in autonomy, a decrease in parental guidance, supervision, and support, and an expansion of social interactions with peers on campus. The aforementioned factors may collectively contribute to an escalation in alcohol consumption. Particularly important is the fact that alcohol consumption is most often a social activity with peers, and thus constitutes a cultural event in the process of identity development (Palen and Coatsworth, 2007). It is equally plausible for alcohol use to gradually evolve into abuse or even addiction later in life, as it is for consumption to steadily decrease during college and eventually cease altogether after graduation.

As with other psychoactive substances, motives for experimenting with alcohol vary, ranging from curiosity, rebellion, sensation seeking, providing pleasure to alleviating boredom (Kuntsche and Müller, 2012). While social motives may drive initial experimentation, they are unlikely to be cited as a reason for continued use (Morrison and Plant, 1991). A review of the extant literature on the motivations of individuals for alcohol consumption reveals that people consume alcohol for a variety of reasons. The pursuit of social benefits, including the attainment of acceptance, the acquisition of peer recognition, and the experience of a sense of belonging, constitute primary motivations for some individuals. The consumption of alcohol by some individuals is primarily driven by a desire to alleviate or manage adverse emotional conditions, such as anxiety or depression. Additionally, some individuals drink to enhance or sustain positive emotional states, such as feelings of excitement or pleasure, which is referred to as the 'reinforcement' motive (Kuntsche and Müller, 2012; Németh et al., 2011).

Gender differences play a significant role in alcohol consumption patterns, with men consistently displaying higher rates of alcohol use and risky drinking behaviors compared to women. A study by Wilsnack et al. (2009) found that men are more likely to engage in heavy episodic drinking, whereas women exhibit higher rates of lifelong abstinence. Despite the existence of global trends indicating a gradual increase in alcohol consumption among women, gender disparities persist, potentially due to both biological and social factors. Moinuddin et al. (2016) emphasize that women are more vulnerable to the physiological effects of alcohol due to differences in alcohol metabolism, which are influenced by sex hormones. Consequently, women experience higher blood alcohol concentrations and greater intoxication levels than men when consuming equivalent amounts of

alcohol. Beyond biological differences, cultural and societal expectations also influence gendered drinking behaviors. Research by Rudnák et al. (2023) underscores the pervasiveness of traditional gender norms, with male respondents demonstrating a higher propensity to endorse statements that reinforce conventional gender roles. These roles include the prioritization of a woman's role in supporting her husband's career and the perception of men as suitable for leadership positions. Such entrenched social norms may contribute to the prevalence of male-dominated drinking cultures, where alcohol serves as a means of social bonding and coping with stress. These findings underscore the complex interplay between biological, psychological, and sociocultural factors in shaping alcohol consumption behaviors across genders.

2.2.1 Addictions and Emotions

The role of emotions in the development of addiction to psychotropic substances was previously theorized by Freud (1930 in Kun and Demetrovics, 2010). He proposed that psychoactive addiction may represent an attempt to evade a distressing environment, physical discomfort, or emotional disillusionment. "With the passage of time, it becomes evident that life presents significant challenges, characterized by profound pain, disappointment, and seemingly insurmountable tasks. In order to endure it, we must implement palliative measures; there are perhaps three such measures: a strong deflection which causes us to make light of our suffering, a substitute satisfaction which diminishes it, and narcotics which make us insensitive to it" (Freud, 1930, p. 75 in Kun and Demetrovics, 2010). According to Wurmser (1974), individuals suffering from an addictive disorder demonstrate an inability to regulate their undifferentiated feelings, impulses, and pervasive internal stress. Consequently, they resort to the use of psychoactive substances. The utilization of addictive substances can thus be interpreted as an endeavor to self-medicate. According to Khantzian (1985), the self-medication hypothesis emphasizes the role of emotion regulation in addictive behaviors. He posits that the consumption of drugs materializes as a dual outcome of psychopharmacological functioning and profound emotional distress. As Wurmser (1974) and Khantzian (1985) have noted, the decision to utilize these substances is contingent upon an individual's challenges with self-regulation and affect regulation, in addition to personality dysfunction. Therefore, it can be concluded that psychoanalytically oriented theories regard substance use as a means of emotion regulation.

Recent research findings further substantiate the robust correlation between emotional dysregulation and addiction. According to the extant research on addiction, individuals may use substances to self-medicate negative emotions arising from heightened stress, anxiety, or anhedonia (Hand et al., 2024). Emotional dysregulation is now recognized as a core feature of substance use disorder as well as behavioral addictions, contributing to compulsive usage patterns and increasing the risk of relapse (Meyer and Segal, 2023). According to Capito et al. (2017), empirical evidence suggests that alcohol consumption can temporarily elevate mood, induce euphoria, and reduce stress and anxiety. Concurrently, alcohol consumption can increase aggression and impulsivity. These findings serve to reinforce the notion that substance use is not merely a coping mechanism for emotional distress; rather, it has the potential to exacerbate emotional instability, thereby creating a cycle of dependency and maladaptive regulation strategies.

2.2.2 Addictions and Emotional Intelligence

Goleman (2011) posited that individuals with limited emotional intelligence are more prone to adverse behaviors, including violence, depression, delinquency, and substance abuse. These outcomes are attributed to the individual's inability to effectively regulate emotions. Study by Janati et al. (2012) identified a substantial correlation between emotional intelligence and the propensity for drug addiction among student populations. Concurrently, Schutte et al. (2011) corroborated their hypothesis that both emotional intelligence as a skill and trait emotional intelligence are associated with alcohol use. The authors further reference previous research indicating that lower trait emotional

intelligence is associated with more frequent and excessive alcohol use (Austin et al., 2005; Schutte et al., 2011). These findings are corroborated by a systematic review by Kun and Demetrovics (2010), which indicates that lower levels of emotional intelligence are associated with more intensive smoking, alcohol use, and illicit drug use. Their analysis underscores two critical components of emotional intelligence that play a pivotal role in addiction: the ability to decode and differentiate emotions and the ability to regulate emotions. Deficits in these areas have the potential to compromise an individual's capacity to manage distress in a constructive manner, thereby increasing the probability of resorting to substance use as a maladaptive coping mechanism.

As Mohagheghi et al. (2015) have indicated, patients suffering from addiction have been shown to exhibit diminished scores on self-esteem scales. This finding suggests the potential for alcohol consumption to function as a form of self-medication, aiming to enhance self-esteem in specific instances. Given that the development of self-esteem typically occurs during early adulthood, addressing these issues at this stage may prevent the initiation of alcohol consumption as a misguided coping mechanism. From an alternative vantage point, the utilization of alcohol as a means of problem-solving can be construed as a deficiency in problem-solving aptitudes and the capacity to confront challenges autonomously.

As demonstrated in previous studies, individuals grappling with substance use disorders frequently encounter difficulties in comprehending and articulating their emotions (Ciarrochi et al., 2013). Furthermore, they demonstrate an inability to employ emotions in a nuanced manner as sensory cues or coping mechanisms, which often results in the pursuit of substances as a means of regulating internal states. Consequently, the utilization of psychoactive substances functions as an external means of alleviating emotional discomfort that is ambiguous or overwhelming in nature. Consequently, individuals grappling with addiction may ascribe their emotional distress to irrational factors in their body or environment rather than recognizing and addressing their underlying emotional difficulties.

According to the findings of Mohagheghi et al. (2015), certain components of emotional intelligence are present in insufficient amounts in individuals with alcohol dependence. This underscores the potential efficacy of identifying and training individuals with lower emotional intelligence scores as a preventative measure for alcohol-related problems. This perspective is corroborated by the findings of Trinidad and Johnson (2002), who observed a negative correlation between emotional intelligence and substance use among adolescents. The findings of the study indicated that individuals with higher emotional intelligence may possess a greater ability to understand social cues, resist peer pressure, and regulate emotions effectively. This, in turn, may reduce their likelihood of engaging in substance use.

2.2.3 Addictions, Emotional Intelligence and Generation Z

The demographic known as Generation Z, comprising individuals born between the mid-1990s and early 2010s, is entering the workforce as digital natives shaped by the pervasive influence of social media (Sharma and Singh, 2023). This exposure presents a unique set of emotional challenges, with some individuals resorting to alcohol consumption as a coping mechanism for stress, isolation, or emotional difficulties. A substantial inverse correlation has been demonstrated between emotional intelligence (EI) and alcohol consumption, with lower EI levels correlating with increased alcohol intake. For instance, a study at Minnesota State University, Mankato, found that individuals with lower emotional intelligence (EI) were more prone to excessive alcohol consumption as a means of emotional regulation (Davlyatov, 2013).

Rybanská (2015) underscores the critical role of emotions in decision-making, noting that strong emotions can distort rational behavior, thereby emphasizing the need for effective emotional regulation. Nwachukwu et al. (2017) underscore the significance of competencies such as self-awareness and resilience in navigating ambiguity and risk, skills inherently associated with EI. These competencies not only support

professional success but may also encourage healthier coping mechanisms, reducing reliance on substances like alcohol. The exploration of the interplay between generational identity, EI, and alcohol use offers valuable insights into the provision of support to young employees. It is suggested that the development and strengthening of EI could enhance workplace performance while mitigating the risks of substance abuse.

3 METHODOLOGY AND DATA

The objective of this study is to examine the association between risky alcohol consumption and trait emotional intelligence among Generation Z students specializing in economics and management. The research population will be utilized to validate or invalidate specific correlations. The findings will determine whether there is a correlation between alcohol consumption levels and emotional intelligence scores.

Once the research objectives were defined, it was necessary to formulate hypotheses:

- H_1: *Generation Z members with completed or ongoing higher education tend to have higher values towards risky alcohol consumption overall.*
- H_2: *Males have a higher proportion of risky alcohol consumption than females.*
- H_3: *Individuals with lower levels of self-control (a subcomponent of trait emotional intelligence) have greater difficulty moderating their alcohol consumption, both in stopping drinking once started and in limiting intake per drinking session.*
- H_4: *Lower levels of overall trait emotional intelligence and its individual components (well-being, self-control, emotionality, sociability, adaptation and motivation) are associated with chronic risky alcohol consumption.*

3.1 Data Collection and Research Sample

The data collection for this study was conducted in March 2024 using Microsoft Forms, an online form builder that facilitates efficient and high-quality data accumulation while ensuring respondent anonymity. To attain a pertinent sample, participants were recruited via social networks, specifically Facebook and Reddit, utilizing groups dedicated to research participation. A snowball sampling approach was employed, encouraging participants to share the questionnaire with other eligible individuals. The entire questionnaire study was conducted exclusively in the Czech language to ensure cultural homogeneity among respondents. While the survey utilized validated Czech versions of the TEIQue-SF and AUDIT instruments, it is important to acknowledge certain cultural limitations inherent in the study design. Given that all participants were native speakers of Czech and the sample was nationally homogeneous, the findings may not be fully generalizable to broader, cross-cultural populations. Emotional intelligence, as a psychological construct, is subject to variation across cultures due to differences in emotional expression, social norms, and communication styles (Yang et al., 2025). Consequently, the results of this study should be interpreted with caution when considering populations outside the Czech cultural context. Future research endeavors should prioritize the replication of these findings with more diverse and multilingual samples to enhance external validity and promote a more comprehensive understanding of potential cultural variations in emotional intelligence and alcohol-related behaviors.

The research sample consists of Generation Z individuals who are either currently pursuing or have completed higher education in economics and management. The term "Generation Z" is typically defined as individuals born between 1997 and 2012 (Jayatissa, 2023). This demographic is beginning to enter the workforce. The analysis of behavioral patterns within this generation is of particular value, as its members are expected to assume increasingly significant

roles in the job market, including managerial positions.

A total of 128 respondents from Generation Z participated in the survey. While the sample size of 128 may constrain the generalizability of the findings, it can still offer valuable insights, particularly in studies focusing on specific subgroups (such as the group of economics and management students from Generation Z). The gender distribution of the sample is presented in Tab. 1.

Tab. 1: Research sample by gender

Gender	Absolute frequency	Relative frequency
Man	61	48
Woman	67	52
Total	128	100

As illustrated in Tab. 1, the sample population is comprised of 61 male subjects (48%) and 67 female subjects (52%). While the gender distribution is relatively balanced, there is a slight predominance of female respondents.

The collected data was analyzed through the implementation of fundamental descriptive statistics computed with the aid of the Microsoft Excel program. Additionally, hypothesis testing was conducted through Jamovi statistical software, employing *t*-tests and Spearman's correlation coefficient.

3.2 Questionnaire Structure

For the present study, a questionnaire was developed by combining two standardized questionnaires. The introduction of the questionnaire delineates its objective, the nature of the research, and provides assurances of respondent anonymity. The initial section of the survey encompasses fundamental demographic information, including gender. This is followed by the second section, which delves into the subject's alcohol consumption patterns. This section employs the standardized AUDIT (Alcohol Use Disorders Identification Test) questionnaire, which is freely available on the AUDITSCREEN website. The Alcohol Use Disorder Identification Test (AUDIT), developed by the World Health Organization (WHO) in 1989, is a widely used self-assessment tool designed to identify risky alcohol use, dependence, and abuse. The instrument under review consists of 10 items, which address three key areas:

1. The quantity and frequency of alcohol consumption are measured by the questions 1–3.
2. The following inquiries (questions 4–6) are intended to ascertain the presence of potential alcohol dependence.
3. The following set of questions pertains to alcohol-related problems (questions 7–10).

These areas can be evaluated individually; however, the total score, ranging from 0 to 40, is often calculated. A score of 8 or higher is generally indicative of potentially hazardous alcohol intake (de Meneses-Gaya et al., 2009). The majority of inquiries pertain to the fundamental relationship between individuals and alcohol, encompassing its propensity to induce dependence and other deleterious effects. The AUDIT questionnaire was developed by selecting the most effective questions from a pool of approximately 150 in an initial WHO study that included countries with diverse socioeconomic, cultural, linguistic, and healthcare backgrounds. Consequently, AUDIT boasts a robust international reputation, with no revisions necessary since its inception. Nevertheless, numerous abridged or adapted versions have been produced. As previously stated, the potential range of scores is from 0, denoting a non-drinker or an individual with no alcohol-related concerns, to 40, with a score of 1–7 indicating low-risk drinking, 8–14 suggesting hazardous or harmful consumption, and 15 or higher indicating probable alcohol dependence (Saunders, 2024). The test utilizes the term "standard glass," which, in this context, denotes a volume of half a liter of 12° beer, two deciliters of wine, or 0.05 liters of spirits (a large shot).

The third section of the composite questionnaire includes the standardized TEIQue-SF (Trait Emotional Intelligence Questionnaire Short Form) by Petrides (2009). This section contains a series of statements that respondents rate on a scale from 1 (completely disagree) to 7 (completely agree), assessing five aspects

of trait emotional intelligence: well-being, self-control, emotionality, sociability, adaptability, and motivation. The generation of an overall trait emotional intelligence score is achieved by the summation of the values from these scales. Scores for each scale range from 1 to 7, and the total trait emotional intelligence score ranges from 7 to 35. The assessment of emotional intelligence as a personality trait is not without its advantages and disadvantages, which are closely connected to the method of measurement. While self-assessment methodologies are characterized by simplicity in construction, ease of scoring, and general reliability when compared to performance-based emotional intelligence tests, they depend on respondents' self-reflection and introspection, which can introduce biases, such as the desire to provide socially acceptable answers (Salbot et al., 2011).

While the TEIQue-SF and AUDIT are widely recognized and validated tools for assessing trait emotional intelligence (TEI) and alcohol use (AUDIT), respectively, both have limitations that warrant consideration. The TEIQue-SF, a condensed version of the Trait Emotional Intelligence Questionnaire, boasts the advantage of brevity, rendering it well-suited for large-scale studies. However, its reduced length can limit its ability to capture the full breadth of emotional intelligence facets compared to the full version. Furthermore, recent meta-analyses, such as that of Orhan (2024), underscore the variability in the tool's reliability across different populations, thereby suggesting that its psychometric robustness may be context-dependent and influenced by sample characteristics. This prompts inquiries into the generalizability and stability of findings when employing the TEIQue-SF in diverse cohorts.

Similarly, the Alcohol Use Disorders Identification Test (AUDIT), though highly regarded for its sensitivity and specificity in identifying risky alcohol consumption patterns, is not without limitations. The reliance on self-reported data renders the study susceptible to various biases, including underreporting or overreporting due to social desirability or recall inaccuracies. Moreover, while the AUDIT is effective in distinguishing the severity of alcohol use, it does not capture the underlying emotional or psychological motivations for drinking. These motivations are central to understanding the relationship between alcohol consumption and emotional intelligence. These limitations underscore the need for a cautious interpretation of results and highlight the importance of complementing these measures with additional qualitative or contextual data, when feasible.

4 RESULTS

This subsection presents the results of the investigation, through the values of risky alcohol consumption and trait emotional intelligence. The results are presented in tables and figures accompanied by supplementary commentary.

Tab. 2: Frequency of alcohol consumption

Alcohol consumption	Absolute frequency	Relative frequency
Never	6	5
Once a month or less	46	36
Two to four times a month	42	33
Two to three times a week	26	20
Four or more times a week	8	6
Total	128	100

One of the AUDIT questions inquires about the frequency with which the respondent consumes alcohol. As illustrated in Tab. 2, the majority of respondents reported drinking only once a month or less (36%) or two to four times a month (33%). A survey revealed that 20% of respondents consume alcoholic beverages two to three times per week. The smallest proportions were those who consumed alcohol four or more times per week (6%), and those who were abstinent (5%). A review of the data reveals that the sample of respondents generally exhibits a lower frequency of alcohol consumption, with most respondents consuming alcohol only a few times per month at most.

Tab. 3: AUDIT test results

AUDIT	Absolute frequency	Relative frequency
Abstinent, no alcohol problems	6	4.7
Low-risk alcohol consumption, the result does not indicate dependence	71	55.5
The result indicates hazardous or dangerous alcohol consumption	36	28.1
The result shows probable alcohol dependence	15	11.7

Tab. 3 presents the distribution of AUDIT total scores, which assess the risk associated with alcohol consumption and are categorized into four distinct levels. The data reveal that 4.7% of respondents are abstinent or exhibit no signs of alcohol-related issues. The majority of respondents (55.5%) were classified as low risk, exhibiting no indications of alcohol dependence. Concurrently, 28.1% of respondents exhibited hazardous or potentially harmful drinking patterns, constituting nearly half of the previous category. Finally, 11.7% of respondents exhibited scores indicative of probable alcohol dependence.

Fig. 1 shows the sum of the risk-free and risk-relative frequencies of alcohol consumption of the respondents from the previous table and allows testing hypothesis H_1: *Generation Z members with completed or ongoing higher education tend to have higher values towards risky alcohol consumption.* The data indicate that 60.2% of respondents fall within the low-risk or risk-free category of alcohol consumption, while 39.8% exhibit risky or addictive drinking behaviors. In light of these findings, the null hypothesis (H_1) can be rejected without the necessity for further statistical testing.

Tab. 4: Risky alcohol consumption in relation to gender

		Statistics	p
Alcohol consumption risk values	Mann-Whitney U	1343	< 0.001

Tab. 4 and Fig. 2 present the results of testing hypothesis H_2: *Males exhibit a higher proportion of risky alcohol consumption than females.* This hypothesis was examined using the Mann-Whitney U t-test, which yielded a significance level $p < 0.001$. Consequently, the null hypothesis is rejected, leading to the conclusion that males demonstrate statistically higher levels of risky alcohol consumption compared to females, thus confirming hypothesis H_2.

Tab. 5: Descriptive statistics of AUDIT and TEIQue-SF test results

	Alcohol consumption risk values	TEIQue
N	128	128
Average	2.47	22.5
Median	2.00	21.5
Standard deviation	0.76	3.87
Minimum	1	12
Maximum	4	31

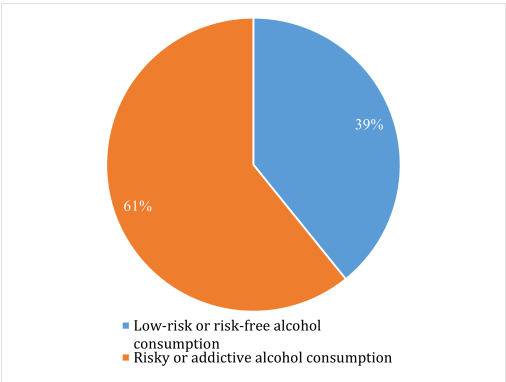


Fig. 1: Risky alcohol consumption of Generation Z

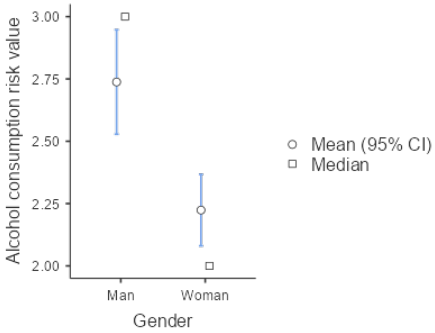


Fig. 2: Risky alcohol consumption in relation to gender

Tab. 6: Descriptive statistics of the individual scales of the TEIQue-SF test

	Well-being	Self-Control	Emotionality	Sociability	Adaptation + Motivation
N	128	128	128	128	128
Average	4.84	4.23	4.63	4.40	4.40
Minimum	1.80	2.00	2.10	1.70	1.00
Maximum	7.00	6.00	6.40	6.20	6.50

Tab. 5 presents the numerical values obtained from the two questionnaires used, which form the foundation for evaluating the subsequent hypotheses. The risk levels of alcohol consumption are categorized on a scale from 1 to 4, where 1 represents abstinence with no alcohol-related issues, 2 indicates low-risk alcohol consumption without signs of dependence, 3 signifies hazardous or dangerous alcohol consumption, and 4 suggests probable alcohol dependence. The mean score falls between 2 and 3.

The results of the trait emotional intelligence test are represented solely by numerical values, with higher scores indicating greater levels of trait emotional intelligence. The mean score for this test is 22.5, with lower values indicating lower emotional intelligence and higher values indicating higher emotional intelligence. The potential score range for this evaluation instrument is from a minimum of 12 to a maximum of 31.

Tab. 6 presents the individual scale scores from the TEIQue-SF questionnaire, which collectively determine each respondent's total trait emotional intelligence score. Each scale ranges from a minimum value of 1 to a maximum value of 7. The mean scores for the different scales are as follows: well-being at 4.84, self-control at 4.23, emotionality at 4.63, and sociability combined with adaptation and motivation at 4.40.

Fig. 3 presents the relative frequency of respondents' answers to AUDIT question 4: During the previous year, how frequently have you encountered circumstances in which you were unable to discontinue alcohol consumption once it had been initiated? The majority of respondents (68%) have never encountered this particular situation. Furthermore, 19% of respondents indicated that they are unable to reduce their alcohol consumption to less than once a month. The survey results indicate that 7% of respondents encounter this situation on a monthly basis, while 3% report experiencing it weekly, on a daily basis, or almost daily.

Tab. 7 and Fig. 4 illustrate the findings of the study, which examined the relationship between respondents' self-control values and their ability to discontinue alcohol consumption once they had commenced. This correlation is then subjected to rigorous testing using Spearman's correlation matrix, a statistical method widely regarded as the gold standard in such analyses. The statistical significance level (p) was determined to be 0.122, indicating that there was no statistically significant difference

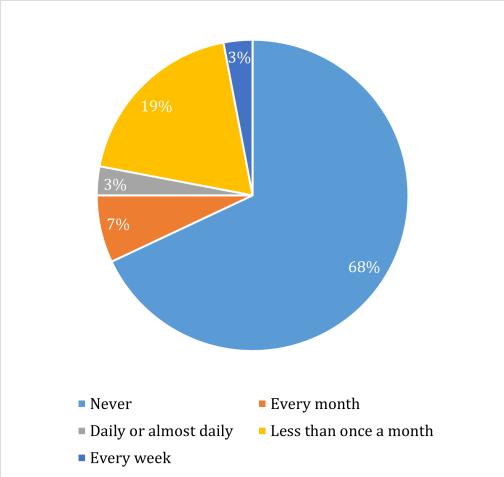


Fig. 3: Distribution of respondents' ability to stop drinking alcohol

Tab. 7: Correlation between the ability to stop drinking and self-control

		Ability to stop drinking	Self-Control
Ability to stop drinking	Spearman's rho	–	
	df	–	
	p-value	–	
Self-Control	Spearman's rho	−0.104	–
	df	126	–
	p-value	0.122	–

between the values. A thorough examination of the distribution of responses reveals that they are predominantly influenced by a single response, thereby complicating the substantiation of statistical disparities. The Spearman's value is −0.104, indicating a negative correlation.

As illustrated in Fig. 5, the distribution of relative frequency responses to AUDIT question 2, which inquires about the typical quantity of standard glasses of alcohol consumed on a typical drinking day, is presented. The results indicate that 39% of respondents reported consuming three to four glasses, while 35% indicated drinking only one or two glasses (it is possible that this category includes 0, although the standardized test does not permit this selection explicitly). Furthermore, 13% of respondents reported consuming five to six glasses per occasion, 10% reported consuming seven to nine glasses, and 3% reported consuming 10 or more glasses in a single session.

As illustrated in Tab. 8 and Fig. 6, the study's findings reveal a significant correlation between respondents' self-control values and the quantity of alcohol consumed on a single occasion. The Spearman's correlation matrix was utilized to analyze the data. The level of significance (p) was determined to be 0.276, which is greater than 0.05. This finding suggests that there is no statistically significant difference between the values. The Spearman's value is −0.053, indicating minimal negative correlation.

Tab. 7–8 and Fig. 4–6 together show the result of testing hypothesis H_3: *Individuals with lower levels of self-control (a subcomponent of trait emotional intelligence) have greater difficulty moderating their alcohol consumption, both in stopping drinking once started and in limiting intake per drinking session.* The findings reveal no statistically significant difference between the values, thereby rejecting the null hypothesis H_3.

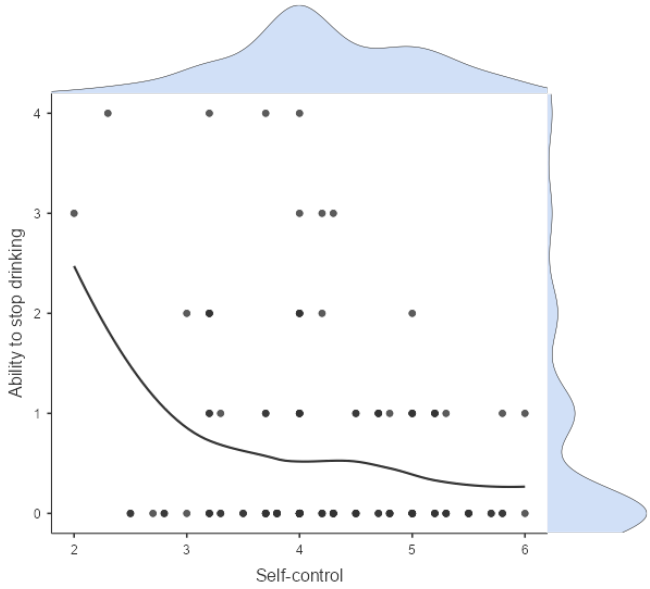


Fig. 4: Correlation between the ability to stop drinking and self-control

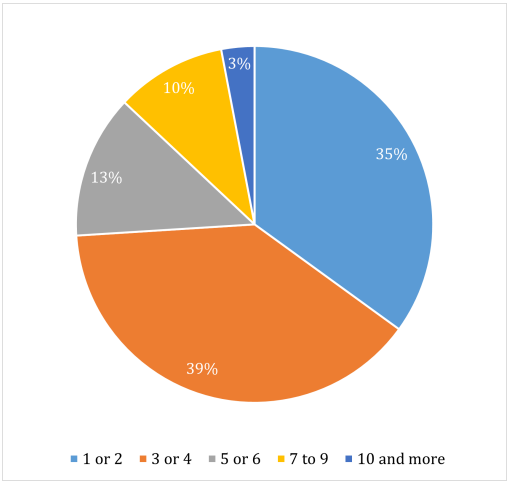


Fig. 5: Distribution of the number of glasses drunk on a typical drinking day

Tab. 8: Correlation of usual number of drinks with self-control (subcomponent of trait emotional intelligence)

		Number of glasses drunk	Self-Control
Number of glasses drunk	Spearman's rho	–	
	df	–	
	p-value	–	
Self-Control	Spearman's rho	−0.053	–
	df	126	–
	p-value	0.276	–

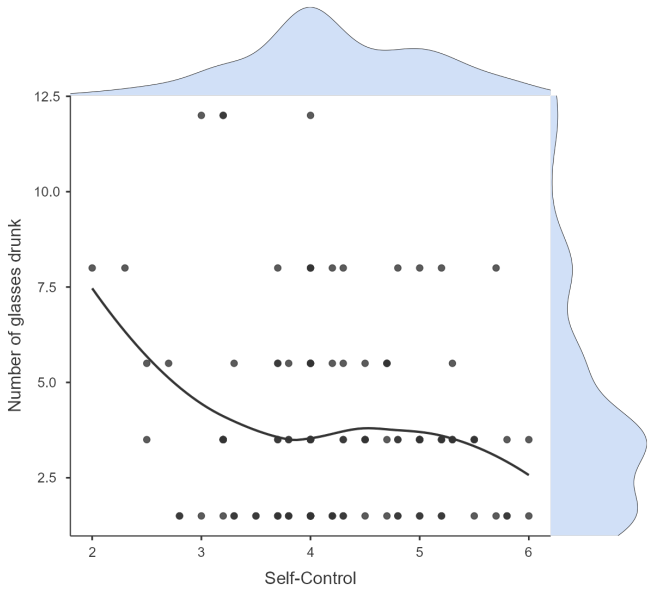


Fig. 6: Correlation between respondents' self-control values and the number of drinks of alcohol consumed on one occasion

Tab. 9: Correlation of alcohol consumption risk and TEIQue and all its individual components

Alcohol consumption risk values		
TEIQue	Spearman's rho	−0.157
	df	126
	p-value	0.039
Sociability	Spearman's rho	−0.076
	df	126
	p-value	0.198
Emotionality	Spearman's rho	−0.125
	df	126
	p-value	0.081
Self-Control	Spearman's rho	−0.202
	df	126
	p-value	0.011
Well-being	Spearman's rho	−0.144
	df	126
	p-value	0.052
Adaptation + Motivation	Spearman's rho	−0.136
	df	126
	p-value	0.064

Tab. 9 and Fig. 7 show the results of testing the main hypothesis H_4: *Lower levels of overall trait emotional intelligence and its individual components (well-being, self-control, emotionality, sociability, adaptation and motivation) are associated with chronic risky alcohol consumption.* The hypothesis is tested using the Spearman correlation matrix. The present

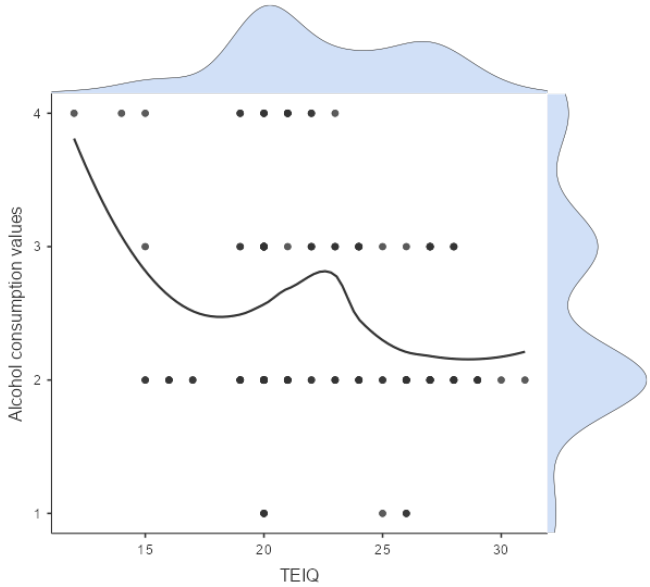


Fig. 7: Correlation of alcohol consumption risk and TEIQue

study examined the correlation between risky alcohol consumption and the global TEIQue, as well as the individual subcomponents. For the global TEIQue, the significance level (p) is 0.039, which is less than 0.05. This indicates that there is a statistically significant difference between the values, and the null hypothesis can be rejected. The Spearman's value is -0.157, indicating a negative correlation. Hypothesis H_4 is hereby accepted.

For the variable designated as "Sociability," the p-value is 0.198. This value is greater than 0.05, which is the critical value for determining statistical significance. This finding suggests that there is no statistically significant difference between the values. The Spearman's value is -0.076, indicating a negligible negative correlation. For the Emotionality variable, the p-value is 0.081, which is greater than 0.05. This indicates that the variable is statistically significant at the 5% level. This finding suggests that there is no statistically significant difference between the values. The Spearman's value is -0.125, indicating a negative correlation. For the variable designated as "Self-Control," the statistical significance level (p) was determined to be 0.011. This value is less than 0.05, indicating that there is a statistically significant difference between the observed values. The Spearman's value is -0.202, indicating a negative correlation. For the purpose of determining well-being, the significance level (p) was found to be 0.052, which is therefore greater than 0.05. This finding suggests that there is no statistically significant difference between the values. The Spearman's value is -0.144, indicating a negative correlation. For the purpose of determining statistical significance, the p-value for the Adaptation + Motivation variable was determined to be 0.064. This value is greater than the 0.05 threshold, indicating that the variable is statistically significant at the 5% level. This finding suggests that there is no statistically significant difference between the values. The Spearman's value is -0.136, indicating a negative correlation.

A thorough examination of the subdimensions of TEI revealed that self-control emerged as the most robust protective factor against excessive alcohol consumption. These results serve to reinforce the conceptual framework proposed by Bar-On (2006), which posits that emotionally intelligent individuals possess higher resilience to stressors and are less likely

to engage in maladaptive coping strategies such as binge drinking. This finding aligns with the results of studies conducted on university populations, which indicate that students with higher TEI scores report a lower prevalence of alcohol-related problems and healthier lifestyle choices (Muli and Lagan, 2017). These findings suggest that individuals with higher emotional intelligence may possess better stress management and emotional regulation skills, potentially reducing their reliance on alcohol as a coping mechanism (Davlyatov, 2013).

In summary, the present study offers empirical evidence that TEI is a crucial factor in understanding alcohol consumption behaviors among Generation Z. However, the study's findings also highlight the need for future research to explore the interplay between emotional intelligence, peer networks, and risk behaviors in greater depth, as well as to delve more deeply into the nuanced effects of social influence and gender-specific patterns. These findings contribute to the expanding corpus of research supporting the role of emotional intelligence in health-related behaviors, particularly among young adults. This study underscores the potential for EI-based interventions in university and workplace settings by linking EI to alcohol consumption (Annamalai et al., 2024).

5 DISCUSSION

The objective of the present study was to examine the relationship between risky alcohol consumption and trait emotional intelligence among former and current university students from Generation Z with a focus on economics and management. The objective of this study was to determine whether specific components of these two constructs influence each other. The study successfully tested four hypotheses, of which one was accepted and three were rejected.

Risky Alcohol Consumption Among Generation Z (H_1)

The results of the study indicated that 60.2% of the respondents exhibited a score suggesting abstinence or low-risk drinking, while 39.8% demonstrated risky, hazardous, or even addictive alcohol consumption. This finding contradicts the hypothesis that Generation Z members in higher education would exhibit higher levels of risky alcohol consumption. Although extant research indicates that university students frequently report elevated alcohol use due to social benefits and cultural norms (Blank et al., 2016), the results suggest a shift in behavior. The observed discrepancy may be attributable to evolving social norms, heightened awareness of alcohol-related risks, or response bias in self-reported alcohol use. These findings may also be indicative of a generational shift in health consciousness and the influence of digital spaces on self-presentation and behavioral norms.

Gender Differences in Alcohol Consumption (H_2)

A subsequent statistical analysis confirmed that males exhibited higher alcohol risk scores than females. This finding is consistent with prior research indicating that males generally consume higher amounts of alcohol than females, despite a global increase in female drinking patterns (Moinuddin et al., 2016). As posited by Wilsnack et al. (2009), the observed gender disparities are likely attributable to biological factors, including variations in alcohol metabolism, muscle mass, and body water composition. From a psychosocial perspective, social learning theory (Bandura, 1991) posits that behaviors observed and socially reinforced, such as excessive alcohol consumption among male peer groups, have the potential to normalize risky behaviors in men to a greater extent than in women.

Self-Control and Alcohol Consumption (H_3)

The analysis did not confirm a statistically significant relationship between self-control, a component of trait emotional intelligence, and

the ability to stop drinking once it has been initiated. Despite the observed negative correlation, the substantial proportion of respondents who had never encountered this situation (68%) precluded the ability to draw definitive conclusions. According to Morutwa and Plattner (2014) and Bandura (1991), individuals with greater self-efficacy and impulse control are less prone to maladaptive coping strategies, including alcohol misuse. This assertion is supported by previous studies and models of self-regulation. The absence of statistical significance in this study may be attributable to limitations in measurement or to the context-specific nature of drinking episodes. This finding underscores the necessity for more situationally nuanced tools in future research.

Trait Emotional Intelligence (and its individual components) and Alcohol Consumption (H_4)

A significant negative correlation was identified between emotional intelligence and risky alcohol consumption (H_4), thereby supporting the hypothesis that lower levels of overall trait emotional intelligence are associated with chronic risky alcohol consumption and increased addiction risk. This finding aligns with the conclusions of previous studies (e.g., Schutte et al., 2011) that have identified a correlation between poor emotional regulation and substance abuse. From a theoretical standpoint, individuals with lower trait emotional intelligence may encounter difficulties in identifying, comprehending, and regulating emotional states. This proclivity for emotional dysregulation renders them more susceptible to the use of alcohol as a maladaptive coping mechanism. Emotional intelligence frameworks, such as those developed by Goleman (2011) and Bar-On (2006), underscore the significance of emotional awareness and impulse control in adaptive behavior.

Furthermore, recent literature suggests that emotional intelligence not only mitigates stress but also buffers against loneliness, a key factor in the development of addictive behaviors. For Generation Z, who often report higher levels of digital social interaction but lower quality of real-life support networks, emotional isolation may serve as a significant mediator between emotional intelligence and alcohol use. This perspective is corroborated by Annamalai et al. (2024), who determined that emotional intelligence functions as a protective factor against feelings of loneliness and, consequently, against the utilization of maladaptive coping mechanisms, such as substance use.

Among the subscales of emotional intelligence, a statistically significant negative correlation was observed only for the Self-Control subscale. This finding serves to reinforce the theoretical role of impulse regulation in preventing risky behaviors. While hypothesis H_3 did not find significance in individual alcohol-related behavior (e.g., inability to stop drinking once started), the broader pattern supports the idea that trait-level self-control is inversely related to overall alcohol risk. This discrepancy underscores the value of multidimensional assessment and supports theoretical models that view self-control as a core mechanism of behavioral regulation (Bandura, 1991; Baumeister et al., 2007).

6 CONCLUSION

The present study examined the relationship between risky alcohol consumption and trait emotional intelligence (TEI) among Generation Z university students specializing in economics and management. The findings offer significant insights into the relationship between emotional intelligence and drinking behaviors within this demographic.

Following a thorough evaluation of the five hypotheses, two were found to be valid, while the remaining three were deemed to be invalid. The most significant result was the confirmation of a negative correlation between risky alcohol consumption and TEI, suggesting that individuals with lower TEI scores are more prone to higher-risk alcohol use. However, these

expectations were not met, as TEI did not have a significant impact on the ability to regulate alcohol intake during single drinking sessions. Moreover, while extant research has demonstrated a consistent correlation between university students and high-risk drinking behaviors, this study found that the majority of Generation Z respondents engaged in low-risk alcohol consumption, indicating a potential generational shift in drinking patterns.

6.1 Future Research

While the present study provides important insights, further research is necessary to deepen our understanding of the relationship between trait emotional intelligence (TEI) and alcohol consumption in Generation Z. Longitudinal studies have the potential to track individuals over time to examine how changes in TEI influence drinking behaviors and whether interventions targeting emotional intelligence can lead to sustained reductions in risky alcohol consumption. For instance, a longitudinal study that follows university students from their first year through early adulthood could yield valuable data on the long-term interplay between emotional regulation and drinking habits.

Cross-cultural comparisons would also be valuable in determining whether similar trends exist across different sociocultural environments. Future research could examine whether the relationship between TEI and alcohol consumption differs in countries with varying drinking norms. For example, a comparison could be made between students in cultures with high alcohol consumption (e.g., the Czech Republic and Germany) and those with stricter regulations or lower consumption rates (e.g., Middle Eastern countries and Scandinavian nations). Such studies could offer insights into the role of cultural attitudes in moderating the impact of emotional intelligence on alcohol use.

Furthermore, subsequent research endeavors should prioritize the assessment of the efficacy of TEI-based interventions in diminishing risky alcohol consumption. Controlled experimental studies could assess different training programs—such as cognitive-behavioral workshops, mindfulness techniques, or emotional self-regulation courses—delivered in university settings, workplace environments, or even through digital platforms. The measurement of outcomes, including alterations in drinking patterns, stress coping strategies, and emotional regulation skills, prior to and following participation, would yield valuable data concerning the real-world impact of these interventions.

Subsequent studies could investigate the long-term effectiveness of TEI interventions by conducting follow-up assessments between six months and several years post-intervention. This would assist in ascertaining whether TEI enhancements are maintained over time and whether they result in enduring behavioral modifications, such as a reduction in binge drinking or the development of enhanced emotional coping mechanisms.

Furthermore, digital and AI-driven interventions are a rapidly expanding field of interest. It is imperative that research explore the potential of mobile applications, artificial intelligence-based emotional coaching, or biofeedback tools that offer real-time emotional self-regulation techniques and behavioral tracking to reduce impulsive alcohol consumption. A comparative analysis of the effectiveness of in-person versus digital TEI training could offer valuable insights for scalable and accessible mental health solutions.

6.2 Practical Implications

The findings underscore the viability of prospective strategies for curtailing risky alcohol use among Generation Z. Given the established correlation between lower TEI and heightened alcohol risk, the integration of interventions designed to enhance emotional intelligence—including resilience training, emotional regulation programs, and stress management workshops—within university settings holds considerable promise in fostering responsible drinking behaviors. In the Czech university context, alcohol consumption is deeply embedded in student life—especially during adaptation weeks and throughout the semester—with drinking serving as the primary means of

socialization, group bonding, and even identity formation. At most Czech universities, students are actively encouraged to drink during official and unofficial events, making alcohol the main "linking part" of the student experience and creating a significant barrier to healthier forms of social engagement.

To address this challenge, universities should take the lead by embedding EI skill-building directly into the student experience and shifting away from alcohol-centered events. For example, instead of traditional adaptation week parties that promote drinking, universities could implement structured EI skill-building workshops, peer-led support groups, and mindfulness sessions. These programs could be modeled after successful initiatives such as the University of Michigan's "Wellness Coaching," where first-year students attend a series of practical workshops focused on managing stress, recognizing emotional triggers, and practicing refusal skills in social drinking situations. Workshops could be led by trained peer mentors and incorporate real-life scenarios, such as responding to pressure to drink at parties or on social media (Wolverine Wellness, 2025). Universities could also take inspiration from the Czech Technical University in Prague (ČVUT), which offers a dedicated mental wellbeing webpage and a mental health manual that includes guidance on understanding and managing emotions (Vavřichová, 2025).

In addition, students could be encouraged to use digital tools like the app SuperBetter, which gamifies resilience-building and emotion regulation, or Czech app Nepanikař, which provides coping strategies and tracks emotional well-being. Universities could also implement annual EI assessments for all students, with those identified as high-risk being offered personalized counseling that integrates cognitive-behavioral therapy (CBT) and emotion-regulation training, as demonstrated effective in reducing substance cravings.

By replacing alcohol-centered activities with EI-based programs and non-alcoholic social events, Czech universities can break the cycle of normalization and create a campus culture that supports healthier coping mechanisms and more inclusive forms of connection. Such changes align with recommendations from Czech public health authorities and European best practices, where alcohol-free weeks and well-being festivals have successfully reduced risky drinking among students. Ultimately, these interventions can help foster safer and more supportive student communities.

These findings link to the broader links between emotional intelligence and mental health. Strengthening emotional regulation and self-awareness not only contributes to healthier drinking habits but also serves as a protective factor against stress, anxiety, and other mental health issues. In this context, Czech institutions have started to respond with systematic support. The National Institute of Mental Health (NIMH) is currently leading several initiatives focused on mental health and emotional resilience in the workplace. One of them, the HARMONY project, launched in 2025 in collaboration with eight European countries, aims to develop tools, supported by artificial intelligence, to enhance emotional well-being and prevent mental health deterioration in small and medium-sized enterprises. The qualitative research part of the project, aimed at university teachers, is currently underway. The aim is to map current educational approaches in universities in this area, emerging trends and challenges that educators face when teaching or supporting students (NIMH, 2025; HARMONY, 2024). Additionally, the ongoing Mental Health Promotion and Prevention Project at NIMH provides Czech organizations with practical frameworks for assessing and supporting employee well-being. This includes guidance on how to address common psychological challenges such as burnout, anxiety, and alcohol misuse. These efforts demonstrate a growing national commitment to fostering healthier coping mechanisms and creating emotionally intelligent environments, both in academia and in the workforce (NIMH, 2024).

To further strengthen the practical relevance of this study, several concrete applications of EI-based interventions can be proposed. Universities could incorporate short, skills-based workshops on emotional self-regulation, stress

management, and refusal skills directly into student adaptation programs. Peer-led mentoring and wellness coaching (such as the University of Michigan's Wellness Coaching) could be adapted within the Czech university context to promote emotional awareness and healthier coping strategies. Moreover, universities may consider integrating emotional intelligence development into existing soft skills or mental health curricula to normalize discussions of emotion regulation and reduce alcohol-centered socialization patterns.

Beyond academia, employers can apply similar approaches by embedding EI-focused resilience training and emotional regulation modules into onboarding and employee well-being programs for young professionals. These measures would translate the study's findings into practical, scalable interventions supporting both public health and workplace well-being across Generation Z populations.

Building on these recommendations, several specific program formats can be considered:

1. *University-based programs.* Interactive EI workshops could be implemented during adaptation weeks or as part of first-year seminars. They should cover (a) recognition of emotional triggers linked to alcohol use, (b) practical self-regulation techniques such as mindfulness, breathing strategies, and cognitive reframing, and (c) assertive communication and peer-pressure resistance. These workshops can be delivered by trained psychologists or peer mentors and complemented by follow-up discussion circles that promote reflection and mutual support. A peer mentoring network could also be established, connecting senior students trained in emotional intelligence and psychological support with new students to foster healthy coping mechanisms and stress management. This model could be localized within Czech universities' counseling centers.
2. *Curriculum and digital learning integration.* Emotional intelligence training can be embedded into elective courses such as Soft Skills Development or Mental Health and Resilience. Credit-bearing modules might include reflective journaling, scenario-based simulations (e.g., managing social pressure to drink), and digital tools for tracking emotions and coping strategies. Mobile applications such as SATI or the Czech app Nepanikař could be integrated into student wellness portals, offering self-guided exercises in emotional regulation and stress prevention.
3. *Campus-wide well-being initiatives.* To reduce the cultural normalization of alcohol in student social life, universities could organize Alcohol-Free Weeks or Well-being Festivals featuring mindfulness workshops, sports events, and creative expressive activities such as art therapy or theater-based emotional training. These events could be co-created by student organizations to promote alcohol-free community building and positive mental health.
4. *Workplace applications.* Employers can build upon these strategies by introducing resilience and EI development modules into onboarding programs for young employees. Short-term digital courses, webinars, or blended learning programs can focus on recognizing emotional triggers, managing workplace stress, and developing adaptive coping skills. For small and medium-sized enterprises, these modules could be integrated into broader mental health initiatives—such as the Czech National Institute of Mental Health's HARMONY project—to support emotional well-being, reduce burnout, and prevent maladaptive behaviors, including alcohol misuse.

Through these targeted and context-sensitive interventions, universities and employers can actively foster emotional intelligence as a protective factor against risky drinking. Implementing such programs would directly translate the study's findings into actionable practice, contributing to healthier, more emotionally resilient Generation Z communities.

6.3 Limitations

A potential limitation of this study is the possibility of social desirability bias, in which respondents may have underreported their

alcohol consumption due to concerns about negative perceptions, despite the assurance of anonymity. Future research could address this by incorporating qualitative methods, such as interviews or focus groups, to foster a more open discussion about alcohol use. A further limitation pertains to the reliance on self-assessment for the measurement of trait emotional intelligence, a practice that is susceptible to influences such as respondents' current mood, situational factors, and subjective self-perception. In order to enhance the precision of the findings, subsequent studies may benefit from the integration of diverse assessment techniques, such as observer ratings or behavioral indicators of emotional intelligence. Moreover, while the study's sample size was adequate for statistical analysis, it is possible that this limited the strength of the detected correlations. In subsequent research, the sample size could be augmented to enhance the robustness of findings and facilitate subgroup analyses based on demographic or cultural factors.

The present study contributes to the existing body of knowledge by offering insights into the relationship between emotional intelligence and alcohol consumption behaviors among Generation Z. Unlike previous studies, which often emphasized high levels of risky drinking among college students, our results show that low-risk behavior prevails among Generation Z respondents. This may signal a generational shift in attitudes toward alcohol and a greater emphasis on healthier lifestyles. Although the literature often reports a gradual blurring of gender differences in alcohol consumption, our data confirm that these differences still persist among Generation Z and are statistically significant. This suggests that gender continues to be a strong predictor of risky drinking, even in the context of the younger generation. These findings have implications for the development of targeted intervention programs that promote emotional resilience and responsible alcohol use. Such programs could be integrated into educational curricula, workplace training for young professionals, and broader public health initiatives aimed at fostering healthier emotional coping strategies.

7 REFERENCES

Annamalai, S., Vasunandan, A. and Mehta, A. 2024. Social Isolation and Loneliness among Generation Z Employees: Can Emotional Intelligence Help Mitigate? *Cogent Business & Management*, 12 (1), 2441474. DOI: 10.1080/23311975.2024.2441474.

Austin, E. J., Saklofske, D. H. and Egan, V. 2005. Personality, Well-Being and Health Correlates of Trait Emotional Intelligence. *Personality and Individual Differences*, 38 (3), 547–558. DOI: 10.1016/j.paid.2004.05.009.

Bandura, A. 1991. Social Cognitive Theory of Self-Regulation. *Organizational Behavior and Human Decision Processes*, 50 (2), 248–287. DOI: 10.1016/0749-5978(91)90022-L.

Bar-On, R. 2006. The Bar-On Model of Emotional-Social Intelligence (ESI). *Psicothema*, 18 (S), 13–25.

Baumeister, R. F., Schmeichel, B. J. and Vohs, K. D. 2007. Self-Regulation and the Executive Function: The Self as Controlling Agent. In Kruglanski, A. W. and Higgins, E. T. *Social Psychology: Handbook of Basic Principles*. 2nd ed. New York: Guilford.

Blank, M.-L., Connor, J., Gray, A. and Tustin, K. 2016. Alcohol Use, Mental Well-Being, Self-Esteem and General Self-Efficacy among Final-Year University Students. *Social Psychiatry and Psychiatric Epidemiology*, 51, 431–441. DOI: 10.1007/s00127-016-1183-x.

Capito, E. S., Lautenbacher, S. and Horn-Hofmann, C. 2017. Acute Alcohol Effects on Facial Expressions of Emotions in Social Drinkers: A Systematic Review. *Psychology Research and Behavior Management*, 10, 369–385. DOI: 10.2147/PRBM.S146918.

Choopan, H., Kalantarkousheh, S. M., Aazami, Y., Doostian, Y., Farhoudian, A. and Massah, O. 2016. Effectiveness of Emotion Regulation Training on the Reduction of Craving in Drug Abusers. *Addict Health*, 8 (2), 68–75.

Ciarrochi, J., Forgas, J. P. and Mayer, J. D. (eds.). 2013. *Emotional Intelligence in Everyday Life*. 2nd ed. Great Britain: Psychology Press. ISBN 1-84169-434-7.

Davlyatov, G. 2013. *The Relationship between Emotional Intelligence and Alcohol Use Among Students at Minnesota State University – Mankato*. Cornerstone: A Collection of Scholarly and Creative Works for Minnesota State University, Mankato [online]. Available at: https://cornerstone.lib.mnsu.edu/etds/58/. [Accessed 2025, February 28].

de Meneses-Gaya, C., Zuardi, A. W., Loureiro, S. R. and Crippa, J. A. S. 2009. Alcohol Use Disorders Identification Test (AUDIT): An Updated Systematic Review of Psychometric Properties. *Psychology & Neuroscience*, 2 (1), 83–97. DOI: 10.3922/j.psns.2009.1.12.

Funder, D. C. 2015. *The Personality Puzzle*. 7th ed. New York: W. W. Norton & Company. ISBN 978-1-324-06060-4.

Goleman, D. 1998. *Working with Emotional Intelligence*. New York: Bantam. ISBN 0-553-37858-9.

Goleman, D. 2011. *Emoční inteligence*. 2nd ed. Prague: Metaphor. ISBN 978-80-7359-334-6.

Goudarzian, A. H., Esmaeili, R., Alizadeh-Navaei, R., Yousefi, M. and Balouchi, A. 2017. Emotional Intelligence Training for Reducing Illicit Drug Use Potential among Iranian Nurses: A Pilot Study. *Iranian Journal of Psychiatry and Behavioral Sciences*, 11 (3), e6676. DOI: 10.5812/ijpbs.6676.

Guo, R., He, Q., Shi, J., Gong, J., Wang, H. and Wang, Z. 2010. Short-Term Impact of Cognition-Motivation-Emotional Intelligence-Resistance Skills Program on Drug Use Prevention for School Students in Wuhan, China. *Journal of Huazhong University of Science and Technology (Medical Sciences)*, 30 (6), 720–725. DOI: 10.1007/s11596-010-0647-6.

Hand, L. J., Paterson, L. M. and Lingford-Hughes, A. R. 2024. Re-Evaluating Our Focus in Addiction: Emotional Dysregulation Is A Critical Driver of Relapse to Drug Use. *Translational Psychiatry*, 14, 467. DOI: 10.1038/s41398-024-03159-5.

HARMONY. 2024. *Fostering Mental Well-being in European SME* [online]. Available at: https://harmony-eu.net/. [Accessed 2025, July 1].

Janati, Y., Musavi, S. A., Lolaty, H. A., Saberi, L. F., Hamta, A., Feyzi, S. and Ghobadi, M. 2012. Investigating Emotional Intelligence and Self-Esteem Level Among Nursing and Midwifery Students of Mazandaran University of Medical Sciences in 2010. *Journal of Mazandaran University of Medical Sciences*, 22 (1), 254–260.

Jayatissa, K. A. D. U. 2023. Generation Z – A New Lifeline: A Systematic Literature Review. *Sri Lanka Journal of Social Sciences and Humanities*, 3 (2), 179–186. DOI: 10.4038/sljssh.v3i2.110.

Khantzian, E. J. 1985. The Self-Medication Hypothesis of Addictive Disorders: Focus on Heroin and Cocaine Dependence. *The American Journal of Psychiatry*, 142 (11), 1259–1264. DOI: 10.1176/ajp.142.11.1259.

Kun, B. and Demetrovics, Z. 2010. Emotional Intelligence and Addictions: A Systematic Review. *Substance Use & Misuse*, 45 (7–8), 1131–1160. DOI: 10.3109/10826080903567855.

Kun, B., Urbán, R., Paksi, B., Griffiths, M. D., Richman, M. J. and Demetrovics, Z. 2019. The Effects of Trait Emotional Intelligence on Adolescent Substance Use: Findings from a Hungarian Representative Survey. *Frontiers in Psychiatry*, 10, 367. DOI: 10.3389/fpsyt.2019.00367.

Kuntsche, E. and Müller, S. 2012. Why Do Young People Start Drinking? Motives for First-Time Alcohol Consumption and Links to Risky Drinking in Early Adolescence. *European Addiction Research*, 18 (1), 34–39. DOI: 10.1159/000333036.

Menagi, F. S., Harrell, Z. A. T. and June, L. N. 2008. Religiousness and College Student Alcohol Use: Examining the Role of Social Support. *Journal of Religion and Health*, 47 (2), 217–226. DOI: 10.1007/s10943-008-9164-3.

Meyer, P. J. and Segal, G. 2023. Editorial: The Role of Emotional Dysregulation in Addiction. *Frontiers in Psychology*, 14, 1253541. DOI: 10.3389/fpsyg.2023.1253541.

Mohagheghi, A., Amiri, S., Rizi, S. M. and Safikhanlou, S. 2015. Emotional Intelligence Components in Alcohol Dependent and Mentally Healthy Individuals. *The Scientific World Journal*, 841039. DOI: 10.1155/2015/841039.

Moinuddin, A., Goel, A., Saini, S., Bajpai, A. and Misra, R. 2016. Alcohol Consumption and Gender: A Critical Review. *Journal of Psychology & Psychotherapy*, 6 (3). DOI: 10.4172/2161-0487.1000267.

Morrison, V. and Plant, M. 1991. Licit and Illicit Drug Initiations and Alcohol-Related Problems amongst Illicit Drug Users in Edinburgh. *Drug and Alcohol Dependence*, 27 (1), 19–27. DOI: 10.1016/0376-8716(91)90082-a.

Morutwa, G. and Plattner, I. E. 2014. Self-Control and Alcohol Consumption among University Students in Botswana. *African Journal of Drug and Alcohol Studies*, 13 (2), 69–78. DOI: 10.4314/ajdas.v13i2.

Muli, N. and Lagan, B. M. 2017. Perceived Determinants to Alcohol Consumption and Misuse: A Survey of University Students. *Perspectives in Public Health*, 137 (6), 326–336. DOI: 10.1177/1757913917710569.

Németh, Z., Urbán, R., Kuntsche, E., San Pedro, E. M., Roales Nieto, J. G., Farkas, J., Futaki, L., Kun, B., Mervó, B., Oláh, A. and Demetrovics, Z. 2011. Drinking Motives among Spanish and Hungarian Young Adults: A Cross-National Study. *Alcohol and Alcoholism*, 46 (3), 261–269. DOI: 10.1093/alcalc/agr019.

NIMH (National Institute of Mental Health). 2024. *Duševní potíže zaměstnanců stojí ekonomiku EU 170 miliard eur ročně. Pracovníci cítí stres a přetíženost, systematické řešení chybí.* Press release [online]. Available at: `https://www.nudz.cz/fileadmin/user_upload/Tiskove_zpravy/TZ-Dusevni_potize_zamestnancu_stoji_ekonomiku_EU_170_miliard_eur_rocne._Pracovnici_citi_stres_a_pretizenost__systematicke_reseni_chybi.pdf`. [Accessed 2025, July 2].

NIMH (National Institute of Mental Health). 2025. *HARMONY-Healthy and Resilient Mindset with an Organized, Nurturing, and Digital Workplace for you WORKPLACE FOR YOU* [online]. Available at: `https://www.nudz.cz/en/research/public-mental-health-research-program/grants-and-projects/free-from-fears-1`. [Accessed 2025, July 2].

Nwachukwu, C., Chládková, H. and Žufan, P. 2017. The Relationship Between Entrepreneurial Orientation, Entrepreneurial Competencies, Entrepreneurial Leadership, and Firm Performance: A Proposed Model. *Business Trends*, 7 (1), 3–16. ISSN 1805-0603.

Orhan, A. 2024. Trait Emotional Intelligence Questionnaire Short Form (TEIQue-SF): Reliability Generalization Meta-Analysis. *Personality and Individual Differences*, 224, 112633. DOI: 10.1016/j.paid.2024.112633.

Palen, L.-A. and Coatsworth, J. D. 2007. Activity-Based Identity Experiences and Their Relations to Problem Behavior and Psychological Well-Being in Adolescence. *Journal of Adolescence*, 30 (5), 721–737. DOI: 10.1016/j.adolescence.2006.11.003.

Petrides, K. V. and Furnham, A. 2001. Trait Emotional Intelligence: Psychometric Investigation with Reference to Established Trait Taxonomies. *European Journal of Personality*, 15 (6), 425–448. DOI: /10.1002/per.416.

Petrides, K. V., Pita, R. and Kokkinaki, F. 2007. The Location of Trait Emotional Intelligence in Personality Factor Space. *British Journal of Psychology*, 98 (2), 273–289. DOI: 10.1348/000712606X120618.

Petrides, K. V. 2009. *Technical Manual for the Trait Emotional Intelligence Questionnaires (TEIQue)* [online]. London: Psychometric Laboratory. Available at: `https://psychometriclab.com/`. [Accessed 2025, February 15].

Rudnák, I., Čarvašová, A., Garamvölgyi, J., Hambardzumyan, G., Vardanyan, L. and Beran Sládkayová, M. 2023. Gender Differences in Career Planning among Young Adults. *European Journal of Business Science and Technology*, 9 (2), 231–248. DOI: 10.11118/ejobsat.2023.012.

Rybanská, J. 2015. Selected Personality Characteristics as Predictors of Emotional Consumer Behaviour. *European Journal of Business Science and Technology*, 1 (2), 128–136. DOI: 10.11118/ejobsat.v1i2.26.

Salbot, V. et al. 2011. *Črtová emocionálna inteligencia a psychometrické vlastnosti nástrojov na jej meranie*. 1st ed. Banská Bystrica: Matej Bel University. 79 pp. ISBN 978-80-557-0303-9.

Salovey, P. and Mayer, J. D. 1990. Emotional Intelligence. *Imagination, Cognition and Personality*, 9 (3), 185–211. DOI: 10.2190/DUGG-P24E-52WK-6CDG.

Saunders, J. B. 2024. *AUDIT: Alcohol Use Disorders Identification Test* [online]. Available at: `https://auditscreen.org/`. [Accessed 2025, March 2].

Schutte, N. S., Malouff, J. M. and Hine, D. W. 2011. The Association of Ability and Trait Emotional Intelligence with Alcohol Problems. *Addiction Research & Theory*, 19 (3), 260–265. DOI: 10.3109/16066359.2010.512108.

Sharma, V. and Singh, K. V. 2023. The Influence of Generation Z's Addiction to Social Media on Their Emotional Well-Being. *Educational Administration: Theory and Practice*, 29 (4): 719–725. DOI: 10.53555/kuey.v30i4.2549.

Stone, A. L., Becker, L. G., Huber, A. M. and Catalano, R. F. 2012. Review of Risk and Protective Factors of Substance Use and Problem Use in Emerging Adulthood. *Addictive Behaviors*, 37 (7), 747–775. DOI: 10.1016/j.addbeh.2012.02.014.

Šebeňa, R. 2022. *Factors Associated with Alcohol Use in University Students.* Olomouc: Univerzita Palackého v Olomouci. DOI: 10.5507/vup.22.24462097.

Trinidad, D. R. and Johnson, C. A. 2002. The Association between Emotional Intelligence and Early Adolescent Tobacco and Alcohol Use. *Personality and Individual Differences*, 32 (1), 95–105. DOI: 10.1016/S0191-8869(01)00008-3.

Vavřichová, B. 2025. *Manuál duševního zdraví vysokoškoláka* [online]. Available at: https://www.elsa.cvut.cz/wp-content/uploads/2022/11/manual-dusevniho-zdravi-vysokoskolaka.pdf. [Accessed 2025, July 2].

Wilsnack, R. W., Wilsnack, S. C., Kristjanson, A. F., Vogeltanz-Holm, N. D. and Gmel, G. 2009. Gender and Alcohol Consumption: Patterns from the Multinational GENACIS Project. *Addiction*, 104 (9), 1487–1500. DOI: 10.1111/j.1360-0443.2009.02696.x.

Wolverine Wellness. 2025. *Wellness Coaching* [online]. Available at: https://wolverinewellness.umich.edu/wellness-coaching. [Accessed 2025, March 2].

Wurmser, L. 1974. Psychoanalytic Considerations of the Etiology of Compulsive Drug Use. *Journal of the American Psychoanalytic Association*, 22 (4), 820–843. DOI: 10.1177/000306517402200407.

Yang, J., Zadorozhny, B. S., Petrides, K. V., Ng, C. S. M. and Pan, J.-H. 2025. Cross-Cultural Differences in Trait Emotional Intelligence: A Meta-Analysis. *Personality and Individual Differences*, 241, 113195. DOI: 10.1016/j.paid.2025.113195.

AUTHOR'S ADDRESS

Barbora Pánková, Faculty of Education, Charles University, Magdalény Rettigové 4, 116 39 Praha 1, Czech Republic, e-mail: barbora.pankova@pedf.cuni.cz;
Centre for Humanities, NEWTON University, 5. května 1640/65, 140 00 Praha 4, e-mail: barbora.pankova@newton.university (corresponding author)

Renata Bašová, Centre for Humanities, NEWTON University, 5. května 1640/65, 140 00 Praha 4, e-mail: renata.basova@newton.university

Šimon Všetička, Centre for Humanities, NEWTON University, 5. května 1640/65, 140 00 Praha 4, e-mail: simonvseticka@gmail.com

THE CONTEXT OF SUSTAINABILITY AND GENERATIONAL DIFFERENCES IN CONSUMER BEHAVIOUR

Hana Urbánková[1]✉, Jana Stávková[1]

[1] *Mendel University in Brno, Czech Republic*

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11 Issue 2
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

This study focuses on intergenerational differences in attitudes towards sustainable consumer behaviour. The research is based on the framework of the UN Sustainable Development Goals (Agenda 2030) and analyses the attitudes of Generation Z, Millennials and Generation X. Opinions on this issue were obtained through a questionnaire survey of 703 respondents. The results show that younger generations are more positively disposed towards sustainability and more open to ecological innovations, but their decisions are often influenced by price and a lack of reliable information. Older generations take a more pragmatic approach to sustainable choices and prefer quality, price and brand trust when making purchases. The study confirms the presence of a value-action gap between intention and reality of consumption across all age groups and highlights the importance of transparency and credibility of environmental information. The findings underscore the need for differentiated marketing communication tailored to generational specifics. Institutions should respond with stricter regulation of environmental labelling and the creation of a uniform standard for the certification of sustainable products to improve transparency for consumers.

KEY WORDS

sustainability, consumer behaviour, consumption behaviour, generational differences, decision-making, marketing communication

JEL CODES

D12, M31, Q01

1 INTRODUCTION

Consumer behaviour in the context of sustainability is a complex process that encompasses environmental, social and economic issues throughout the entire life cycle of products, from purchase to disposal. According to Skene (2022) it is also important to take into account subjective norms, perceived behavioural control and demographic factors that influence indi-

URBÁNKOVÁ, Hana, and STÁVKOVÁ, Jana. 2025. The Context of Sustainability and Generational Differences in Consumer Behaviour. *European Journal of Business Science and Technology,* 11 (2): 206–219.
ISSN 2694-7161, DOI 10.11118/ejobsat.2025.009.

viduals decisions to consume more sustainably. Sustainability is characterised by an ideal economic system in which economic development is based on a balance between purely economic factors, environmental considerations and social justice. Sheoran and Kumar (2022) describe sustainable consumer behaviour as behaviour that takes into account environmental, social and economic aspects throughout the consumption cycle (purchase, use, disposal) and is influenced by variables such as subjective norms, perceived behavioural control and other demographic factors (Sheoran and Kumar, 2022, pp. 103–145). Sustainable consumption is largely driven by consumer habits, and it is not always easy to break consumer habits (Puntiroli et al., 2022). Consumer education is very important for sustainable consumption, which is why it is also necessary to motivate young people to think about consumption patterns and gradually adopt sustainability (Calafell et al., 2019; Puntiroli et al., 2022). As studies show (OECD, 2023; Eurostat, 2022), more and more consumers prefer products and services that minimise their negative impact on the environment. According to Thøgersen (2023) a key factor in the transition to sustainable consumer behaviour is social norms and the belief that individual decisions can have a collective impact. Ajzen (2020) states that a significant barrier affecting consumers across generations is the so-called value-action gap, i.e. a situation where individuals declare a positive attitude towards environmentally friendly behaviour, but their actual purchasing decisions often do not correspond to this. According to Gifford and Nilsson (2014), this gap is caused by a number of psychological barriers, including economic constraints, low confidence in environmental certifications, and the perceived complexity of changing consumption habits.

An important factor determining consumer behaviour is the period in which an individual was born. The origins of generational division in society can be traced back to Auguste Comte (1830–1842), who considered social evolution to be a key framework for the development of society. In his works, we find the idea that institutions and generations are the drivers of social development. Although he does not directly use the term "generational change," his emphasis on the social reproduction of ideas and institutions between generations is close to this interpretation. According to Mannheim (1952, p. 276), a generation is "people born in the same historical period who share a common position in the historical dimension of the social process and are exposed during their youth to the same formative events that shape their attitudes, culture and social identity." Generational differences in consumer behaviour are particularly evident in the way products are evaluated and in purchasing priorities. Generation Z is most often defined as those born between 1997 and 2012 (Schroth, 2019), although some authors cite a slightly different time frame, such as after 1995 (Bassiouni and Hackley, 2014). This cohort is often referred to as "digital natives" because they grew up surrounded by digital technologies, the internet and smart devices from an early age (Priporas et al., 2017). According to Karim (2019), "Generation Z consumes media predominantly digitally and on mobile devices, while Generation X still relies on traditional media such as television and newspapers." This generation is characterised by a high level of environmental engagement. However, differences between generations show that each age segment of the population approaches the issue of sustainability differently (McKinsey & Company, 2020; Gentina et al., 2016). A significant shift in consumer behaviour has been observed, particularly in relation to the growing emphasis on sustainability, ethics and environmental responsibility. Generation Z and Generation Y (also known as Millennials) are often described in the professional literature as consumers with a higher degree of value orientation who actively seek out brands that represent social and environmental responsibility (Šálková et al., 2023; Trivedi and Pal, 2023). For example, a study by Rai et al. (2021) points out that younger generations are perceived as more willing to accept sustainable solutions if they are properly informed about their benefits. Generation X and Baby Boomers show lower levels of behavioural engagement in sustainability, even though they often declare

positive attitudes towards environmental values (Kamenidou et al., 2020). Their decisions tend to be more influenced by price, quality and personal habits, and they respond more to traditional forms of marketing with an emphasis on utility and rationality of communication.

However, as Gifford and Nilsson (2014) point out, many consumers face a value-action gap, where they declare support for sustainability but in reality prefer other factors such as price and availability. The COVID-19 pandemic has caused a significant change in individual behaviour, particularly in relation to leisure and recreational activities. People sought safer environments to maintain their physical and mental health, which led to a significant increase in interest in outdoor activities. This shift was not only a direct response to health risks, but also reflected a broader societal trend towards nature and active lifestyles. Lecouteux and Moulin (2024) report that even after pandemic restrictions were lifted, interest in activities such as running, hiking and cycling persisted, confirming the potential for long-term changes in consumer preferences. Companies responded with an increased emphasis on natural motifs, green branding, and marketing focused on health and authenticity. Many factors influence consumer decision-making, and it is desirable to understand them in order to uncover the determinants of consumer behaviour that can be influenced in an effort to change behaviour. Responsible consumption is a goal defined by the UN 2030 Agenda for Sustainable Development: The Sustainable Development Goals (Ferraz and Pyka, 2023). The question remains how to effectively influence consumers to change their behaviour towards sustainable responsible consumption. What determinants of consumer behaviour need to be addressed in order to achieve behavioural change in consumers towards sustainability? Consumer education and training play a key role in sustainable consumption. Thøgersen (2023) suggests that providing education and information about sustainable options can strengthen consumers' ability to make informed decisions. According to a study by Prayag et al. (2022), Generation Z not only exhibits the highest level of environmental values, but also a higher level of cognitive and behavioural consistency – i.e. it is able to translate these values into specific consumer behaviour (e.g. choosing eco-certified accommodation). Generation Y, also known as millennials, is most often defined as those born between 1981 and 1996 (Dimock, 2019). Howe and Strauss (2000) consider millennials to be a "new great generation" characterised by digital literacy, optimism, trust in authority, teamwork and a focus on meaningful work. They expect a balance between personal and professional life, and often support equality, diversity and social change in social issues. Dimock (2019) specifies that the millennial generation ends in 1996, as Generation Z has been entering the world of the internet and smartphones since birth. Millennials are often described as value-oriented consumers. The study by Prayag et al. (2022) classifies some millennials as so-called actively sustainable consumers who behave ecologically not only in terms of their attitudes but also their actions – especially in the area of travel. Generation X, born approximately between 1965 and 1980, is often described as pragmatic, responsible and function-oriented. According to Holloway (2025), although they perceive environmental aspects positively, their consumer behaviour is mainly motivated by price, quality and proven products. Generation X more often draws information from traditional media and prefers direct recommendations. Brand et al. (2022) found that Generation X requires a higher degree of transparency and product information and often reads detailed reviews. Compared to Generation Z, sustainability appeals to them more as an added value than as a key factor in purchasing decisions. Šálková et al. (2023) state that while Generation X perceives luxury as a status symbol, younger generations (Y and Z) associate it with individuality and experience. Baby Boomers (born around 1946–1964), the generation preceding Generation X, show even lower environmental engagement. Prayag et al. (2022) classify them as having mixed priorities – they declare an interest in ecology, but often remain conservative in their consumer behaviour. Research shows that different age

groups of consumers respond differently to various forms of marketing communication. Digital campaigns, influencers and interactive content are most effective with Generation Z and Millennials, while television commercials, print media and personal recommendations have a greater effect on Generation X and Baby Boomers. However, across generations, the credibility and transparency of environmental certifications remain a key factor (Stylos et al., 2024). The importance of marketing in the field of sustainability is also confirmed by research by Ornelas Herrera et al. (2025), which analysed the preference for sustainable food within circular agriculture in six European countries. The results of the study show that consumers respond positively above all to the transparency and credibility of brands, emphasising the benefits for the local community and the environment, and clear and verifiable information about the origin of the product.

Based on these findings, the authors set the following objectives for the study: to identify the attitudes of individual generations towards sustainable consumer behaviour and a healthy lifestyle; to identify the factors that influence individual generations and their sustainable consumer behaviour; to determine the extent to which perceptions of sustainability influence actual consumer behaviour. Part of the objective of this study is to recommend communication priorities for institutions focused on sustainable consumer behaviour across generations in favour of sustainability.

2 METHODOLOGY

A questionnaire survey was conducted to achieve the set objective. This survey was carried out among 703 respondents in the Czech Republic between 9 February and 21 February 2025. The questionnaire was compiled using theoretical knowledge and previous research in the field of consumer behaviour, sustainability and healthy lifestyles. The influence of individual generations on this behaviour is also a subject of interest. The data was collected via an online questionnaire created in Google Forms, which was distributed via social networks and email communication. The structure of the respondents is shown in Tab. 1. The questionnaire consists mainly of closed questions (dichotomous, selection, scale) and is structured into several thematic units: perceptions of sustainability, attitudes towards sustainability and healthy lifestyles, and factors influencing sustainable consumer behaviour. The final part of the questionnaire contains socio-demographic characteristics. An example question from the questionnaire from the introductory section on perceptions of sustainability was: "What do you understand by the term sustainability?" Respondents chose all valid options, e.g. environmental protection, circular economy, social justice, ethical production, etc. The importance of sustainable behaviour, their opinions and attitudes is expressed using a Likert scale (scale 1 = completely unimportant to 7 = very important), e.g. "How important do you think sustainable behaviour is in everyday life?", 1 means completely unimportant to 7 = very important. The section focused on healthy lifestyles included questions such as: To what extent do you agree with the statements: "I consciously try to eat healthily", "I pay attention to the composition of food", "Habit and convenience prevent me from leading a healthy lifestyle". In terms of consumer behaviour, questions included: "How important is sustainability (ecological materials, ethical production) to you?" and "What would motivate you to buy more sustainable products?" (e.g. lower price, greater choice, higher quality). A complete overview of all questions is provided in Tab. 2.

Note: The representation of individual generations in the sample is not uniform, with millennials accounting for almost two-thirds of respondents and Generation X and Generation Z each accounting for only one-fifth of respondents. Therefore, the results for individual generations may be distorted, and this imbalance in the sample is one of the limitations of the

Tab. 1: Structure of respondents to the questionnaire survey

		Questionnaire survey n = 703, [%]
Generation	Generation Z (18–25 years old)	17.2
	Generation Y – Millennials (26–41 years old)	64.6
	Generation X (42–57 years old)	18.2
Economic activity	Employees	65.6
	Private entrepreneurs	13.3
	Unemployed	0.9
	Students	7.4
	Maternity or parental leave	12.8
Salary	Less than CZK 20,000	13.2
	CZK 20,001–35,000	29.8
	CZK 35,001–50,000	32.4
	CZK 50,001–70,000	11.5
	More than CZK 70,000	8.5
	I don't want to say	4.6
Education	Primary education	1.8
	Full secondary education	35.3
	University degree	62.9
Size of municipality of residence	Less than 5,000 inhabitants	30.5
	5,000–50,000 inhabitants	27.3
	50,001–500,000 inhabitants	21.7
	More than 500,000 inhabitants	20.5

results of this study. Only one-tenth of the respondents are men, so the predominance of women may also distort the results. However, both genders are included in the sample for the sake of completeness of the consumer outputs (when evaluating the results of the female-only sample, the results did not differ significantly).

Descriptive statistics and graphs are used to obtain an overview of the opinions and attitudes expressed by respondents on content-related questions. The chi-square test of independence in a contingency table is used to test the differences in behaviour between individual generations. A prerequisite for its use: None of the expected cell frequencies should be less than one, no more than 20% of the expected cell frequencies should be less than 5 (Cochran, 1952). The chi-square test was used to examine differences in individual questionnaire items across generations (Tab. 2).

Factor analysis is used to identify the factors influencing the behaviour of respondents. Factor analysis is applied to summarise the variability in the data set and reduce the number of variables to a certain number of newly created factors. The calculation begins by determining the factor loadings based on the eigenvalues in the principal component analysis. The second stage is factor rotation, i.e. transformation to interpreted factors. The last step is the calculation of factor loadings and the identification of newly created factors (Hebák et al., 2013). When describing the factor loadings of variables, factor rotation is applied using the Varimax method.

To assess significant differences between generational groups, the non-parametric Kruskal-Wallis H test was applied (the assumption of normality was not met, thus a non-parametric alternative to one-way ANOVA was selected). This test evaluates whether the distributions of the compared groups differ significantly by assessing differences in median ranks. The test is based on ranking all observations across groups and comparing the sum of ranks between groups. When the null hypothesis of equal

medians across groups is rejected, it is possible to conclude that at least one group differs significantly from the others. Following a significant Kruskal-Wallis test result, the Dwass-Steel-Critchlow-Fligner (DSCF) post-hoc test was conducted to identify specific differences between pairs of generations. All statistical analyses were performed using IBM SPSS Statistics 29 software, with a significance level of 0.05.

3 RESULTS

3.1 Sustainable Consumer Behaviour from a Generational Perspective

Generation Z and Millennials accounted for more than 80% of all research participants, which corresponds to their higher engagement in sustainability issues. In contrast, Generation X was less represented, which may affect the generalisability of the results for these groups. Nevertheless, even among older generations, a certain degree of interest in environmental issues can be observed, but their purchasing decisions are more significantly influenced by economic factors and the availability of eco-friendly products. In terms of the perception of sustainability as a value, Generation Z considers sustainable behaviour to be an integral part of their lifestyle. As many as 87% of respondents from this group said that sustainability plays an important role in their everyday decisions. Among Millennials, this figure was slightly lower, but still significant (79%), while among Generation X it was 54%. This difference suggests that the perception of environmental responsibility is largely generation-dependent and is related not only to social discourse but also to specific values formed in the youth of each generation. A key finding is that there are almost no differences between generations in terms of attitudes towards sustainable consumer behaviour, but there are clear differences in actual behaviour. Only 62% of Generation Z and 58% of Millennials actually buy eco-friendly products on a regular basis, confirming the existence of the so-called value-action gap. This phenomenon is a key problem in the area of sustainable consumption, as it suggests that despite positive attitudes towards eco-friendly products, consumers often prioritise other factors, particularly price and availability.

The evaluation of 32 questions concerning sustainability was organised into individual areas: sustainable behaviour in general, factors influencing sustainable behaviour, healthy eating and perception of a healthy lifestyle, obstacles to a healthy lifestyle, preference for sustainable products, and trustworthiness. The first set of questions focused on assessing the importance of the factors listed, the second set on agreement with the obstacles listed, and the third on perceptions of the statements listed. The highest level of agreement was recorded for the importance of sustainable behaviour in everyday life. The survey showed that the perception of the importance of sustainable consumer behaviour is crucial, with this area receiving the highest ratings across all generations. The question about the credibility of companies' sustainability measures demonstrates the expected increased interest in sustainability, but the average response score is lower than for the perception of the importance of sustainable behaviour in everyday life. Another resonant area is healthy eating, with which respondents also strongly identify. The obstacles to a healthy lifestyle that were rated highest by respondents were high financial costs. Sustainable transport and mobility, responsible behaviour and ethical production are considered the least important. The evaluation of individual questions also varies between generations.

The results of the responses on a 7-point Likert scale by generation were processed in 32 contingency tables for 32 questions, each of which was tested for differences in responses by generation (Tab. 2). The chi-square test of independence in the contingency table was used for this purpose, but only on the condition that

Tab. 2: Results of testing differences in responses by generation chi-square test

	***p*-value**
How important do you think sustainable behaviour is in everyday life?	×
Environmental protection	0.626
Long-term balance between economy, society and ecology	0.060
Efficient use of natural resources without depleting them	0.169
Minimising waste and promoting a circular economy	0.197
Sustainable consumption and responsible purchasing	0.840
Social justice and equal opportunities	0.583
Energy self-sufficiency and use of renewable resources	0.331
Sustainable transport and mobility	0.529
Responsible business and ethical production	0.724
Do you prefer products from companies that promote sustainability?	0.325
Do you find companies' sustainability measures credible?	0.006
Lack of time	0.322
High financial costs	0.633
Low motivation	0.281
Lack of information	0.892
Lifestyle of my surroundings	0.252
Stress and mental discomfort	0.314
Health limitations	0.145
Lack of available options	0.613
Habit and convenience	0.823
Nothing prevents me, I follow a healthy lifestyle	0.088
I consciously try to eat healthily	0.300
I monitor the composition of food	0.532
I have a good relationship with food and enjoy eating	0.399
I eat emotionally – I use food to cope with stress or emotions	0.793
The price of food has the greatest influence on my eating habits.	0.345
Lack of time has the greatest influence on my eating habits.	0.017
The lack of available information has the greatest influence on my eating habits.	×
Marketing and advertising of food products have the greatest influence on my eating habits.	×
My eating habits are most influenced by the influence of family and friends.	0.539
I don't worry about whether my diet is healthy	×

Note: × = the condition for using the chi-square test is not met.

a maximum of 20% of the expected values were < 5, which was not met for 4 questions. Of the other questions tested, only 2 questions were statistically significant at the 5% significance level, which are shown below in the tables and graphs.

When asked whether companies' actions are trustworthy, Generation X respondents were more likely to agree. The differences in responses are statistically significant at the 5% level according to the chi-square test: $\chi^2(12; N = 697) = 27.943$, $p = 0.006$. However, Cramer's V value of 0.142 indicates only a weak factual significance of this dependence.

When asked whether lack of time most influences eating habits, Generation X respondents were more likely to disagree. The differences in responses are statistically significant at the 5% level according to the chi-square test: $\chi^2(12; N = 697) = 24.564$, $p = 0.017$. However, Cramer's V value of 0.133 indicates only a weak factual significance of this dependence.

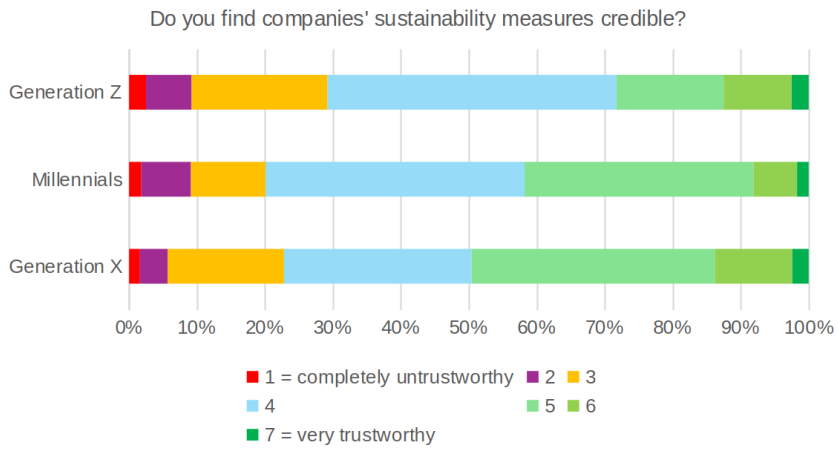


Fig. 1: Perception of corporate credibility in the area of sustainability

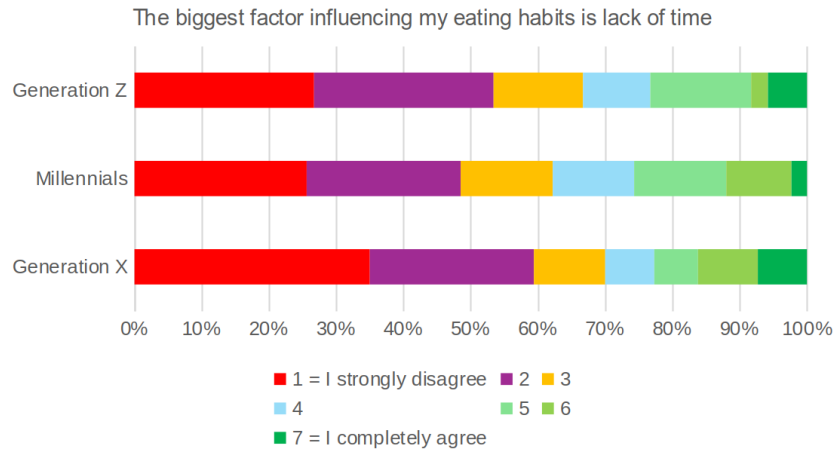


Fig. 2: Time as an obstacle to eating habits

3.2 The Influence of Individual Factors on Sustainable Consumer Behaviour

Factor analysis was used to verify the degree of influence of individual variables on sustainable behaviour, which was the subject of the questionnaire survey. This analysis was used to identify new factors of sustainable behaviour containing closely related variables (questions). These new factors will then be compared between generations and statistically significant differences will be tested. The result of the rotated component matrix (using the varimax rotation method) indicates the assignment of the original 32 variables to 6 newly created factors. This classification is based on factor loadings, i.e. correlations between the original variable and the new factor. The closest to each other are the questions from the sustainability assessment set (9 questions), which form the first factor, followed by questions from the set assessing barriers to sustainable behaviour (8 questions), which form the second factor, and then questions on adherence to a healthy lifestyle (4 questions), which form the third factor. Furthermore, factor 4 is represented by questions about the influence on eating habits (5 questions), factor 5 by questions about emotions (3 questions) and factor 6 by general questions about sustainability (3

Tab. 3: Classification of questions into six newly created factors

Factor 1 Sustainability assessment	Environmental protection
	Long-term balance between economy, society and ecology
	Effective use of natural resources without depleting them
	Minimisation of waste and promotion of the circular economy
	Sustainable consumption and responsible purchasing
	Social justice and equal opportunities
	Energy self-sufficiency and use of renewable resources
	Sustainable transport and mobility
	Responsible business and ethical production
Factor 2 Barriers to a healthy lifestyle	High financial costs
	Low motivation
	Lack of information
	The lifestyle of those around me
	Stress and mental discomfort
	Health limitations
	Lack of available options
	Habit and convenience
Factor 3 Eating habits	Nothing prevents me from following a healthy lifestyle
	I consciously try to eat healthily
	I pay attention to food ingredients
	I have a good relationship with food and enjoy eating
Factor 4 Barriers to eating habits	The price of food has the greatest influence on my eating habits
	The lack of available information has the greatest influence on my eating habits
	Marketing and advertising of food has the greatest influence on my eating habits
	My eating habits are most influenced by the influence of family and friends
	I do not consider whether my diet is healthy
Factor 5 Emotions	Perception of lack of time
	I eat emotionally – I use food to cope with stress or emotions
	I am most influenced by the recommendations of others
Factor 6 The importance of sustainability	How important do you think sustainable behaviour is in everyday life?
	Do you prefer products from companies that promote sustainability?
	Do you find companies' sustainability measures credible?

questions). These six newly created factors, each of which contains questions that carry similar information, can therefore be used for the entire area without losing any significant information.

Tab. 3 shows the arrangement of questions into the six newly created factors corresponding to the following names: sustainability assessment, barrier assessment, healthy lifestyle adherence, eating habits, emotions, and sustainability significance.

When testing the differences in the average values of the newly created factors between generations, only factor 6, consisting of questions on the overall importance of sustainable behaviour and preferences and credibility, was statistically significantly different based on the Kruskal-Wallis test: $\chi^2(2; N = 703) = 12.281$; $p = 0.002$. According to the DSCF post-hoc paired comparison test, a statistically significant difference ($p = 0.009$) was demonstrated between generations X and Z. The older generation (X) therefore has a higher degree of overall importance of sustainable behaviour. The differences in the average ratings of individual variables included in the newly created factors by generation are graphically represented in Fig. 3.

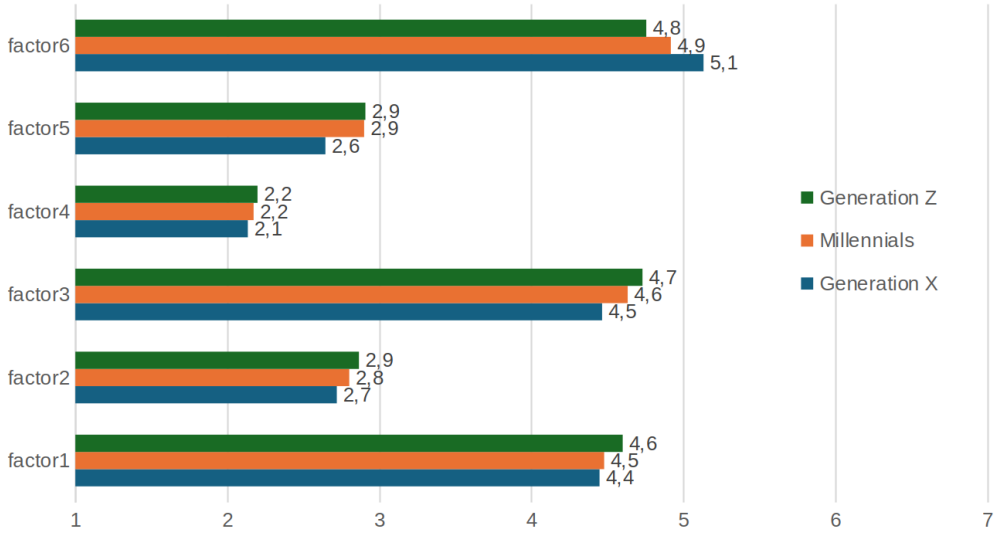


Fig. 3: Average values of questionnaire items by factor and generation

The average values of questionnaire items by factor and generation shown above represent the mean values of all questionnaire items included in each of the six factors. The highest level of agreement among consumers across all generations was recorded for Factor 6 (importance of sustainability for life). A very similar level of agreement was found for Factor 1 (general perception of sustainability) and Factor 3 (eating habits and healthy lifestyle). The lowest agreement rating was recorded for Factor 4 (barriers to eating habits). Factor 2 (barriers to a healthy lifestyle) and Factor 5 (emotions) were rated similarly at a low level of agreement.

4 DISCUSSION

The results of this study showed the highest level of agreement regarding the importance of sustainable behaviour in everyday life. We know that consumers' efforts to behave sustainably depend on their personal attitudes and perceptions of values (Tewari et al., 2022). The area of perception of the importance of sustainable consumer behaviour across all generations received the highest rating in this study. Prinzing et al. (2024) also emphasise the importance of sustainable behaviour and its impact on everyday life in this context, stating that people who perform more environmentally sustainable everyday actions also report higher subjective well-being, with active, more demanding and social forms of behaviour having a stronger positive effect. In drawing the following conclusions, we take into account the structure of the sample. The barriers to a healthy lifestyle that were rated highest by respondents in this study were high financial costs. These results are consistent with OECD data (2023), according to which 65% of consumers consider price to be the main barrier to purchasing eco-friendly products.

The study's findings also show that promoting sustainable consumption requires a comprehensive approach aimed at eliminating economic barriers, increasing the availability of eco-friendly products, and strengthening confidence in the labelling of sustainable products. At the same time, it is necessary to take into account generational differences in information and value preferences, which have a fundamental impact on consumers' willingness to adopt sustainable alternatives in their everyday

lives. Across generations, long-term changes in purchasing behaviour can be achieved and sustainability can be strengthened as a standard part of consumer decisions. Significant differences may arise in willingness to pay extra, frequency of purchase, and type of information sources used.

The study found that Generation X lacks a motivational link between attitude and action. Sustainable behaviour among consumers is low even with moderate awareness. Millennials achieve the highest scores in both attitudes and ecological behaviour, with a demonstrably high consistency between values and actions. This is confirmed by Prayag et al. (2022), who argue that Millennials are willing to prioritise sustainable solutions even at a higher price if they perceive them to be in line with their own values. Generation Z shows a strong attitude but a lower degree of transfer into real behaviour; this generation has the potential for environmental behaviour, but its implementation is lower. Generation X scores low on both variables; this generation lacks a motivational link between attitude and action, with trust, price and availability being the factors that influence this. Among Millennials, there is a positive relationship and a high degree of consistency between values and actions. While Generations Z and Y perceive sustainability as a fundamental value, for Generation X it represents an added rather than a determining value in consumer decision-making. Data from Eurostat (2022) show that eco-friendly products account for approximately 15% of retail turnover in the Czech Republic, with the highest share of purchases made by consumers with higher incomes. Gifford and Nilsson (2014) emphasise that many consumers face a value-action gap, where they declare their support for sustainability but in reality prefer other factors such as price and availability. Institutions need to take action to encourage sustainable consumer behaviour. Thøgersen (2023, p. 197): "Without substantial institutional and infrastructural support, the impact of individual choices remains limited, even if consumers are motivated to act in line with sustainable goals." In this area, it is possible to introduce various incentives to support sustainable consumer behaviour, but also strict regulations that promote sustainable consumer behaviour. These have been introduced, for example, by Sweden, one of the leading countries in terms of sustainable policies and global sustainability performance. In 2016, Sweden introduced a reduced VAT rate for repair services (e.g. sewing, patches) for clothing, footwear and home textiles – originally from 25% to 12%. From 1 January 2025, a law requiring separate collection of textile waste, including damaged items (e.g. underwear, socks), will come into force in Sweden. The law is intended to encourage greater reuse and recycling of textiles and reduce the amount of textiles that end up in landfills or in general waste. From 1 January 2025, under the so-called RUT-avdrag / RUT deduction, households will also be able to deduct 25% of the cost of professional laundry and home textile services, even though this work could normally be done at home. This also includes minor repairs to clothing or textiles and transport (pickup/drop-off) as part of this service.

Effective strategies to promote sustainable behaviour should therefore combine economic incentives, regulatory measures against greenwashing and a targeted communication strategy tailored to different age groups. Only in this way can long-term changes in purchasing behaviour be achieved and sustainability be strengthened as a standard part of consumer decisions. To support all of the following recommendations, it is important to realise that even small changes in behaviour can lead to rapid and widespread social shifts towards more sustainable consumption patterns, as emphasised by Thøgersen (2023) in his concept of social tipping points.

5 CONCLUSION

The results of this study show that the attitudes of individual generations towards sustainable behaviour and a healthy lifestyle differ, but only from a certain point of view. Overall, the data indicate a high level of interest in sustainability and a healthy lifestyle. The factors that influence individual generations and their sustainable behaviour are fundamentally influenced primarily by personal preferences. Although younger generations show a higher level of environmental awareness, their consumption behaviour is influenced by affordability, available product information, and the overall situation in society. This study shows that younger generations (especially Generation Z and Millennials) expressed a greater willingness to pay extra for eco-friendly products compared to older generations. Generation Z is most sensitive to issues such as ecology, fair trade, ethical production and sustainability. Generation X remains more focused on utility and price. The degree of influence of sustainability perceptions on actual consumer behaviour is determined both by price and by the availability and transparency of information for consumers.

The study shows that respondents across generations attach great importance to the careful use of natural resources, waste minimisation and environmental protection, while sustainable transport and ethical production were perceived as less important. Healthy eating was among the most emphasised areas, with most respondents reporting a conscious effort to eat healthily, with Generation Z rating this area as the most important. Respondents most often cited high financial costs, habits and convenience, as well as stress and mental discomfort, as barriers to a healthy lifestyle. The perception of stress as an obstacle varies significantly across generations, with Generation Z mentioning it most often and Generation X least often. An intergenerational difference was also noted in the assessment of the influence of lifestyle on the environment.

A key element in promoting sustainable consumption is ensuring transparency of information about eco-friendly products and transparency of sustainable production by companies. Supporting sustainable consumption requires cooperation between public institutions, companies and the non-profit sector. Transparency and consistent monitoring of companies' environmental claims, together with effective awareness-raising and educational programmes, can contribute to a gradual shift in consumer behaviour towards more sustainable choices. Institutions should emphasise clear and understandable communication and certification of eco-friendly products so that consumers have access to verified data and are able to make informed decisions. A key step towards effectively promoting sustainable behaviour is to tailor communication strategies to different age groups. Across all generations, the higher price of eco-friendly alternatives was most often cited as a barrier, confirming that economic factors remain a key element influencing sustainable consumer behaviour. The results obtained and the recommendations derived from them are also a suitable basis for social marketing creators.

6 REFERENCES

Ajzen, I. 2020. The Theory of Planned Behaviour: Frequently Asked Questions. *Human Behaviour and Emerging Technologies*, 2 (4), 314–324. DOI: 10.1002/hbe2.195.

Bassiouni, D. H. and Hackley, C. 2014. 'Generation Z' Children's Adaptation to Digital Consumer Culture: A Critical Literature Review. *Journal of Customer Behaviour*, 13 (2), 113–133. DOI: 10.1362/147539214X14024779483591.

Brand, B. M., Rausch, T. M. and Brandel, J. 2022. The Importance of Sustainability Aspects When Purchasing Online: Comparing Generation X and Generation Z. *Sustainability*, 14 (9), 5689. DOI: 10.3390/su14095689.

Calafell, G., Banqué, N. and Viciana, S. 2019. Purchase and Use of New Technologies among Young People: Guidelines for Sustainable Consumption Education. *Sustainability*, 11 (6), 1541. DOI: 10.3390/su11061541.

Comte, A. 1830–1842. *Cours de philosophie positive (Vols. 1–6)* [online]. Paris: Rouen Freres; Bachelier. Available at: `https://archive.org/details/coursdephilosop00comtgoog`. [Accessed 2025, March 30].

Cochran, W. G. 1952. The χ^2 Test of Goodness of Fit. *Annals of Mathematical Statistics*, 23 (3), 315–345. DOI: 10.1214/aoms/1177729380.

Dimock, M. 2019. *Defining Generations: Where Millennials End and Generation Z Begins* [online]. Pew Research Center. Available at: `https://www.pewresearch.org/short-reads/2019/01/17/where-millennials-end-and-generation-z-begins/`. [Accessed 2025, March 30].

EUROSTAT. 2022. *Sustainable Consumption Patterns in the EU: Statistical Overview* [online]. Available at: `https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Sustainable_consumption_patterns`. [Accessed 2025, March 11].

Ferraz, D. and Pyka, A. 2023. Circular Economy, Bioeconomy, and Sustainable Development Goals: A Systematic Literature Review. *Environmental Science and Pollution Research*. DOI: 10.1007/s11356-023-29632-0.

Gentina, E., Shrum, L. J. and Lowrey, T. M. 2016. Teen Attitudes toward Luxury Fashion Brands from a Social Identity Perspective: A Cross-Cultural Study of French and U.S. Teenagers. *Journal of Business Research*, 69 (12), 5785–5792. DOI: 10.1016/j.jbusres.2016.04.175.

Gifford, R. and Nilsson, A. 2014. Personal and Social Factors that Influence Pro-Environmental Concern and Behaviour: A Review. *International Journal of Psychology*, 49 (3), 141–157. DOI: 10.1002/ijop.12034.

Hebák, P. et al. 2013. *Statistické myšlení a nástroje analýzy dat*. Prague: Informatorium. ISBN 978-80-7333-105-4.

Holloway, S. 2025. Understanding Consumer Reactions to Sustainable Supply Chains and Green Marketing. *SSRN Electronic Journal*. DOI: 10.2139/ssrn.5135352.

Howe, N. and Strauss, W. 2000. *Millennials Rising: The Next Great Generation*. New York: Vintage Books.

Karim, S. 2019. A Comparison of the Media Consumption Habits of Gen X, Gen Y and Gen Z. *Allana Management Journal of Research*, 9 (2). ISSN 2581-3137.

Kamenidou, I., Stavrianea, A. and Bara, E.-Z. 2020. Generational Differences toward Organic Food Behaviour: Insights from Five Generational Cohorts. *Sustainability*, 12 (6), 2299. DOI: 10.3390/su12062299.

Lecouteux, G. and Moulin, L. 2024. Cycling in the Aftermath of COVID-19: An Empirical Estimation of the Social Dynamics of Bicycle Adoption in Paris. *Transportation Research Interdisciplinary Perspectives*, 25, 101115. DOI: 10.1016/j.trip.2024.101115.

Mannheim, K. 1952. The Problem of Generations. In Kecskemeti, P. (ed.). *Essays on the Sociology of Knowledge*, Chapter VII, pp. 276–322. London: Routledge & Kegan Paul.

McKinsey & Company. 2020. *The State of Fashion 2020: Coronavirus Update* [online]. Available at: `https://www.mckinsey.com/industries/retail/our-insights/the-state-of-fashion-2020-coronavirus-update`. [Accessed 2025, April 5].

OECD. 2023. *Sustainable Consumption and Green Economy Trends in the EU* [online]. OECD Reports on Sustainable Development. Available at: `https://www.oecd.org/environment/sustainable-consumption`. [Accessed 2025, March 11].

Ornelas Herrera, S. I., Baba, Y., Kallas, Z., Meers, E., Michels, E., Hajdu, Z. and Spicnagel, A. M. 2025. The Role of Environmental Attitudes and Consumption Patterns in Consumers' Preferences for Sustainable Food from Circular Farming System: A Six EU Case Studies. *Agricultural and Food Economics*, 13, 7. DOI: 10.1186/s40100-025-00350-0.

Prayag, G., Aquino, R. S., Hall, C. M., Chen, N. and Fieger, P. 2022. Is Gen Z Really That Different? Environmental Attitudes, Travel Behaviours and Sustainability Practices of International Tourists to Canterbury, New Zealand. *Journal of Sustainable Tourism*, 33 (6), 1016–1037. DOI: 10.1080/09669582.2022.2131795.

Priporas, C.-V., Stylos, N. and Fotiadis, A. K. 2017. Generation Z Consumers' Expectations of Interactions in Smart Retailing: A Future Agenda. *Computers in Human Behaviour*, 77, 374–381. DOI: 10.1016/j.chb.2017.01.058.

Prinzing, M., Lades, L. K., Weber, T. O., Fredrickson, B. and Laffan, K. 2024. Pro-Environmental Behaviours and Well-Being in Everyday Life. *Journal of Environmental Psychology*, 98, 102394. DOI: 10.1016/j.jenvp.2024.102394.

Puntiroli, M., Moussaoui, L. S. and Bezençon, V. 2022. Are Consumers Consistent in Their Sustainable Behaviours? A Longitudinal Study on Consistency and Spillover. *Journal of Business Research*, 144, 322–335. DOI: 10.1016/j.jbusres.2022.01.075.

Rai, H. B. 2021. The Net Environmental Impact of Online Shopping, Beyond the Substitution Bias. *Journal of Transport Geography*, 93, 103058. DOI: 10.1016/j.jtrangeo.2021.103058.

Schroth, H. 2019. Are You Ready for Gen Z in the Workplace? *California Management Review*, 61 (3), 5–18. DOI: 10.1177/0008125619841006.

Sheoran, M. and Kumar, D. 2022. Conceptualisation of Sustainable Consumer Behaviour: Converging the Theory of Planned Behaviour and Consumption Cycle. *Qualitative Research in Organizations and Management*, 17 (1), 103–135. DOI: 10.1108/QROM-05-2020-1940.

Skene, K. R. 2022. How Can Economics Contribute to Environmental and Social Sustainability? *Frontiers in Sustainability*, 3, 980583. DOI: 10.3389/frsus.2022.980583.

Stylos, N., Rahimi, R. and Robinson, P. 2024. *Contemporary Marketing Management for Tourism and Hospitality: How New Tech and Gen Z Drive Sustainable Business Transformation*. Cham: Springer. DOI: 10.1007/978-3-031-65049-9.

Šálková, D., Procházková, R. and Kučírková, K. 2023. Differences in Attitude Towards Ethical Shopping between Generations X, Y and Z in a Marketing Communication Context. In *Marketing Identity 2023: Ethics in Marketing Communication*, pp. 678–689. DOI: 10.36689/uhk/hed/2023-01-064.

Tewari, A., Srivastava, S., Gangwar, D. and Verma, V. C. 2022. Young Consumers' Purchase Intention toward Organic Food: Exploring the Role of Mindfulness. *British Food Journal*, 124 (1), 78–98. DOI: 10.1108/BFJ-12-2020-1162.

Thøgersen, J. 2023. *Concise Introduction to Sustainable Consumption*. Cheltenham, UK: Edward Elgar Publishing. ISBN 978-1-80392-450-2.

Trivedi, P. and Pal, R. 2023. Is That Green? A Comparison of the Green Buying Habits of Millennials, Baby Boomers, and Generation Z. *Journal of the Asiatic Society of Mumbai*, 97 (5), 120–129.

AUTHOR'S ADDRESS

Hana Urbánková, Department of Marketing and Trade, Faculty of Business and Economics, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic, e-mail: pindryco@mendelu.cz (corresponding author)

Jana Stávková, Department of Marketing and Trade, Faculty of Business and Economics, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic

GEOPOLITICAL SHOCKS AND ASSET PRICING: GLOBAL CROSS-SECTIONAL EVIDENCE FROM DEFENSE AND AEROSPACE FIRMS AMID THE RUSSIA–UKRAINE WAR

ATM Adnan[1]✉, Md Arif Hasan Khan[2], Md Tapan Mahmud[3], Sabira Kumkum[3], Abdullah Al-Mamun[4]

[1] *BGMEA University of Fashion & Technology, Dhaka, Bangladesh*
[2] *Northern University of Business and Technology, Khulna, Bangladesh*
[3] *Bangladesh University of Professionals, Dhaka, Bangladesh*
[4] *University of Wollongong, Australia*

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11 Issue 2
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

This study addresses a critical gap in geopolitical finance by examining the heterogeneous capital market reactions of 370 global defense and aerospace (D&A) firms to the 2022 Russia-Ukraine war. While the impact of geopolitical shocks on financial markets is well-documented, the specific determinants of intra-sectoral returns remain underexplored. Employing an event study methodology, this research quantifies abnormal returns around the invasion date and conducts cross-sectional analyses to test whether these returns are systematically moderated by firms' home country attributes, including geopolitical alignment (G7 vs. non-G7), economic status, and national defense budget levels. The empirical results reveal a profound and statistically significant divergence: firms domiciled in developed, G7, and high-budget nations experienced large positive abnormal returns, while those in other national contexts suffered significant losses. Critically, the analysis finds no evidence of a firm-size "leadership premium," as the performance difference between the industry's largest firms and their smaller counterparts was statistically insignificant. These findings suggest the market's reaction was a sophisticated assessment of sovereign fiscal capacity, where investors priced in a "geopolitical premium" for firms in nations with a credible ability to fund a military buildup, while penalizing those in fiscally constrained countries for perceived macroeconomic risk. This research contributes to the literature by demonstrating that during a systemic geopolitical crisis, a nation's macroeconomic and political attributes can dominate firm-specific characteristics in driving asset valuation.

KEY WORDS

geopolitical shocks, capital markets, event study, investor sentiment, defense and aerospace, Russia–Ukraine war

JEL CODES

G11, G12, G14

ADNAN, ATM, KHAN, Md Arif Hasan, MAHMUD, Md Tapan, KUMKUM, Sabira, and AL-MAMUN, Abdullah. 2025. Geopolitical Shocks and Asset Pricing: Global Cross-Sectional Evidence from Defense and Aerospace Firms amid the Russia–Ukraine War. *European Journal of Business Science and Technology,* 11 (2): 220–249. ISSN 2694-7161, DOI 10.11118/ejobsat.2025.013.

1 INTRODUCTION

The interplay between geopolitical instability and global financial markets represents a critical domain of economic inquiry, as such conflicts introduce significant, non-diversifiable systematic risk that can profoundly reshape asset valuations (Nemat et al., 2025). The full-scale invasion of Ukraine by Russia on February 24, 2022, stands as one of the most consequential geopolitical shocks of the 21st century, triggering a cascade of unprecedented economic sanctions (see Fig. 1), severe commodity price volatility, and a fundamental recalibration of the global security architecture (Auer et al., 2025; Sharma et al., 2024). The weighted Uncertainty Index (WUI) Index (see Fig. 2), a key measure of international tensions, surged to its highest level on record after the covid 19 breakout, signaling a period of extreme uncertainty for investors and policymakers (Ahir et al., 2022).

The immediate economic repercussions were global in scope; Brent crude oil prices surpassed $100 per barrel for the first time since 2014, European natural gas prices soared by over 50% on the day of the invasion, and agricultural markets faced dire disruptions, with wheat prices climbing over 50% in the subsequent months (Patidar et al., 2024). This shockwave rippled through equity markets, causing sharp sell-offs in major indices like the S&P 500 and Germany's DAX, while precipitating a collapse of over 45% in the Russian stock market, forcing its suspension (Izzeldin et al., 2023). The Russia-Ukraine conflict has also triggered a significant shift in global defense spending. In the aftermath of the invasion, nations around the world, particularly those in NATO and the Asia-Pacific region, reassessed their military readiness, leading to an unprecedented increase in military expenditure, which reached $2.24 trillion in 2022, marking a 9% year-on-year increase (Elgin et al., 2022; Swain, 2024). The European Union launched the "Readiness 2030" program, earmarking €800 billion for defense infrastructure, underscoring the growing militarization in response to the crisis (Soare, 2025). As a result, defense and aerospace companies emerged as crucial beneficiaries of this shift, as investor sentiment favored stocks within these industries amid the heightened geopolitical risk.

The performance of the Defense & Aerospace sector is intrinsically linked to geopolitical instability, with its market valuation often reacting predictably to the outbreak of international hostilities (Zhang et al., 2022; Gheorghe and Panazan, 2025). A substantial body of research applying this framework to military conflicts consistently demonstrates that Defense & Aerospace firms, often termed "war stocks" (Hudson and Urquhart, 2015) tend to

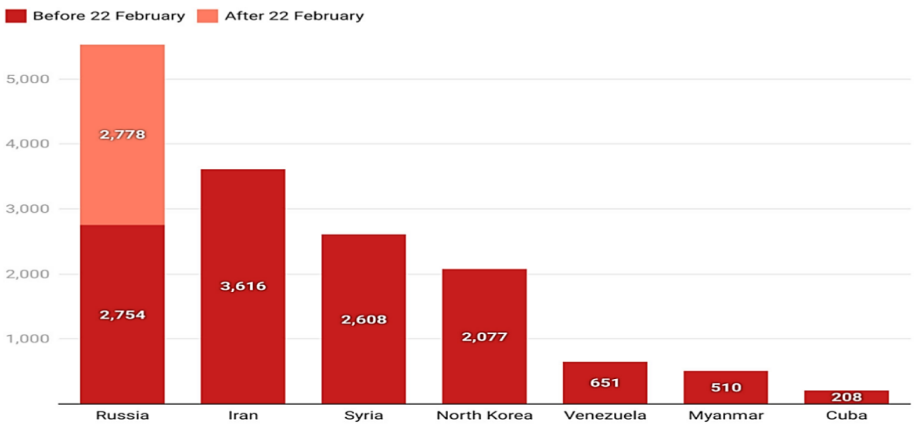


Fig. 1: Number of Sanctions imposed against Russia and other selected Countries since 2014 and after February 22, 2022 (Davydov et al., 2022)

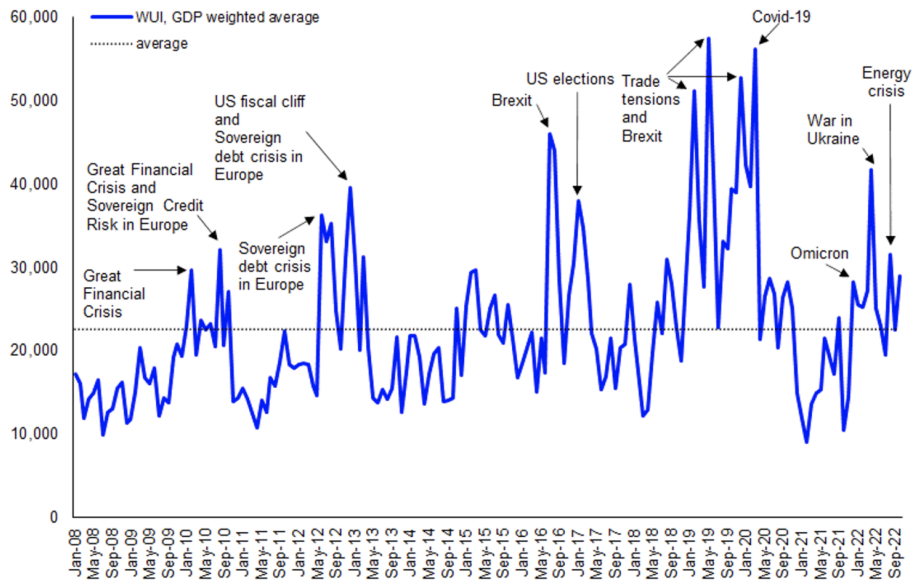


Fig. 2: Weighted Uncertainty Index 2008–2022 (authors compilation from `https://worlduncertaintyindex.com/`)

experience positive abnormal returns due to investor anticipation of increased government procurement and defense spending (Schneider and Tröger, 2004; Yudaruddin and Lesmana, 2024). Studies examining the Russia-Ukraine conflict have largely affirmed this trend, documenting significant positive returns for defense equities and heightened volatility across asset classes in the immediate aftermath of the invasion (Boubaker et al., 2023; Covachev and Fazakas, 2025). These market reactions are heavily influenced by investor sentiment, where fear and risk aversion drive portfolio reallocations toward perceived safe-haven assets and sectors poised to benefit from geopolitical turmoil (Maddodi and Kunte, 2024; Song et al., 2025). The redirection of capital into defense stocks is a clear manifestation of this behavioral shift, reflecting a changed perception of geopolitical risk that extends far beyond the defense industry into energy and technology sectors.

However, despite a growing consensus on the sector's overall positive reaction, the extant literature has largely treated the D&A industry's response as monolithic, creating a significant research gap. While numerous studies have analyzed aggregate market or sectoral impacts of the conflict (Assaf et al., 2023; Mishra et al., 2024), there is a notable absence of granular, firm-level, cross-country analyses that investigate the heterogeneity of this response within the global D&A sector. Prior research has not systematically examined how a firm's geographical domicile, the economic status of its home country, or its nation's geopolitical alignment moderates its valuation impact in a major conflict with distinct international battle lines. The Russia-Ukraine war, which sharply delineated the geopolitical landscape between G7-aligned nations and other global powers, provides an ideal yet underexplored setting to investigate these crucial cross-sectional differences. This knowledge gap constrains a nuanced understanding of how investors price not only event-driven risk but also a firm's specific national and political context during a crisis.

Therefore, the primary objective of this study is to address this critical void by examining the capital market reaction of a comprehensive global sample of 370 publicly listed Defense and Aerospace firms to the Russian invasion on the event date of February 24, 2022. Moving beyond a simple aggregate analysis, this paper employs an event study methodology followed by several cross-sectional analyses to identify the key determinants of differential market

reactions. Specifically, this research seeks to answer whether the abnormal returns are significantly different based on: (1) the firm's geographical location, with a comparison of Asian, European, and North & South American firms; (2) the economic status of the base country, distinguishing between developed and emerging economies; and (3) the geopolitical association of the home country, comparing firms based in G7 versus non-G7 nations. By providing a detailed, firm-level analysis on a global scale, this research offers a novel and granular contribution to the literature on geopolitical risk and asset pricing. It furnishes valuable insights into the financial dynamics of a strategic industry during a period of profound geopolitical instability, informing policymakers, investors, and academics.

The remainder of this paper is organized as follows: Section 2 presents the literature and theoretical framework, Section 3 details the data and methodology, Sections 4 and 5 present and discuss the empirical findings, and Section 6 concludes with policy implications and directions for future research.

2 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Extensive research documents that major geopolitical shocks such as wars, invasions, and political crises tend to trigger negative reactions in global stock markets, eroding investor confidence and increasing volatility (Leigh et al., 2003; Schneider and Troeger, 2006). This phenomenon, first observed in early studies like Niederhoffer (1971), is primarily driven by sudden risk repricing and heightened uncertainty. However, the aggregate market downturn often masks significant heterogeneity. During such crises, investors typically execute a "flight-to-safety," reallocating capital toward safe-haven assets like gold and oil while rotating into defensive equity sectors (Rigobon and Sack, 2005).

The performance of the Defense and Aerospace (D&A) sector, in particular, is intrinsically linked to geopolitical instability (Zhang et al., 2022). Financial literature consistently demonstrates that D&A firms, often termed "war stocks," tend to experience positive abnormal returns following the onset of military conflicts, acting as a "war hedge" (Hudson and Urquhart, 2015; Gheorghe and Panazan, 2024). This reaction is driven by investor anticipation of increased government defense budgets and new military procurement contracts (Schneider and Troeger, 2006). Studies examining the 2022 Russia-Ukraine conflict have largely affirmed this trend, documenting pronounced positive abnormal returns in the defense sector firms in both Europe and North America (Yudaruddin and Lesmana, 2024; Kakhkharov et al., 2024), which contrasted sharply with losses in most other industries (Covachev and Fazakas, 2025). Given this overwhelming and consistent evidence from both foundational and contemporary research, we formulate our primary hypothesis:

H_1: The Russia-Ukraine conflict led to statistically significant positive abnormal returns for global Defense and Aerospace firms.

While an overall positive reaction for the D&A sector is expected, contemporary research on the Russia-Ukraine war has moved beyond this aggregate observation to emphasize the profound heterogeneity of market responses. A growing consensus indicates that the magnitude of these abnormal returns is systematically moderated by a range of country and firm level characteristics. Studies have consistently documented that a firm's geographical proximity to the conflict (Joshipura and Lamba, 2024; Grinius and Baležentis, 2025), the economic status of its home country (Boubaker et al., 2022), and its nation's geopolitical affiliations (Yudaruddin and Lesmana, 2024) are all crucial determinants of investor reaction. Furthermore, evidence suggests a firm-level "flight to quality," where investors disproportionately favor industry leaders perceived as more resilient and

better positioned to secure large government contracts (Gheorghe and Panazan, 2024). This body of evidence provides a compelling rationale for dissecting the aggregate market reaction through a cross-sectional lens. Therefore, to investigate these specific sources of variation, the following hypotheses are proposed.

First, a firm's geographical proximity to a conflict zone is a critical determinant of investor risk perception. The literature identifies a "proximity penalty," where markets closer to a conflict experience greater economic disruption and more severe negative returns (Grinius and Baležentis, 2025). Yousaf et al. (2022), analyzing the 2022 invasion, found that European and Asian markets were hit hardest, while Silva et al. (2023) confirm that within Europe, physical proximity to the war drove the worst losses. This creates a compelling tension for European D&A firms, which are poised to benefit from increased regional defense spending but are simultaneously exposed to greater macroeconomic risks. This leads to our next hypothesis:

H_2: *The stock market reaction of D&A firms differs significantly based on their geographical domicile.*

Second, a firm's market reaction is expected to be contingent upon the economic status of its home country. The literature traditionally posits that emerging markets exhibit amplified vulnerability to global shocks due to limited fiscal buffers, higher political risk, and greater sensitivity to capital flight, making them inherently riskier during a crisis (IMF, 2025). Interestingly, some recent studies on the Ukraine conflict have nuanced this view, finding that developed markets, due to their high degree of globalization and trade exposure, sometimes suffered deeper aggregate market losses than their emerging market counterparts (Boubaker et al., 2022; Sun et al., 2022). However, this aggregate market logic is unlikely to hold within the specialized D&A sector. During a major military conflict, investors are not just assessing macroeconomic risk but are actively seeking firms best positioned to receive large, stable, and coordinated government defense contracts. These contracts are overwhelmingly awarded to firms in developed economies which possess the requisite scale, established government relationships, and political stability to ramp up production. Therefore, it is reasonable to expect a "flight to quality" within the sector toward firms based in developed nations, which are perceived as more reliable and direct beneficiaries of the ensuing increase in military spending. This distinction leads to the following hypothesis:

H_3: *D&A firms domiciled in developed economies experienced significantly higher positive abnormal returns than their counterparts in emerging economies.*

Beyond geography and economics, A nation's geopolitical affiliation is a critical source of cross-sectional variation in market reactions to conflict. The literature suggests that investors perceive firms based in countries with strong political and military alliances, such as the G7 or NATO, as more likely to benefit from coordinated increases in defense spending and economic stimulus during a crisis. This is consistent with evidence from Boubaker et al. (2022), who found that markets in NATO member countries experienced less negative, and in some cases even positive, abnormal returns around the Russia-Ukraine event, a phenomenon they attribute to a "military preparedness dividend." Similarly, studies focused on strategic sectors show that firms in NATO countries exhibited stronger positive reactions, as political allegiance is seen as a proxy for anticipated government action and contract allocation (Yudaruddin and Lesmana, 2024). However, the literature also indicates that political alignment alone is not a monolithic determinant, as its effects are often moderated by economic and geographic factors. Nuanced research reveals significant heterogeneity even within politically aligned blocs like the G7. For instance, Abbassi et al. (2023) attribute differing reactions among G7 firms during the Ukraine invasion to varying levels of trade dependence and energy exposure, which in some cases overrode the benefits of their shared political stance. This interplay is further refined by Silva et al. (2023), who demonstrate that while trade exposure to the conflict zone was a key driver of negative

returns outside Europe, physical proximity to the war was the dominant factor within Europe. Collectively, these findings underscore that a firm's market reaction to a geopolitical shock is highly cross-sectional, shaped by a complex interplay of its home country's political affiliations, its economic entanglement with the conflict, and its geographical location. We therefore hypothesize that investors anticipated firms domiciled within G7 nations would be the primary beneficiaries of new defense contracts.

H_4: D&A firms domiciled in G7 countries experienced significantly higher positive abnormal returns than their counterparts in non-G7 countries.

Finally, beyond country-level attributes, firm-specific characteristics, most notably size and market leadership, are expected to play a crucial role. The global defense industry is highly concentrated, with a small number of large, prime contractors receiving the vast majority of government spending on major weapons platforms (Smith, 2022). During geopolitical crises, investors not only rotate into the defense sector but also execute a "flight to quality" within it, favoring established market leaders. These large, dominant firms are perceived as the most direct and certain beneficiaries of increased military budgets due to their production capacity, R&D capabilities, and entrenched government relationships (Gheorghe and Panazan, 2024). Furthermore, such firms are better equipped to navigate the supply chain disruptions and economic volatility that accompany major conflicts, demonstrating greater resilience (Nemat et al., 2025). In contrast, smaller firms, which often act as subcontractors, may see benefits with a significant lag, and their future revenue streams are perceived as less certain. While many studies analyze aggregate sectoral data, the specific role of firm size in moderating these returns remains underexplored, representing a key firm-level nuance. This leads to our final hypothesis:

H_5: The top 100 D&A firms by defense revenue experienced a significantly stronger positive market reaction to the invasion compared to smaller firms in the sector.

The current literature establishes a strong basis for this research, confirming that the Defense and Aerospace (D&A) sector typically experiences positive stock returns during geopolitical crises like the Russia-Ukraine war due to anticipated increases in military spending. However, a comprehensive, firm-level cross-sectional analysis of the global D&A sector's response is largely missing. Specifically, it remains unclear how factors such as a firm's geographical location, its home country's economic status, and its geopolitical affiliation influence these market reactions. This study aims to address this critical gap by providing a detailed examination of these differential responses across 370 firms, offering a more nuanced understanding of how investors price geopolitical risk in this strategic industry.

3 DATA AND METHODOLOGY

Employing a standard event study methodology (MacKinlay, 1997; Brown and Warner, 1980), this research quantifies the impact of the Russia-Ukraine war on the stock returns of global defense and aerospace firms by analyzing abnormal (AR) and cumulative abnormal returns (CAR) around the invasion date. Furthermore, this research conducts cross-sectional analyses to determine if these reactions vary based on firm size, geography, geopolitical association and national defense expenditure. This approach is standard for isolating the financial impact of specific occurrences and has been effectively applied to geopolitical conflicts in prior research, e.g. Yousaf et al. (2022), Memdani and Shenoy (2019), Chen and Siems (2007).

Tab. 1: Firms' distribution by country, geopolitical membership, Economic status & Geo Graphic location, Defense budget & benchmark indices

No.	Country	No. of Firms	G7 Membership	Geographic Position	Economic Status	Defense Budget	Benchmark Indices
1	USA	93	Yes	America	Developed	High	S&P 500
2	China	71	NO	Asia	Developing	Medium	SSEC
3	Germany	38	YES	Europe	Developed	Medium	DAX
4	France	14	YES	Europe	Developed	High	CAC 40
5	UK	22	YES	Europe	Developed	High	FTSE 100
6	Italy	7	YES	Europe	Developed	Medium	FTITLMS
7	Sweeden	8	YES	Europe	Developed	Medium	OMXSPI
8	Canada	17	YES	America	Developed	Medium	S&P/TSX Composite Index
9	Australia	13	NO	Asia	Developed	Medium	ASX All Ordinaries
10	Israel	11	NO	Asia	Developing	High	TA-125 Index
11	Türkiye	2	YES	Asia	Developing	Medium	BIST 100
12	South Korea	26	NO	Asia	Developed	High	KOSPI
13	Brazil	2	NO	America	Developing	Medium	IBRX
14	Japan	15	NO	Asia	Developed	Medium	Nikkei 225
15	India	17	NO	Asia	Developing	High	BSESN
16	Singapore	8	NO	Asia	Developing	High	STI
17	Norway	6	YES	Europe	Developed	Medium	OSEAX

3.1 Data Description

The sample consists of 370 publicly traded defense and aerospace firms listed on 19 stock exchanges across 17 leading arms manufacturing and exporting countries, as identified using the Statista (2025) database. Daily stock price data and corresponding national benchmark indices were sourced from Investing.com and Yahoo Finance. To facilitate the cross-sectional analysis, firms were segmented based on their country of domicile into four distinct categories: (i) geographic region, following the World Bank framework; (ii) geopolitical alignment (G7 vs. non-G7); (iii) economic status (e.g., Developed, Developing) according to WTO; and (iv) national defense budget level in terms of GDP (Thielicke, 2024). (v) market leadership – Top 100 vs. others (Defense News, 2022). A comprehensive description of the sample distribution by country, along with these classifications, is presented in Tab. 1.

3.2 Event Study Methodology

3.2.1 Event Day, Estimation Period and Event Windows

The event date ($t = 0$) is defined as February 24, 2022, marking Russia's full-scale invasion of Ukraine. This selection is consistent with the established literature on this conflict war (Nerlinger and Utz, 2022; Ahmed et al., 2023; Yousaf et al., 2022). To establish a benchmark for normal returns, we use a 250-day estimation window spanning from $t - 265$ to $t - 15$. Following the standard established by Brown and Warner (1985) and MacKinlay (1997), this extended period ensures robust parameter estimates for the market model by mitigating the influence of short-term volatility and reducing the risk of model overfitting, thereby enhancing the accuracy of the abnormal return calculations (Aktas et al., 2007). The market reaction is then measured over a 21-day symmetric event window from $t-10$ to $t+10$, which is designed to capture both anticipatory market movements and subsequent price adjustments.

3.2.2 Return Model

To ensure statistical robustness, daily stock returns were calculated using the natural logarithmic model (Eq. 1). This standard approach yields time-additive returns and, critically, provides a distribution that more closely approximates the normality assumption required for the parametric tests used to assess statistical significance (Armitage, 1995).

$$R_{it} = \ln \frac{P_{it}}{P_{it-1}} \cdot 100, \tag{1}$$

where R_{it} is actual daily return of firm i on day t, P_{it} is the closing stock price of firm i on day t and P_{it-1} is the closing stock price of firm i on day $t-1$.

Expected (normal) returns were estimated using the single-factor market model, with parameters derived via Ordinary Least Squares (OLS). This model is standard in event study literature as it controls for systematic, market-wide movements, thereby reducing the variance of the abnormal return and increasing the statistical power of the test (Cable and Holland, 1999; Dyckman et al., 1984; MacKinlay, 1997). Its empirical validity has been well-established since the foundational work of (Fama et al., 1969). The model's demonstrated robustness across diverse market environments makes it particularly well-suited for this multi-country investigation of the global defense sector (Campbell et al., 2010). The market model is specified as follows:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \epsilon_{it}, \tag{2}$$

where R_{it} is return of firm i on day t, R_{mt} is the market return on day t, α_i and β_i are the regression parameters for firm i, and ϵ_{it} is the error term. The market return R_{mt} for each firm is calculated based on the respective benchmark indexes where the firm is listed.

3.2.3 Abnormal Returns (AR) and Cumulative Abnormal Returns (CAR)

Once the parameters were estimated, the expected returns R_{it} for each stock during the event window were calculated, and the abnormal return was computed as:

$$\mathrm{AR}_{it} = R_{it} - \hat{R}_{it}, \tag{3}$$

where AR_{it} shows the abnormal return on index i on day t, and R_{it} shows the actual return on the index i on day t.

The Average Abnormal Return (AAR) across N firms for each day t in the event window was then calculated as:

$$\mathrm{AAR}_t = \frac{1}{N} \sum_{i=1}^{n} \mathrm{AR}_{it}, \tag{4}$$

where AAR_t is the Average abnormal return on day t, N is the total number of firms in the sample.

To capture the cumulative effect of the event over multiple days, Cumulative Abnormal Returns (CAR) for a firm i over an event window from day t_1 to day t_2 were computed as:

$$\mathrm{CAR}_{i(t_1,t_2)} = \sum_{t=t_1}^{t_2} \mathrm{AR}_{it}, \tag{5}$$

where $\mathrm{CAR}_{i(t_1\ ,t_2\ )}$ is the cumulative abnormal return for firm i from day t_1 to day t_2.

Finally, this study used AAR to calculate the cumulative average abnormal returns (CAARs) for the event window. The Cumulative Average Abnormal Return (CAAR) for the entire sample over the same period was calculated as:

$$\mathrm{CAAR}_{(t_1,t_2)} = \frac{1}{N} \sum_{i=1}^{N} \mathrm{CAR}_{i(t_1,t_2)}, \tag{6}$$

where $\mathrm{CAAR}_{(t_1,t_2)}$ is the cumulative average abnormal return over the event window t_1 to t_2.

3.3 Significance Testing

To ensure the statistical robustness of the findings, this study employs a suite of both parametric and non-parametric tests. For the significance of abnormal returns, the standardized cross-sectional t-test developed by Boehmer et al. (1991) is used, which accounts for event-induced heteroskedasticity by standardizing abnormal returns by their firm-specific, estimation-period standard deviation. To complement this and ensure robustness to non-normal return distributions and outliers, the non-parametric Wilcoxon signed-rank test

(Wilcoxon, 1945) is also applied. This dual-testing approach aligns with best practices in contemporary event study research, e.g., Nerlinger and Utz (2022), Yousaf et al. (2022). Given that financial return data frequently exhibit non-normality (e.g., fat tails and skewness), which can affect the reliability of parametric tests, the inclusion of the non-parametric Wilcoxon test serves as a crucial robustness check to validate our findings. To test for significant differences between subsample groups, this study uses an independent samples t-test with correction for unequal variances, and its non-parametric equivalent, the Mann-Whitney U test (Mann and Whitney, 1947).

4 FINDINGS, ANALYSIS AND DISCUSSION

4.1 Overall Market Reaction and Sustained Revaluation of the Sector

The empirical results (see Tab. 2 and Fig. 3) provide robust and statistically significant support for our primary hypothesis (H_1). As depicted in the AAR chart, the global Defense and Aerospace (D&A) sector experienced a substantial positive abnormal return of 1.464% on the event day (Day 0), which is highly significant (t-stat = 5.59). This finding is consistent with the established "war stocks" phenomenon, confirming that investors immediately priced in the anticipation of a sharp increase in government defense spending and military procurement following the invasion (Schneider and Troeger, 2006; Hudson and Urquhart, 2015). This "flight-to-arms" reaction aligns with contemporary studies on the Ukraine conflict which document a similar positive revaluation of the D&A sector, positioning it as a hedge against the widespread negative returns that permeated most other industries (Zhang et al., 2022; Covachev and Fazakas, 2025).

Critically, the analysis of cumulative returns reveals that this was not a fleeting, single-day event. The CAAR over the full $[-10, +10]$ event window reached 7.38%, a figure that is both statistically and economically significant (t-stat = 5.11). This sustained accumulation of abnormal returns demonstrates a fundamental and persistent revaluation of the D&A sector over a multi-week period, suggesting that as more information about the conflict's scale and the West's resolve became available, investors continually revised their long-term growth expectations for these firms upward.

A more detailed examination of the daily AARs reveals a sophisticated market response characterized by both anticipation and post-event information processing. The market did not wait for the formal invasion to begin reacting; there was a statistically significant positive AAR of 0.479% on Day -1 (t-stat = 3.04). This provides strong evidence of market anticipation, suggesting that investors were actively processing information regarding troop buildups and escalating political rhetoric, and pricing in the increasing probability of a full-scale military conflict. This finding aligns with the principles of semi-strong market efficiency and is consistent with research showing that markets in close proximity to the conflict began reacting even before the event date (Yousaf et al., 2022).

Intriguingly, the single largest abnormal return did not occur on the event day itself, but on Day +2, with an AAR of 2.426% (t-stat = 8.74). This delayed, yet more pronounced, reaction can be critically interpreted in several ways. First, it suggests that while the invasion itself was anticipated, its full implications including the speed and severity of the Western response, the announcement of unprecedented sanctions, and commitments to substantial military aid were not fully priced in on Day 0. The spike on Day +2 likely reflects the market's absorption of this new information, which clarified the immense scale of future demand for military hardware and technology. Second, this pattern suggests that the initial reaction on Day 0 may have been an underestimation of the conflict's likely duration and intensity. As the reality of a prolonged and major European war set in, investors drastically revised their expectations upward, leading to a second and

Tab. 2: Average Abnormal Returns (AAR) and Cumulative AAR (CAAR) around the event date with parametric and non-parametric significance tests

Event Day	AAR	Cross Sectional T Test	Wilcoxon Signed-Rank Test	Event Day	AAR	Cross Sectional T Test	Wilcoxon Signed-Rank Test
Average Abnormal Return (AAR)							
−10	0.048%	0.35	0.347	1	0.025%	0.11	0.11
−9	−0.212%	−1.21	−1.18	2	2.426%	8.74***	8.54***
−8	0.566%	3.25***	3.18***	3	1.436%	5.01***	4.89***
−7	−0.102%	−0.66	−0.64	4	0.040%	0.20	0.19
−6	0.334%	1.63**	1.59	5	0.068%	0.28	0.27
−5	0.396%	3.03***	2.96***	6	0.454%	1.84*	1.80*
−4	−0.046%	−0.29	−0.28	7	0.694%	2.92***	2.84***
−3	−0.166%	−0.89*	−0.87	8	−0.576%	−1.58	−1.54
−2	0.083%	0.52	0.51	9	−0.793%	−0.72	−0.71
−1	0.479%	3.04***	2.96***	10	0.590%	3.02***	2.94***
0	1.464%	5.59***	5.46***				
Cumulative Average Abnormal Return (CAAR)							
$[-1, 0]$	1.94%	6.85***	−6.90***	$[-2, +2]$	4.47%	9.75***	−9.87***
$[0, 0]$	1.46%	5.59***	−5.44***	$[-3, +3]$	5.74%	8.73***	−9.92***
$[0, +1]$	1.48%	5.04***	−5.68***	$[-5, +5]$	6.20%	8.07***	−9.16***
$[-1, +1]$	1.96%	6.43***	−7.37***	$[-10, +10]$	7.20%	5.11***	−6.41***

Note: This table reports the Average Abnormal Returns (AAR) for each event day ($t - 10$ to $t + 10$) and the Cumulative Average Abnormal Returns (CAAR) for various event windows for the global sample of 370 firms. For both the daily AARs and the cumulative CAARs, the provided cross-sectional t-test and Wilcoxon signed-rank test are used to evaluate the null hypothesis that the abnormal return is equal to zero. All AAR and CAAR values are presented in percent, with Day 0 representing the invasion date and significance levels denoted by asterisks: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

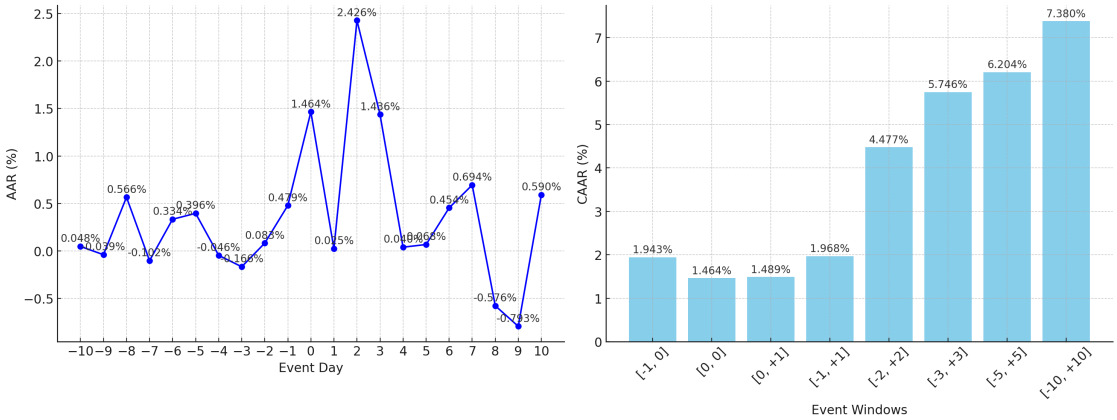


Fig. 3: Abnormal Returns: AAR Over Event Days and CAAR Across Event Windows

more powerful wave of capital rotation into the sector. The subsequent positive AARs on days +3, +6, and +7 further reinforce this narrative of sustained positive sentiment as the new geopolitical reality was digested by the market.

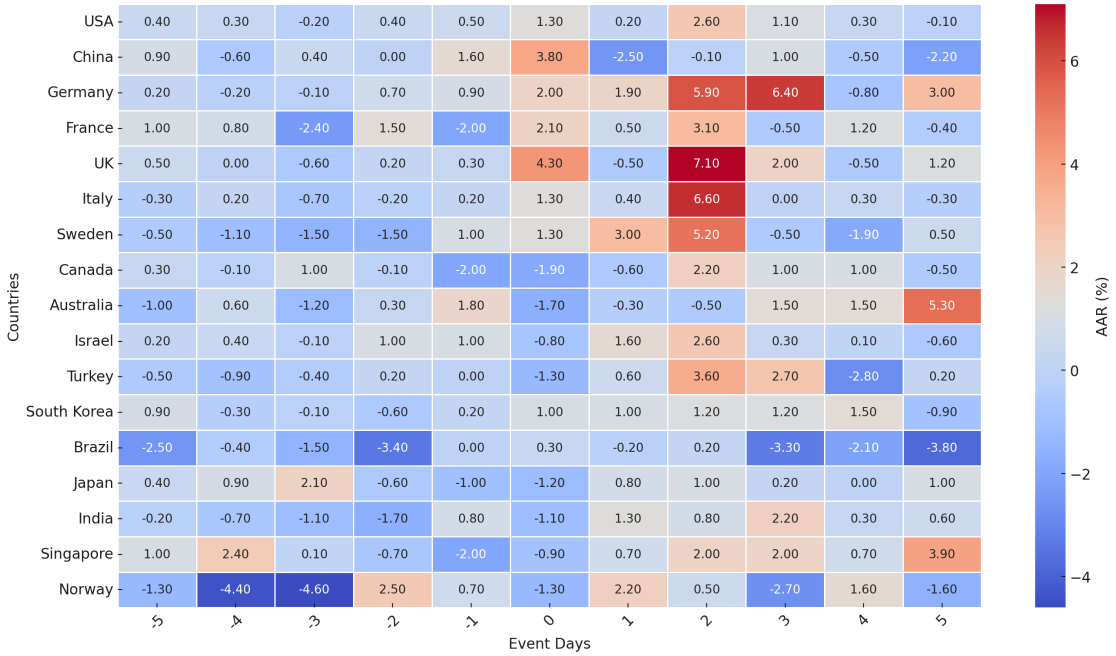
4.2 Firms Domicile-Wise Market Reaction Analysis

A granular, country-level analysis (see Tab. 3 and Fig. 4) of abnormal returns reveals a stark and theoretically significant divergence in market reactions, primarily driven by a nation's geopolitical alignment and geographical proximity to the conflict. The most powerful positive reaction was concentrated in European nations central to the NATO alliance and the United States. Firms in Germany, the United Kingdom, Italy, and Sweden experienced exceptionally large and statistically significant positive abnormal returns, with the most pronounced gains occurring not on the event day itself but in the immediate aftermath. For instance, German firms posted a staggering AAR of 5.90% on Day +2 and 6.40% on Day +3, while UK firms saw a massive AAR of 7.10% on Day +2. This powerful, synchronized surge critically reframes the "proximity penalty" discussed in the literature (Grinius and Baležentis, 2025); for the D&A sector, geographic closeness to the conflict transformed a regional macroeconomic risk into a powerful sectoral boon. This provides robust support for the "military preparedness dividend" theory, where investors priced in an imminent regional threat that would necessitate immediate and substantial budgetary reallocations across the continent (Boubaker et al., 2022).

Conversely, this bullish sentiment was largely absent in nations geographically distant from the conflict, even among politically aligned, developed economies. Firms in Canada, Australia, and Japan exhibited ambivalent or even negative returns, such as Canada's −1.90% AAR on Day 0. This divergence suggests that for these countries, the negative macroeconomic externalities of the war such as supply chain disruptions and heightened global risk aversion (Nemat et al., 2025) tempered or neutralized the positive sector-specific sentiment. The negative effect was even more pronounced in non-aligned emerging markets like Brazil and India, which posted significant negative AARs of −3.40% (Day −2) and −1.10% (Day 0) respectively. For these nations, a general "flight from emerging market risk" appears to have dominated investor decisions, a phenomenon well-documented during global crises (Mohamad, 2022; Keleş, 2023).

The unique cases of strategically positioned allies and non-aligned major powers further highlight the sophistication of the market's response. Israel, a leading defense exporter, and Turkey, a critical NATO member, saw strong positive AARs of 2.60% and 3.60% respectively on Day +2, indicating that investors were also rewarding firms for their combat-proven technology and strategic importance. Perhaps most revealing is the volatile reaction of Chinese firms: a sharp positive AAR of 3.80% on Day 0 was immediately erased by a significant negative reversal of −2.50% on Day +1. This sharp gyration likely reflects a rapid repricing of risk as initial speculation gave way to sophisticated investor fears of secondary sanctions and escalating geopolitical tensions with the West (Yang et al., 2023; Wang and Su, 2023). Collectively, these divergent trajectories demonstrate a highly rational market response, where the primary driver of positive returns was not simply the existence of conflict, but a firm's location within the political and geographic nexus of the Western alliance poised to respond to it.

The analysis of Cumulative Average Abnormal Returns (CAAR; see Tab. 4 and Fig. 5) moves beyond the immediate shocks to reveal the sustained and fundamental nature of this market revaluation. The powerful, upward-trending CAARs for firms in key European nations confirm that the positive daily AARs were not temporary spikes but compounded into a significant and lasting repricing of the sector. For instance, the massive daily returns for German firms on Day +2 and +3 accumulated into a remarkable CAAR of 19.92% over the $[-5, +5]$ window. This persistent accumulation,



Note: The heatmap displays Average Abnormal Returns (AAR) for different countries across event days (−5 to +5). The color intensity represents the magnitude of AAR values, with blue indicating negative values and red indicating positive values. This allows for easy comparison of market reactions before, during, and after the event across different countries. Countries with more red show positive AAR, while those with blue show negative or neutral responses.

Fig. 4: Heatmap of Average Abnormal Returns (AAR) Across Event Days for Different Countries

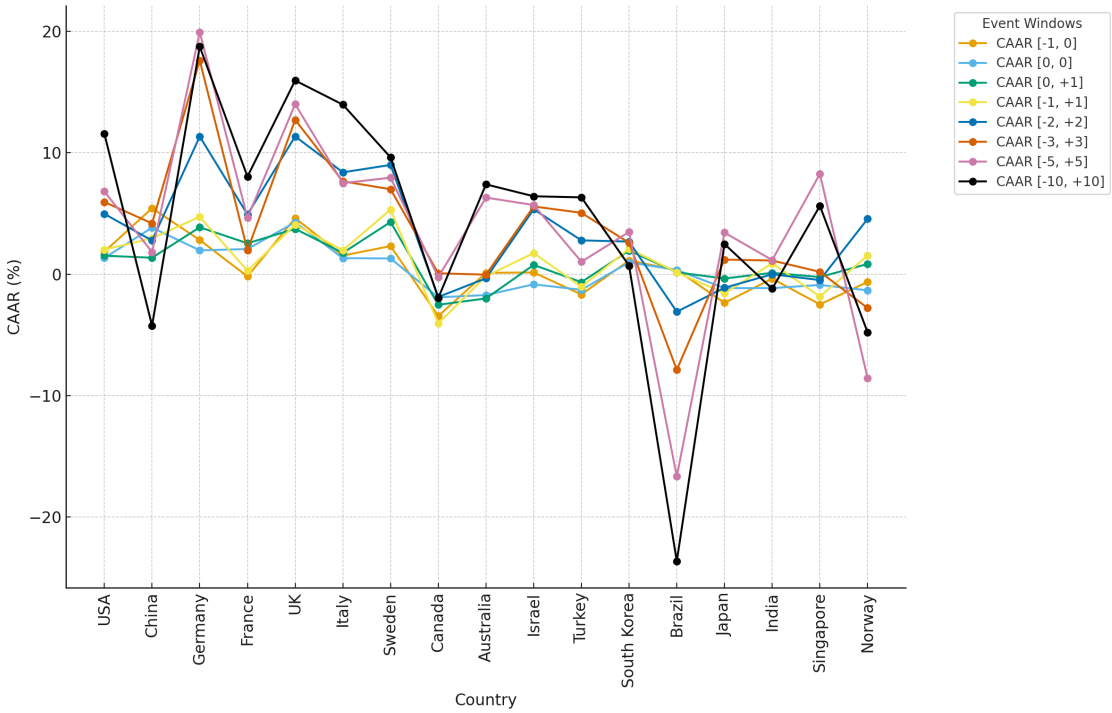


Fig. 5: Cumulative Abnormal Returns (CAAR) Across Countries for Different Event Windows

Tab. 3: Defense & Aerospace Firms' Country Specific Market Reaction (AAR)

Country (Firms)	Event Days	−5	−4	−3	−2	−1	0	1	2	3	4	5
USA	AAR	0.400%	0.300%	−0.200%	0.400%	0.500%	1.300%	0.200%	2.600%	1.100%	0.300%	−0.100%
(93)	CSect T	1.218	0.976	−0.335	1.124	1.722	2.967***	0.611	5.785***	2.885***	0.982	−0.319
	Wilcoxon	2.099**	1.801*	0.399	1.601	1.993*	3.099***	0.899	5.200***	2.701**	1.205	0.499
China	AAR	0.900%	−0.600%	0.400%	0.000%	1.600%	3.800%	−2.500%	−0.100%	1.000%	−0.500%	−2.200%
(71)	CSect T	3.167***	−1.113	1.469	−0.165	6.330***	6.506***	−11.970***	−0.737	4.506***	−1.673	−10.300***
	Wilcoxon	2.902**	1.703*	0.500	0.204	3.302***	3.504***	0.191	4.798***	2.794***	1.402	0.104
Germany	AAR	0.200%	−0.200%	−0.100%	0.700%	0.900%	2.000%	1.900%	5.900%	6.400%	−0.800%	3.000%
(38)	CSect T	0.777	−0.389	−0.217	1.460	1.840*	2.667***	1.528	4.516***	3.398***	−0.890	2.426**
	Wilcoxon	1.503	1.202	0.604	1.691	2.299	2.997***	1.799*	4.499***	3.409***	1.199	0.404
France	AAR	1.000%	0.800%	−2.400%	1.500%	−2.000%	2.100%	0.500%	3.100%	−0.500%	1.200%	−0.400%
(14)	CSect T	0.976	0.578	−1.329	1.049	−1.160	1.127	0.233	1.574	−0.190	0.547	−0.244
	Wilcoxon	1.295	0.993	1.795*	1.192	0.801	1.394	0.206	2.009	0.395	0.993	0.208
UK	AAR	0.500%	0.000%	−0.600%	0.200%	0.300%	4.300%	−0.500%	7.100%	2.000%	−0.500%	1.200%
(22)	CSect T	1.905*	−0.144	−2.070*	0.541	1.495	4.190***	−1.469	5.127***	1.633	−0.649	2.020*
	Wilcoxon	2.114**	0.805	1.394	0.998	2.297**	2.995**	1.501	4.602***	1.991*	0.897	1.106
Italy	AAR	−0.300%	0.200%	−0.700%	−0.200%	0.200%	1.300%	0.400%	6.600%	0.000%	0.300%	−0.300%
(7)	CSect T	−0.515	0.736	−1.409	−0.363	0.361	0.606	0.368	2.028*	−0.036	0.223	−0.269
	Wilcoxon	0.706	0.898	0.291	0.596	0.906	1.197	0.395	2.092*	0.303	0.809	0.405
Sweden	AAR	−0.500%	−1.100%	−1.500%	−1.500%	1.000%	1.300%	3.000%	5.200%	−0.500%	−1.900%	0.500%
(8)	CSect T	−0.347	−1.382	−1.812	−2.397**	0.587	0.576	1.201	1.648	−0.470	−1.215	0.308
	Wilcoxon	0.993	0.795	1.001	2.197***	0.998	1.395	1.298	2.799***	0.494	0.901	0.292
Canada	AAR	0.300%	−0.100%	1.000%	−0.100%	−2.000%	−1.900%	−0.600%	2.200%	1.000%	1.000%	−0.500%
(17)	CSect T	0.345	−0.187	1.246	−0.057	−1.830	−1.080	−1.029	1.741	0.750	−0.041	−0.413
	Wilcoxon	0.594	0.396	1.107	0.797	1.492	1.205	1.397	2.396**	1.201	0.319	0.506
Australia	AAR	−1.000%	0.600%	−1.200%	0.300%	1.800%	−1.700%	−0.300%	−0.500%	1.500%	1.500%	5.300%
(11)	CSect T	−1.819*	0.816	−1.486	0.119	1.809	−0.831	−0.107	−0.166	1.984*	0.505	1.414
	Wilcoxon	0.891	1.199	0.492	0.893	1.105	0.705	1.001	1.498	2.109**	1.306	0.605
Israel	AAR	0.200%	0.400%	−0.100%	1.000%	1.000%	−0.800%	1.600%	2.600%	0.300%	0.100%	−0.600%
(11)	CSect T	0.601	1.187	−0.278	1.386	1.473	−0.930	1.754	2.497**	0.825	0.101	−0.863
	Wilcoxon	0.301	1.199	0.296	0.996	1.192	0.797	1.299	2.199**	1.101	0.501	0.299
Türkiye	AAR	−0.500%	−0.900%	−0.400%	0.200%	0.000%	−1.300%	0.600%	3.600%	2.700%	−2.800%	0.200%
(2)	CSect T	−1.462	−2.994*	−5.083**	0.305	−0.210	−1.302	0.433	0.744	0.754	−1.167	0.124
	Wilcoxon	1.092	0.691	1.303	2.003*	1.498	0.796	1.101	1.492	1.195	1.003	0.897
South	AAR	0.900%	−0.300%	−0.100%	−0.600%	0.200%	1.000%	1.000%	1.200%	1.200%	1.500%	−0.900%
Korea	CSect T	2.190*	−1.033	−0.252	−1.706	0.784	0.879	1.159	2.748**	−0.449	2.236**	−1.837
(26)	Wilcoxon	1.797	1.008	0.504	0.999	2.299	2.199	2.091	4.394***	0.697	2.193**	1.711
Brazil	AAR	−2.500%	−0.400%	−1.500%	−3.400%	0.000%	0.300%	−0.200%	0.200%	−3.300%	−2.100%	−3.800%
(2)	CSect T	−12.800***	−1.948	−0.729	−1.094	−0.001	0.197	−0.165	0.083	−2.375	−1.891	−7.959**
	Wilcoxon	3.001***	1.203	−0.199	0.903	0.109	1.501	0.807	0.994	2.007	1.807	−8.159**
Japan	AAR	0.400%	0.900%	2.100%	−0.600%	−1.000%	−1.200%	0.800%	1.000%	0.200%	0.000%	1.000%
(15)	CSect T	0.715	1.452	1.515	−1.307	−1.860	−2.055*	0.863	2.627**	0.471	−0.066	1.302
	Wilcoxon	1.193	1.904	1.003	0.892	1.803	1.993*	1.201	2.505**	0.508	0.909	1.004
India	AAR	−0.200%	−0.700%	−1.100%	−1.700%	0.800%	−1.100%	1.300%	0.800%	2.200%	0.300%	0.600%
(17)	CSect T	−0.362	−2.113**	−1.815*	−3.620***	1.429	−2.549**	1.888*	1.435	2.014*	0.563	1.181
	Wilcoxon	1.501	3.895***	1.801*	2.092**	1.197	0.991	1.991	2.393	1.791	1.207	0.991
Singapore	AAR	1.000%	2.400%	0.100%	−0.700%	−2.000%	−0.900%	0.700%	2.000%	2.000%	0.700%	3.900%
(6)	CSect T	0.640	1.964	0.480	−1.227	−0.540	−1.130	1.234	1.006	0.435	0.542	1.920
	Wilcoxon	0.407	0.797	0.494	1.205	0.808	0.893	1.198	1.597	1.108	1.007	2.309*
Norway	AAR	−1.300%	−4.400%	−4.600%	2.500%	0.700%	−1.300%	2.200%	0.500%	−2.700%	1.600%	−1.600%
(4)	CSect T	−1.609	−1.310	−2.283	1.343	0.321	−1.670	2.487*	0.166	−0.861	1.356	−0.794
	Wilcoxon	1.297	0.991	−0.844	2.001	1.199	−1.906	1.106	0.492	−1.797	1.101	−1.493

Note: This table reports the Average Abnormal Returns (AAR) for each event day ($t-10$ to $t+10$) and the Cumulative Average Abnormal Returns (CAAR) for various event windows for the full global sample of 370 firms. For both the daily AARs and the cumulative CAARs, the provided cross-sectional t-test and Wilcoxon signed-rank test evaluate if the abnormal return is statistically different from zero. All return values are in percent. Day 0 is the invasion date. Significance levels are denoted by asterisks: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

also seen in the UK (15.94%) and Italy (13.95%) over the full event window, demonstrates that investors' positive sentiment grew stronger over time as the paradigm shift in European security policy became more evident. Conversely, the CAAR results confirm the enduring negative sentiment for firms outside the Western alliance. The negative daily returns observed for Brazilian firms compounded into a catastrophic CAAR of −23.63% in the $[-10, +10]$ window, indicating that the initial negative reaction was not an overreaction but the start of a sustained flight of capital. Perhaps most tellingly, the CAAR for Chinese firms illustrates a complete

Tab. 4: Country Specific CAAR

Country (Firms)	Event Windows	[−1, 0]	[0, 0]	[0, +1]	[−1, +1]	[−2, +2]	[−3, +3]	[−5, +5]	[−10, +10]
USA	CAAR	1.840%	1.330%	1.520%	2.020%	4.960%	5.940%	6.810%	11.570%
(93)	CSect T	4.030***	3.000***	3.040***	4.220***	7.020***	5.300***	6.430***	5.530***
	Wilcoxon	4.278***	2.931***	3.364***	4.982***	6.903***	5.183***	7.220***	5.914***
China	CAAR	5.430%	3.830%	1.350%	2.950%	2.770%	4.180%	1.820%	−4.240%
(71)	CSect T	10.170***	6.590***	2.680***	6.280***	5.170***	5.650***	−4.240***	−8.120***
	Wilcoxon	9.935***	6.861***	2.448**	6.047***	5.291***	4.693***	−5.102***	−8.401***
Germany	CAAR	2.810%	1.960%	3.860%	4.720%	11.330%	17.590%	19.920%	18.730%
(38)	CSect T	3.453***	2.667***	3.298***	3.807***	5.243***	5.024***	4.230***	3.942***
	Wilcoxon	2.947***	2.824***	2.844***	3.101***	5.976***	4.911***	4.264***	3.230***
France	CAAR	−0.190%	2.070%	2.540%	0.280%	4.910%	1.970%	4.640%	8.030%
(14)	CSect T	−0.281	3.057***	3.751***	0.414	7.252***	2.910***	6.853***	11.860***
	Wilcoxon	−0.250	2.663***	2.981***	0.350	3.899***	2.173***	3.521***	4.200***
UK	CAAR	4.610%	4.270%	3.730%	4.070%	11.340%	12.700%	13.990%	15.940%
(22)	CSect T	4.114***	4.190***	2.956***	2.996***	4.584***	3.769***	4.255***	4.639**
	Wilcoxon	4.107***	3.661***	3.367***	2.386**	3.988***	2.789***	3.591***	3.737***
Italy	CAAR	1.530%	1.320%	1.750%	1.960%	8.380%	7.640%	7.490%	13.950%
(7)	CSect T	0.588	0.606	1.047	1.039	2.994***	2.659**	3.548***	3.879***
	Wilcoxon	0.957	0.692	0.989	0.888	2.254**	2.299**	3.318***	3.408***
Sweden	CAAR	2.310%	1.290%	4.290%	5.310%	8.990%	6.990%	7.940%	9.610%
(8)	CSect T	0.723	0.576	2.182**	2.113**	3.150***	2.450**	2.893***	3.050***
	Wilcoxon	0.895	−0.306	1.944*	2.058**	2.850***	2.250**	2.674***	2.800***
Canada	CAAR	−3.450%	−1.910%	−2.520%	−4.060%	−1.880%	0.070%	−0.250%	−1.960%
(17)	CSect T	−1.912*	−1.080	−1.339	−3.819**	−2.574**	0.258	−0.850	−2.416**
	Wilcoxon	−2.332*	−1.235	−1.173	−3.450**	−2.306**	0.218	−0.754	−2.292**
Australia	CAAR	0.110%	−1.720%	−2.000%	−0.170%	−0.340%	−0.040%	6.300%	7.390%
(11)	CSect T	0.066	−0.831	−0.657	0.804	−1.805	−2.101*	−0.895	−1.203
	Wilcoxon	0.472	−0.153	−0.693	0.756	−1.602	−1.900*	−0.804	−1.105
Israel	CAAR	0.140%	−0.840%	0.760%	1.730%	5.340%	5.570%	5.690%	6.410%
(11)	CSect T	0.098	−0.930	0.592	0.973	2.851***	2.837***	2.341***	2.158***
	Wilcoxon	0.080	−0.148	−0.718	1.384	2.895***	2.687***	2.387**	1.164
Türkiye	CAAR	−1.670%	−1.290%	−0.660%	−1.040%	2.780%	5.050%	1.020%	6.320%
(2)	CSect T	−2.100	−1.302	−0.272	−1.587	0.452	0.517	0.553	0.659
	Wilcoxon	−2.210	−1.123	0.467	−1.846	0.048	0.266	1.011	0.823
South Korea	CAAR	1.120%	0.970%	1.940%	2.090%	2.680%	2.580%	3.470%	0.700%
	CSect T	0.864	0.639	2.201**	2.457**	2.662**	2.446**	2.236**	0.217
(26)	Wilcoxon	0.599	0.896	2.250**	2.941***	2.311**	2.282**	2.040**	−0.515
Brazil	CAAR	0.340%	0.340%	0.150%	0.150%	−3.090%	−7.870%	−16.660%	−23.630%
(2)	CSect T	4.147*	0.197	0.257	0.123	−0.489	−0.809	−0.968	−0.845
	Wilcoxon	4.295*	0.328	0.260	0.006	−1.197	−1.019	−1.139	−1.246
Japan	CAAR	−2.360%	−1.150%	−0.360%	−1.570%	−1.120%	1.200%	3.420%	2.480%
(15)	CSect T	−2.044**	−2.055**	−0.579	−2.468**	−1.161	0.875	1.710	0.659
	Wilcoxon	−2.125**	−1.853*	0.364	−2.381**	−1.032	0.838	0.751	0.646
India	CAAR	−0.370%	−1.150%	0.110%	0.890%	−0.010%	1.120%	1.160%	−1.200%
(17)	CSect T	−0.500	−2.549**	0.139	0.927	−0.010	0.617	4.272***	3.866***
	Wilcoxon	−0.470	−1.317	0.043	1.078	−0.027	0.033	4.843***	4.242***
Singapore	CAAR	−2.490%	−0.890%	−0.240%	−1.840%	−0.490%	0.190%	8.250%	5.620%
(6)	CSect T	−0.793	−1.130	−0.264	−0.549	−0.277	0.066	2.531***	3.165**
	Wilcoxon	−0.397	−1.585	0.437	−1.250	0.016	1.161	2.036**	2.882***
Norway	CAAR	−0.640%	−1.330%	0.840%	1.530%	4.550%	−2.790%	−8.570%	−4.790%
(4)	CSect T	−0.319	−1.670	1.894	0.740	1.515	−0.521	0.366	0.708
	Wilcoxon	−0.269	−1.922*	1.119	0.774	0.984	−0.284	−0.094	1.483

Note: This table reports the country-specific Cumulative Average Abnormal Returns (CAAR) for various event windows. For each country and event window, the provided cross-sectional t-test (CSect T) and Wilcoxon signed-rank test evaluate if the CAAR is statistically different from zero. All CAAR values are in percent. Day 0 is the invasion date. Significance levels are denoted by asterisks:
* ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

reversal of initial sentiment; the strong positive reaction around Day 0 was entirely erased over the subsequent days, resulting in a negative CAAR of −4.24% for the full window. In essence, the CAAR analysis confirms that the daily reactions identified in the AAR data were not isolated events but were part of a persistent, multi-week re-evaluation where investors systematically rewarded firms within the core Western alliance while punishing or divesting from those perceived to be on the outside of it.

4.3 Cross-Regional Analysis of Market Reactions

The analysis of market reactions on a geographic regional basis reveals a profound and statistically significant heterogeneity between the three major domiciles: Europe, the Americas, and Asia (see Tab. 5 and Fig. 6) confirmed by both ANOVA (F-stat = 2.99, p = 0.052) and Kruskal-Wallis tests (H-stat = 7.60, p = 0.022). The most powerful positive reaction was concentrated in Europe, which posted a remarkable CAAR of 17.76% over the full event window. This finding critically inverts the "proximity penalty"; while broader European markets suffered due to their high trade and energy dependence (Demir and Duan, 2018; Grinius and Baležentis, 2025), for D&A firms, this same proximity acted as a powerful positive catalyst. The largest gains occurred on Day +2, suggesting the market was reacting to major policy shifts like Germany's Zeitenwende, rather than the invasion itself, a finding consistent with studies documenting the outperformance of European defense stocks post-invasion (Covachev and Fazakas, 2025; Licht, 2023). North American firms also saw a robust positive CAAR of 8.96%, though the lesser magnitude suggests investors priced in the most urgent budgetary increases occurring on the continent directly facing the threat. In stark contrast, the reaction of Asian firms was negative overall (CAAR of −0.38%), demonstrating that for these distant nations, adverse macroeconomic consequences like inflationary pressures and volatility spillovers overwhelmed any speculative sectoral benefit (Fang and Shao, 2022). This aligns with the "risk-off" sentiment that often triggers capital outflows from emerging markets during global uncertainty (Zehri et al., 2025).

4.4 Cross-Sectional Analysis by Economic Status

Stratifying by firms' home-country income status reveals a large, statistically significant asymmetry in market reactions, consistent with H_3 (see Tab. 6 and Fig. 7). Firms headquartered in developed economies exhibit a pronounced and durable positive response, with CAAR cumulating to 10.91% over the full $[-10, +10]$ window. This trend accelerated in the days following the invasion, reflecting a pronounced "flight to quality" within the sector as investors favored the stability and strategic positioning of these firms. Investors disproportionately rewarded firms in developed nations, likely perceiving them as the most reliable and direct beneficiaries of the large, coordinated government defense contracts that followed the invasion (Gaio et al., 2022). These firms benefit from stable political systems, established procurement relationships with Western governments, and the industrial capacity to scale production, making them a safer bet during a period of extreme uncertainty. This confirms that while a geopolitical shock may briefly lift all boats in a sector, enduring value is ascribed only to those firms in developed economies perceived as having the institutional and political resilience to truly capitalize on the new geopolitical landscape (Assaf et al., 2023; Joshi et al., 2023).

Conversely, firms in developing economies followed a starkly different trajectory. An initially stronger positive reaction around the event day, with a CAAR of 4.11% in the $[-1, 0]$ window, rapidly and dramatically reversed in the post-event period. This initial speculative surge was completely erased, with the CAAR plummeting to a final, statistically significant −3.87% over the full event window. As discussed previously, this reversal strongly suggests that the adverse macroeconomic consequences of the conflict

Tab. 5: AAR, CAAR, and Variance analysis Across Different Regions

Event	North & South America (115)			Europe (95)			Asia (160)		
Day	AAR	CSect T	Wilcoxon	AAR	CSect T	Wilcoxon	AAR	CSect T	Wilcoxon
−10	0.53%	2.145**	1.501	0.51%	1.521	1.065	−0.57%	−3.597***	−2.518**
−9	0.01%	0.021	0.015	0.17%	0.708	0.496	−0.60%	−3.362***	−2.353**
−8	0.76%	2.282**	1.597	0.63%	2.414**	1.690*	0.39%	1.364	0.955
−7	0.02%	0.060	0.042	−0.48%	−1.362	−0.953	0.04%	0.189	0.132
−6	1.27%	2.887***	2.021**	0.75%	2.050**	1.435	−0.59%	−2.234**	−1.564
−5	0.30%	1.082	0.757	0.24%	0.995	0.697	0.56%	3.160***	2.212**
−4	0.23%	0.838	0.587	−0.24%	−0.792	−0.554	−0.12%	−0.492	−0.344
−3	−0.02%	−0.046	−0.032	−0.92%	−2.555**	−1.789*	0.18%	0.863	0.604
−2	0.24%	0.779	0.545	0.52%	1.651	1.156	−0.29%	−1.311	−0.918
−1	0.19%	0.680	0.476	0.22%	0.567	0.397	0.84%	4.164***	2.915***
0	0.84%	1.812*	1.268	2.20%	4.249***	2.974***	1.47%	3.666***	2.566***
1	0.06%	0.227	0.159	1.11%	1.775*	1.243	−0.65%	−2.193**	−1.535
2	2.48%	5.993***	4.195***	5.49%	7.191***	5.034***	0.54%	2.181**	1.527
3	1.04%	2.724	1.907	2.86%	2.987***	2.091***	0.87%	4.865***	3.406***
4	0.23%	0.754	0.528	−0.36%	−0.697	−0.488	0.15%	0.572	0.400
5	−0.23%	−0.689	−0.482	1.41%	2.338**	1.637	−0.53%	−1.556	−1.089
6	0.24%	0.673	0.471	2.18%	2.820***	1.974*	−0.43%	−2.342***	−1.639*
7	1.05%	1.769*	1.238	0.58%	1.206	0.844	0.50%	2.488***	1.742*
8	0.35%	0.717	0.502	0.17%	0.138	0.097	−1.69%	−6.794***	−4.760***
9	−0.27%	−0.795	−0.557	−1.01%	−0.241	−0.169	−1.04%	−5.251***	−3.680***
10	−0.36%	−1.054	−0.738	1.76%	3.174***	2.222**	0.57%	3.439***	2.407***
Window	**CAAR**	**CSect T**	**Wilcoxon**	**CAAR**	**CSect T**	**Wilcoxon**	**CAAR**	**CSect T**	**Wilcoxon**
$[-1, 0]$	1.03%	2.094	1.466	2.41%	4.191	2.934	2.32%	5.352	3.746
$[0, 0]$	0.84%	1.812	1.268	2.20%	4.249	2.974	1.47%	3.666	2.566
$[0, +1]$	0.90%	1.743	1.220	3.30%	4.495	3.147	0.83%	2.331	1.632
$[-1, +1]$	1.09%	2.066	1.446	3.52%	4.630	3.241	0.91%	1.853	1.297
$[-2, +2]$	3.81%	5.083	3.558	9.53%	7.973	5.581	1.92%	4.274	2.992
$[-3, +3]$	4.83%	4.601	3.221	11.47%	5.965	4.175	2.97%	5.589	3.912
$[-5, +5]$	5.36%	4.223	2.956	12.51%	5.750	4.025	3.03%	4.442	3.109
$[-10, +10]$	8.96%	4.584	3.209	17.76%	3.955	2.769	−0.38%	−0.423	−0.296

Analysis of Variance Test	**Statistics**	***p*-value**
ANOVA (F Statistic)	2.9979*	0.0524
Kruskal-Wallis (H Statistic)	7.5973**	0.0224

Note: This table reports the Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) for firms segmented by geographic region (North & South America, Europe, and Asia). For both the daily AARs and the cumulative CAARs within each region, the provided cross-sectional t-test (CSect T) and Wilcoxon signed-rank test evaluate if the abnormal return is statistically different from zero. All return values are in percent. The 'Analysis of Variance' section tests for significant differences between the regions. Day 0 is the invasion date. Significance levels are denoted by asterisks: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Tab. 6: AAR & CAAR for D&A Firms in Developed and Developing Economies

	Developed			Developing		
Event Day	**AAR**	**CSect T**	**Wilcoxon**	**AAR**	**CSect T**	**Wilcoxon**
−10	0.44%	2.7242***	−2.564**	−1.13%	−5.441***	−2.518**
−9	0.16%	0.7452**	2.606**	−1.34%	−7.622***	−2.353**
−8	0.22%	1.0499	1.170	1.59%	6.464***	0.955
−7	−0.18%	−0.9631	0.373	0.14%	0.580	0.132
−6	0.84%	3.6511***	−1.435	−1.17%	−2.882**	−1.564
−5	0.33%	2.1458**	1.082	0.58%	2.472**	2.212**
−4	0.14%	0.8463	0.838	−0.60%	−1.518	−0.344
−3	−0.24%	−1.0383	−0.046	0.06%	0.255	0.604
−2	0.25%	1.2856	0.779	−0.42%	−1.835	−0.918
−1	0.18%	0.9266	0.685	1.37%	6.081***	2.915***
0	1.04%	3.4451***	1.812*	2.73%	5.371***	2.566***
1	0.60%	2.1465**	0.227	−1.68%	−6.627***	−3.535
2	3.19%	9.0626***	5.993***	0.13%	0.628	1.527
3	1.52%	4.1005***	2.724***	1.18%	4.212***	3.406***
4	0.19%	0.7610	0.754	−0.41%	−1.686	0.400
5	0.65%	2.1267**	−1.689	−1.66%	−7.327***	−4.089***
6	0.89%	2.7924***	2.173**	−0.84%	−3.996***	−1.639*
7	0.74%	2.4070**	1.969*	0.57%	2.191**	1.742*
8	−0.01%	−0.0133	0.717	−2.28%	−6.087***	−4.760***
9	−0.56%	−0.3886	−0.795	−1.48%	−7.902***	−3.680***
10	0.53%	2.1050**	−1.054	0.77%	3.656***	2.407***
Event Window	**CAAR**	**TSTAT**	**Wilcoxon**	**CAAR**	**TSTAT**	**Wilcoxon**
$[-1, 0]$	1.22%	3.7190***	2.352**	4.11%	8.085***	3.286***
$[0, 0]$	1.04%	3.4450***	2.103**	2.73%	5.371***	2.162**
$[0, +1]$	1.64%	4.4230***	3.754***	1.05%	2.578***	1.032
$[-1, +1]$	1.81%	4.7250***	3.104***	2.43%	5.847***	2.389**
$[-2, +2]$	5.26%	9.0270***	6.653***	2.14%	4.256***	1.726*
$[-3, +3]$	6.54%	7.7790***	4.905***	3.38%	4.684***	1.935*
$[-5, +5]$	7.85%	8.0780***	6.207***	1.29%	1.599	0.680
$[-10, +10]$	10.91%	6.0940***	5.658***	−3.87%	−3.343***	−1.372

Analysis of Variance Test	**Statistics**	***p*-value**
Independent Sample T test (t Score)	3.111***	0.002
Mann-Whitney U test (z Score)	2.908***	0.004

Note: This table reports the Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) for firms segmented by their home country's economic status (Developed vs. Developing). The TSTAT and Wilcoxon tests assess the statistical significance of the daily AARs and cumulative CAARs within each group. The 'Analysis of Variance' section at the bottom reports the results of an Independent Sample t-test and a Mann-Whitney U test, which evaluate if the difference in returns between the two groups is statistically significant. All return values are in percent. Significance levels are denoted by asterisks: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$)

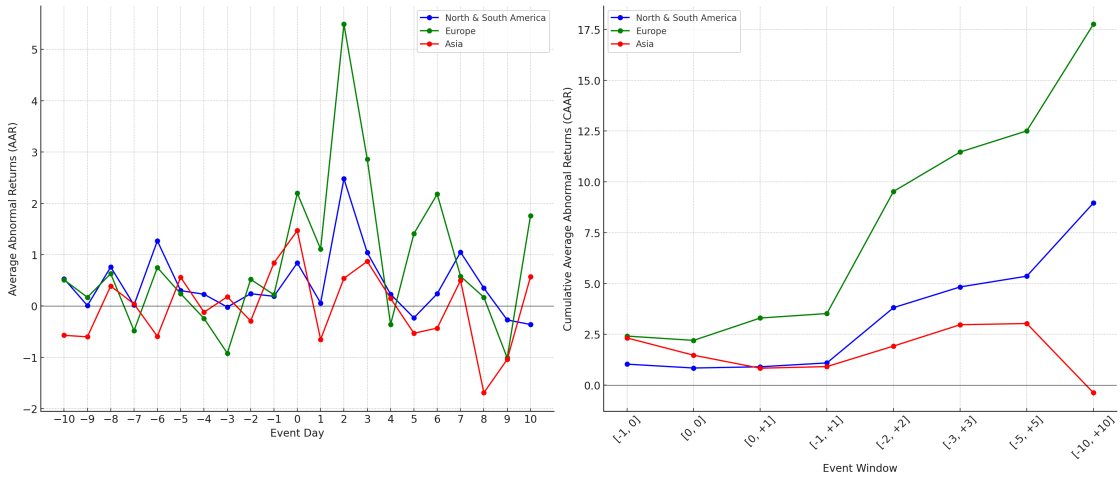


Fig. 6: AAR and CAAR for different regions over event windows

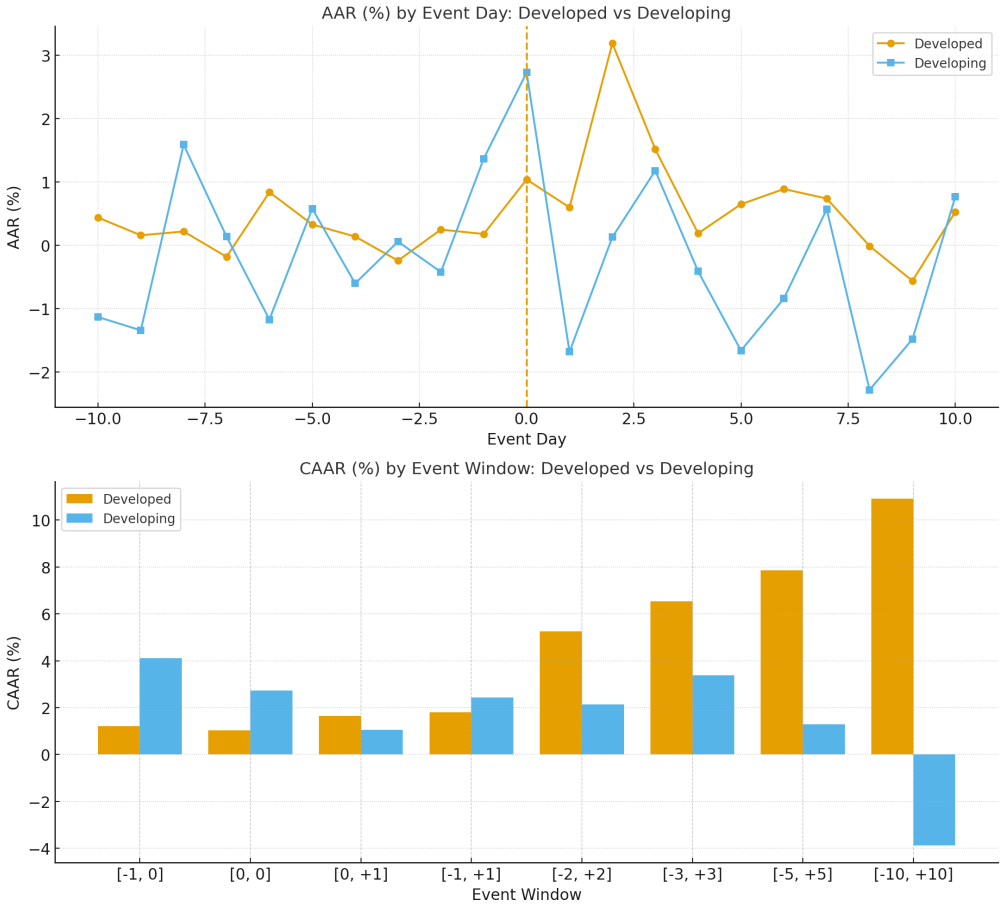


Fig. 7: AAR and CAAR Comparison of Defense & Aerospace Firms: Developed vs. Developing Countries

and a general flight from emerging market risk ultimately overwhelmed any initial positive sentiment for these firms (Keleş, 2023). This is consistent with the broader literature highlighting the amplified vulnerability of emerging markets to global shocks (Zehri et al., 2025; Nasouri, 2025). While some studies have noted that developed markets can suffer deeper aggregate market losses due to high trade exposure (Chowdhury and Khan, 2024), our findings reveal that within the D&A sector, the opposite is true: investors ultimately favored the stability and strategic positioning of firms in developed economies (Gaio et al., 2022; Obi et al., 2023). This confirms H_3 and demonstrates that while a geopolitical shock may briefly lift all boats in a sector, enduring value is ascribed only to those firms perceived as having the institutional and political resilience to truly capitalize on the new geopolitical landscape.

The statistical significance of this observed heterogeneity is also confirmed by the analysis of variance. Both the Independent Sample T-test (t-score $= 3.11$, $p = 0.002$) and the non-parametric Mann-Whitney U test (z-score $= 2.91$, $p = 0.004$) indicate that the difference between the two groups.

4.5 Cross-Sectional Analysis by Geopolitical Status

A cross-sectional analysis of the event study results provides robust empirical support for the hypothesis that defense and aerospace (D&A) firms in G7 nations experienced a significantly more favorable market reaction than their non-G7 counterparts (see Tab. 7 and Fig. 8). While firms in both groups saw positive abnormal returns on the event day, the G7 cohort's returns were substantially larger and more persistent. This is most evident in the Cumulative Abnormal Average Returns (CAAR) over the 11-day $[-5, +5]$ event window, where G7 firms registered a gain of 9.06%, nearly four times the 2.47% return for non-G7 firms. The statistical significance of this divergence is confirmed by a Mann-Whitney U test ($p = 0.0226$), definitively indicating that the superior performance of the G7 firms was not due to random chance.

This pronounced disparity reflects the market's efficient pricing of a "geopolitical premium" associated with the G7 bloc. Investors appear to have anticipated that the powerful, economically-aligned G7 nations would engage in larger, more coordinated, and more certain increases in defense and aerospace investment following the event. This interpretation aligns with existing literature demonstrating that membership in strong geopolitical alliances is a critical determinant of market responses to conflict (Yudaruddin and Lesmana, 2024; Boubaker et al., 2022). The weaker, less uniform reaction of non-G7 firms can be attributed to their heterogeneity in political allegiances and economic capacity (Bossman and Gubareva, 2023; Hu et al., 2025), which created a more ambiguous and less compelling investment signal. Ultimately, the analysis confirms that a firm's domicile within a dominant geopolitical alliance is a primary mediating factor in how capital markets price the financial implications of major international events.

4.6 Cross-Sectional Heterogeneity: The Macroeconomic Constraint of Defense Budgets

The cross-sectional analysis reveals a profound heterogeneity in market reactions, contingent on the domicile country's pre-existing defense expenditure as a percentage of GDP (see Tab. 8 and Fig. 9). The empirical evidence provides strong support for the hypothesis that firms in high defense budget nations significantly outperform those in low budget nations. This divergence is most starkly illustrated in the Cumulative Abnormal Returns (CAR). While firms in high-budget countries accrued a statistically significant CAR of 6.49% over the $[-5, +5]$ window, firms in low-budget countries experienced a dramatic value destruction, posting a CAR of -6.30% over the same period. The statistical significance of this divergence is positively confirmed by both the independent sample T-test ($t = 3.200$, $p < 0.01$) and the non-parametric Mann-Whitney U test ($z = 2.829$, $p < 0.01$), which reject the null hypothesis of identical return distributions. This

Tab. 7: Firms Reaction on basis of Geopolitical Status

	G7			Non-G7		
Event Day	**AAR**	**TSTAT**	**Wilcoxon**	**AAR**	**TSTAT**	**Wilcoxon**
−10	0.60%	2.968***	2.523**	−0.67%	−4.287***	−3.858***
−9	0.18%	0.642	0.385	−0.72%	−4.019***	−3.617***
−8	0.73%	3.493***	3.144***	0.35%	1.201	0.720
−7	−0.29%	−1.285	−0.771	0.14%	0.700	0.420
−6	1.03%	3.566***	3.210***	−0.57%	−2.105**	−1.789*
−5	0.38%	2.079**	1.767*	0.42%	2.255**	1.917*
−4	0.21%	1.091	0.654	−0.38%	−1.459	−0.875
−3	−0.12%	−0.392	−0.235	−0.23%	−1.265	−0.759
−2	0.37%	1.712*	1.027	−0.29%	−1.256	−0.753
−1	0.07%	0.302	0.181	1.01%	4.873***	4.385***
0	1.37%	3.981***	3.583***	1.59%	3.915***	3.524***
1	0.44%	1.393	0.836	−0.51%	−1.640	0.984
2	3.70%	9.006***	8.105***	0.76%	2.503***	2.127**
3	1.97%	4.105***	3.694***	0.74%	3.657***	3.291***
4	0.05%	0.161	0.096	0.03%	0.120	0.072
5	0.64%	1.927*	1.156	−0.67%	−1.980*	−1.188
6	1.15%	2.840***	2.414**	−0.45%	−2.360**	−2.006**
7	0.70%	1.784*	1.070	0.69%	3.335***	3.002***
8	0.08%	0.139	0.083	−1.44%	−5.229***	−4.706***
9	−2.33%	−6.554***	−5.899***	1.22%	0.493	0.296
10	0.56%	1.752*	1.051	0.63%	3.570***	3.213***
CAR Windows	**CAAR**	**TSTAT**	**Wilcoxon**	**AAR**	**TSTAT**	**Wilcoxon**
$[-1, 0]$	1.43%	3.830***	3.447***	2.61%	6.043***	5.437***
$[0, 0]$	1.37%	3.981***	3.582***	1.59%	3.915***	3.522***
$[0, +1]$	1.80%	4.196***	3.776***	1.08%	2.797***	2.371**
$[-1, +1]$	1.87%	4.381***	3.943***	2.10%	4.819***	4.337***
$[-2, +2]$	5.94%	8.493***	7.643***	2.57%	5.109***	4.598***
$[-3, +3]$	7.79%	7.434***	6.690***	3.08%	5.099***	4.589***
$[-5, +5]$	9.06%	7.597***	6.837***	2.48%	3.255***	2.929***
$[-10, +10]$	11.45%	7.952***	7.157***	1.67%	0.640	0.384

Analysis of Variance Test	**Statistics**	***p*-value**
Independent Sample T test (t Score)	1.846*	0.0673
Mann-Whitney U test (z Score)	2.284**	0.0226

Note: This table reports the Average Abnormal Returns (AAR) and Cumulative Average Abnormal Returns (CAAR) for firms segmented by their home country's geopolitical status (G7 vs. Non-G7). The TSTAT and Wilcoxon tests assess the statistical significance of the daily AARs and cumulative CAARs within each group. The 'Analysis of Variance' section reports the results of an Independent Sample T-test and a Mann-Whitney U test, which evaluate if the difference in returns between the two groups is statistically significant. All return values are in percent. Significance levels are denoted by asterisks: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

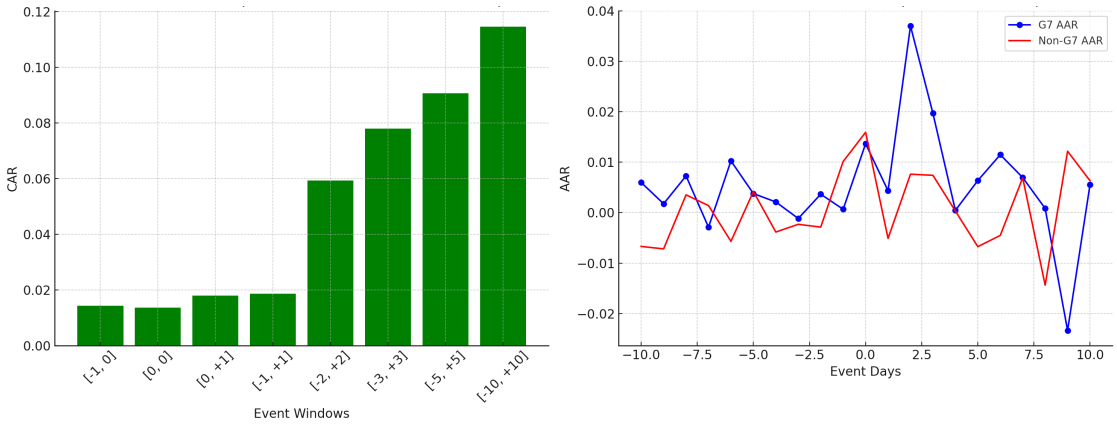


Fig. 8: Comparison of Cumulative Abnormal Returns (CAR) and Average Abnormal Returns (AAR) Across Event Windows.

finding extends the established literature on regional disparities (Auer et al., 2025; Joshipura and Lamba, 2024) by identifying a nation's fiscal commitment to defense as a critical explanatory variable for market performance during geopolitical shocks.

This valuation asymmetry can be rationalized as the market's forward-looking assessment of macroeconomic stability versus fiscal constraint. For the high-budget cohort, investors credibly anticipate that new expenditures can be sustainably funded, leading to positive re-pricing consistent with research on well-supported defense sectors (Martins et al., 2025). Conversely, the strong negative reaction for the low-budget cohort indicates that the market is pricing in a severe "crowding-out" effect, where the systemic risk of macroeconomic instability from forced spending outweighs any potential firm-specific contract gains (Karaki and Safieddine, 2023; Olejnik and Kuna, 2025). The market, therefore, differentiates not merely on the opportunity for new revenue, but on the sovereign capacity to capitalize on that opportunity without inducing fiscal distress.

4.7 The Firm Size Effect in the Defense & Aerospace Sector During Geopolitical Shocks

A cross-sectional analysis based on firm size, operationalized by segmenting the sample into "Top 100" global defense firms by revenue and "The Rest," reveals a nuanced market reaction to the geopolitical shock (see Tab. 9 and Fig. 10). The primary finding is that the event acted as a powerful, sector-wide catalyst, precipitating a positive and statistically significant revaluation for defense firms irrespective of their market leadership. This is evidenced by the robustly positive and significant Cumulative Abnormal Returns (CAR) for both cohorts in the critical $[-1, +1]$ event window (Top 100: 3.16%; The Rest: 1.61%). This sector-wide uplift suggests that investors anticipated a broad-based increase in defense expenditures and military procurement, a finding consistent with recent studies indicating that major geopolitical conflicts provide a valuation boost to the defense sector as a whole, not merely its largest players (Martins, 2024).

However, the analysis did not find statistically significant proof that the largest defense companies performed better than the rest. While the stock prices for the Top 100 firms did rise by a larger amount on paper (for example, 10.04% vs. 5.03% in one timeframe), statistical tests showed this difference was not large enough to be meaningful and could have been due to random chance. This lack of a clear "leadership advantage" is a critical finding. It suggests that investors did not believe the benefits of the conflict would be captured only by the main, big contractors. Instead, investors seem to have wisely recognized that the defense industry is a deeply interconnected

Tab. 8: Cross-Sectional Analysis of Abnormal Returns: High vs. Low Defense Budget Nations

	High Defense (195)			Moderate to Low (175)		
Event Day	**AAR**	**TSTAT**	**Wilcoxon**	**AAR**	**TSTAT**	**Wilcoxon**
−10	0.17%	0.836	1.988**	−0.57%	−2.944***	−1.909*
−9	0.18%	0.590	2.568***	0.13%	0.783	−0.817
−8	0.34%	1.486	2.600***	−0.74%	−3.561***	2.886***
−7	−0.38%	−1.660	−1.794*	1.73%	9.184***	2.146**
−6	0.64%	2.683***	3.036***	1.04%	2.895***	2.576***
−5	0.48%	2.567***	4.094***	−1.32%	−6.924***	2.055**
−4	0.21%	1.101	2.357***	−4.37%	−16.014***	−3.479***
−3	−0.41%	−1.457	−3.177***	−4.63%	−19.449***	−11.380***
−2	0.12%	0.546	−0.399	2.52%	12.709***	7.475***
−1	0.22%	0.950	4.015***	0.69%	3.122***	4.179***
0	1.28%	3.782***	2.625***	−1.33%	−3.248***	5.214***
1	0.40%	1.613	2.611***	2.16%	5.815***	3.070***
2	2.75%	8.113***	8.189***	0.50%	1.134	0.629
3	0.98%	3.028***	4.193***	−2.71%	−5.288***	5.040***
4	0.41%	1.601	2.017**	1.57%	5.871***	3.307***
5	0.06%	0.265	0.670	−1.65%	−4.316***	−3.261***
6	0.82%	2.035**	1.775*	2.27%	8.388***	4.443***
7	1.21%	3.482***	4.267***	−0.23%	−0.708	0.374
8	0.33%	0.572	−1.080	−0.83%	−1.992*	−4.540***
9	−1.23%	−4.160***	−4.554***	−1.05%	−0.435	−0.771
10	0.18%	0.670	2.810***	2.03%	7.304***	5.432***
CAR Windows	**CAAR**	**TSTAT**	**Wilcoxon**	**AAR**	**TSTAT**	**Wilcoxon**
$[-1, 0]$	1.49%	4.255***	3.914***	−0.64%	−1.353	5.877***
$[0, 0]$	1.28%	3.782***	2.625***	−1.33%	−3.248***	5.214***
$[0, +1]$	1.68%	4.464***	4.446***	0.84%	1.850*	4.037***
$[-1, +1]$	1.90%	5.271***	5.373***	1.53%	2.986***	5.285***
$[-2, +2]$	4.76%	8.680***	7.961***	4.55%	5.982***	6.480***
$[-3, +3]$	5.33%	6.560***	7.309***	−2.79%	−2.555***	7.036***
$[-5, +5]$	6.49%	7.034***	7.587***	−6.30%	−4.586***	4.408***
$[-10, +10]$	8.76%	6.715***	6.860***	−4.79%	−1.752*	1.688

Analysis of Variance Test	**Statistics**	***p*-value**
Independent Sample T test (t Score)	3.200***	0.0064
Mann-Whitney U test (z Score)	2.829***	0.0047

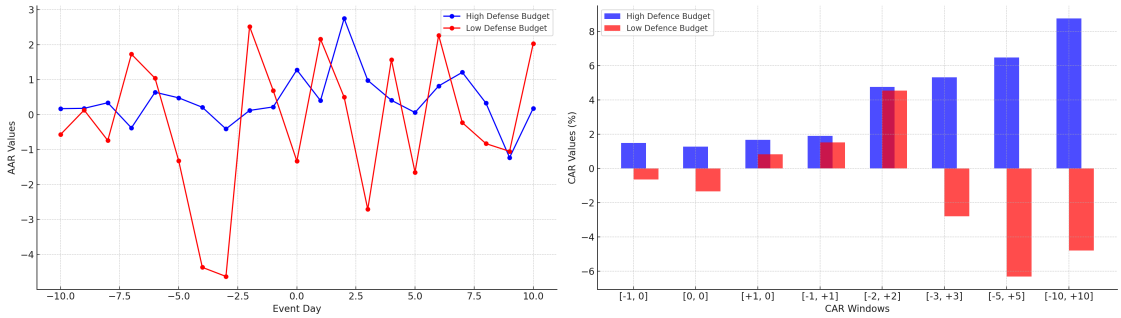
Note: This table reports the Average Abnormal Returns (AAR) and Cumulative Abnormal Returns (CAAR) for firms segmented by their home country's defense budget level (High Defense vs. Moderate to Low). The TSTAT and Wilcoxon tests assess the statistical significance of the daily AARs and cumulative CAARs within each group. The 'Analysis of Variance' section reports the results of an Independent Sample T-test and a Mann-Whitney U test, which evaluate if the difference in returns between the two groups is statistically significant. All return values are in percent. Significance levels are denoted by asterisks: * ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).

Tab. 9: AAR of Top 100 Defense firms vs Rest of the Defense & Aerospace Firms

	Top 100			The Rest		
Event Day	**AAR**	**TSTAT**	**Wilcoxon**	**AAR**	**TSTAT**	**Wilcoxon**
−10	0.29%	1.930*	1.904*	−0.03%	−0.167	−0.210
−9	−0.16%	−0.530	0.111	−0.24%	−1.149	−1.706*
−8	0.97%	4.770***	4.405***	0.45%	2.080**	4.169
−7	0.17%	0.865	0.356	−0.18%	−0.971	−0.056
−6	−0.04%	−0.231	−0.596	0.43%	1.671	1.346
−5	0.45%	2.813***	2.482***	0.38%	2.350***	3.210***
−4	0.45%	2.875***	2.930***	−0.19%	−0.976	−2.124**
−3	−0.14%	−0.893	−1.710*	−0.18%	−0.760	−1.251
−2	0.15%	0.639	0.332	0.06%	0.309	−0.999
−1	0.70%	3.294***	3.458***	0.44%	2.262***	4.934***
0	1.74%	4.730***	4.650***	1.33%	4.197***	3.947***
1	0.73%	3.258***	3.083***	−0.16%	−0.576	−1.753*
2	4.58%	6.347***	6.744***	1.78%	6.363***	6.530***
3	1.64%	3.175***	3.439***	1.36%	4.020***	5.984***
4	−0.14%	−0.459	−0.037	0.08%	0.326	−0.900
5	−0.11%	−0.315	−0.013	0.13%	0.453	−1.470
6	0.99%	3.156***	2.986***	0.31%	1.028	−0.354
7	1.09%	2.909***	2.866***	0.52%	1.804*	2.374***
8	−0.91%	−2.442***	−2.343***	−0.54%	−1.181	−3.851***
9	−1.84%	−4.262***	−4.562***	−0.50%	−0.360	−7.370***
10	0.88%	3.186***	3.236***	0.51%	2.124***	4.912***
CAR Windows	**CAAR**	**TSTAT**	**Wilcoxon**	**AAR**	**TSTAT**	**Wilcoxon**
$[-1, 0]$	2.43%	5.451***	5.455***	1.77%	5.187***	5.209***
$[0, 0]$	1.74%	4.730***	4.650***	1.33%	4.197***	3.947***
$[0, +1]$	2.46%	5.656***	5.307***	1.17%	3.298***	3.603***
$[-1, +1]$	3.16%	6.393***	6.134***	1.61%	4.412***	5.157***
$[-2, +2]$	7.89%	6.793***	6.800***	3.45%	7.291***	7.296***
$[-3, +3]$	9.38%	6.024***	6.314***	4.63%	6.542***	7.674***
$[-5, +5]$	10.04%	6.862***	6.569***	5.03%	5.689***	6.662***
$[-10, +10]$	11.46%	5.945***	5.834***	5.75%	3.346***	3.746***

Analysis of Variance Test	**Statistics**	***p*-value**
Independent Sample T test (t Score)	0.802	0.424
Mann-Whitney U test (z Score)	1.157	0.246

Note: This table reports the Average Abnormal Returns (AAR) and Cumulative Abnormal Returns (CAAR) for firms segmented by size (Top 100 vs. The Rest). The TSTAT and Wilcoxon tests assess the statistical significance of the daily AARs and cumulative CAARs within each group. The 'Analysis of Variance' section reports the results of an Independent Sample T-test and a Mann-Whitney U test, which evaluate if the difference in returns between the two groups is statistically significant. All return values are in percent. Significance levels are denoted by asterisks:
* ($p < 0.10$), ** ($p < 0.05$), *** ($p < 0.01$).



Note: Figure compares the Cumulative Abnormal Returns (CAR) and Average Abnormal Returns (AAR) for defense companies with high and low defense budgets. The data is visualized across various event windows, highlighting the performance differences and market reactions based on the budget allocation. The first chart shows the CAR for both categories, while the second chart illustrates the daily AAR fluctuations in response to defense budget changes.

Fig. 9: Comparison of Cumulative Abnormal Returns (CAR) and Average Abnormal Returns (AAR) for High and Low Defense Budget

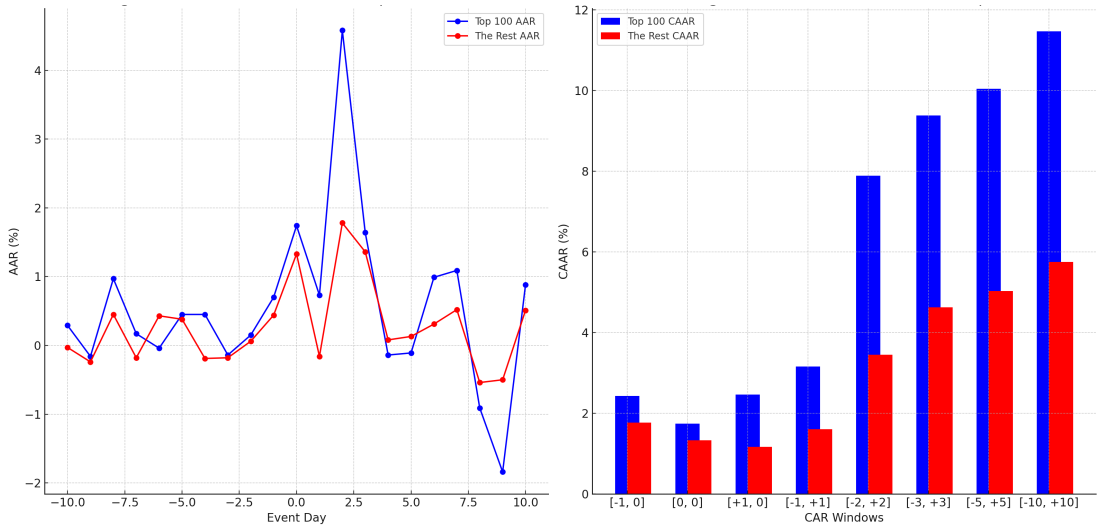


Fig. 10: AAR and CAAR for Top 100 vs The Rest Across Event Days and CAR Windows

supply chain. They understood that a surge in demand for the Top 100 firms would require those companies to place more orders with the vast network of smaller, specialized suppliers. In other words, a rising tide lifts all boats. While the more famous Top 100 stocks may have seen more trading activity right after the event, causing their prices to jump around more, the core investment idea, that the whole sector would benefit quickly spread. Therefore, investors didn't just rush to the "safest" big companies. Instead, they re-evaluated the entire defense industry as more valuable, anticipating a new era of higher government spending.

5 DISCUSSION

The empirical results of this study contribute to the literature on geopolitical finance by both reinforcing and refining existing frameworks. In line with foundational research on "war stocks," the findings first confirm that the Russia-Ukraine conflict triggered significant positive abnormal returns for the global D&A sector, validating the "flight-to-arms" hypothesis (H_1) also documented in contemporary studies (Schneider and Troeger, 2006; Covachev and Fazakas, 2025; Zhang et al., 2022). However, the central contribution of this paper moves beyond this aggregate effect to dissect the profound heterogeneity of these returns, demonstrating that country-level attributes overwhelmingly dominated firm-specific characteristics. The outperformance of firms domiciled in G7, developed, and high-budget nations (H_2, H_3, H_4) aligns with literature identifying a "military preparedness dividend" for geopolitically aligned blocs like NATO, where investors anticipate coordinated increases in defense spending (Boubaker et al., 2022). Critically, this research refines the "proximity penalty" concept, which posits that markets closer to a conflict suffer greater losses (Grinius and Baležentis, 2025; Yousaf et al., 2022). For the strategically vital D&A sector, this study finds the opposite: geographic proximity to the conflict transformed a regional macroeconomic risk into a powerful "proximity premium," particularly for European firms. Furthermore, the analysis challenges a simple firm-level "flight to quality" narrative by finding no statistically significant "leadership premium" for the industry's largest firms (H_5). This suggests the market reaction was not a narrow rotation into a few prime contractors but a systemic, sector-wide revaluation of the entire defense industrial base and its interconnected supply chain. Finally, the starkly negative returns for firms in low-budget and emerging economies support the notion of a macroeconomic "crowding-out" effect, where investors price in the systemic risk of fiscal instability, outweighing any potential for new contracts (Solarin and Sahu, 2015; Karaki and Safieddine, 2023). This indicates a sophisticated market mechanism that assesses not just the opportunity for new revenue but, more importantly, the sovereign fiscal capacity to sustainably fund a military buildup.

6 CONCLUSION

This study sought to dissect the capital market reaction of the global defense and aerospace (D&A) sector to the 2022 Russia-Ukraine war, moving beyond aggregate analysis to investigate the firm- and country-level determinants of what we find to be a profoundly heterogeneous response. The primary objective was to test whether returns were systematically moderated by a firm's geopolitical alignment, national economic status, fiscal capacity for defense spending, and market leadership.

Our empirical results first confirm a statistically significant and sustained positive abnormal return for the global D&A sector as a whole, validating the "war stocks" hypothesis (H_1). However, this aggregate effect masks critical cross-sectional divergences that constitute the core of our findings. We find that a firm's market reaction was overwhelmingly dictated by its country of domicile. Firms in G7 nations (H_4), developed economies (H_3), and European countries (H_2) particularly those domiciled in nations with high pre-existing defense budgets experienced significantly larger and more persistent positive abnormal returns than their counterparts. Conversely, the hypothesis of a firm-level "flight to quality" (H_5) was not supported; the performance difference between the top 100 industry leaders and smaller firms was statistically insignificant. This suggests that investors priced in a systemic, sector-wide revaluation of the entire defense ecosystem rather than concentrating value in market leaders.

The interpretation of these results reveals a sophisticated market mechanism. The outperformance of firms in G7 and high-budget nations reflects a "geopolitical premium," where investors favored firms in countries perceived to have both the political will and, crucially, the fiscal capacity to fund a sustained increase in military expenditure. The starkly negative returns for firms in low-budget and non-aligned emerging markets indicate that investors priced in a severe macroeconomic "crowding-out" effect, where the systemic risks of fiscal instability outweighed any potential for new contracts. The lack of a firm-size effect suggests the market rationally priced in the deep interdependencies of the defense industrial base, anticipating that a surge in prime contractor demand would inevitably flow through the entire supply chain.

Theoretically, these findings make several contributions to the literature on geopolitical risk. First, they critically refine the "proximity penalty" concept (Grinius and Baležentis, 2025), demonstrating that for a strategically aligned sector like defense, geographic proximity to a conflict can transform into a powerful "proximity premium." Second, our results challenge the simple application of a "flight to quality" heuristic at the firm level, showing that during a systemic geopolitical shock, the market's focus shifts to country-level credibility. From a practical standpoint, the implications are clear. For investors, our findings underscore that in this sector, a nation's geopolitical and macroeconomic attributes can be more potent drivers of returns than traditional firm-specific metrics. For policymakers, the market's adverse reaction in fiscally constrained nations serves as a powerful signal about the perceived risks of unfunded defense mandates.

This study's limitations present clear avenues for future research. Our analysis is centered on a single, albeit momentous, geopolitical event, and future work should test whether these fiscal and geopolitical mechanisms hold across different types of conflicts. Furthermore, our cross-sectional variables are country-level proxies; future research could employ granular, firm-level data on government contracts and supply chain dependencies to more directly test the ecosystem revaluation hypothesis.

In conclusion, this research demonstrates that the market's reaction to the Ukraine war was not merely a flight to "war stocks," but a sophisticated and rapid pricing of a new geopolitical reality. In this new paradigm, investors look beyond a firm's balance sheet to that of its sovereign domicile, where a nation's strategic alignment and, critically, its fiscal capacity to act, are the ultimate determinants of value.

7 REFERENCES

Abbassi, W., Kumari, V. and Pandey, D. K. 2023. What Makes Firms Vulnerable to the Russia–Ukraine Crisis? *The Journal of Risk Finance*, 24 (1), 24–39. DOI: 10.1108/JRF-05-2022-0108.

Ahir, H., Bloom, N. and Furceri, D. 2022. *The World Uncertainty Index*. NBER Working Paper No. 29763.

Ahmed, S., Hasan, M. M. and Kamal, M. R. 2023. Russia–Ukraine Crisis: The Effects on the European Stock Market. *European Financial Management*, 29 (4), 1078–1118. DOI: 10.1111/eufm.12386.

Aktas, N., de Bodt, E. and Cousin, J.-G. 2007. Event Studies with a Contaminated Estimation Period. *Journal of Corporate Finance*, 13 (1), 129–145. DOI: 10.1016/j.jcorpfin.2006.09.001.

Armitage, S. 1995. Event Study Methods and Evidence on Their Performance. *Journal of Economic Surveys*, 9 (1), 25–52. DOI: 10.1111/j.1467-6419.1995.tb00109.x.

Assaf, R., Gupta, D. and Kumar, R. 2023. The Price of War: Effect of the Russia-Ukraine War on the Global Financial Market. *The Journal of Economic Asymmetries*, 28, e00328. DOI: 10.1016/j.jeca.2023.e00328.

Auer, C., Bosello, F., Bressan, G., Delpiazzo, E., Monasterolo, I., Otto, C., Parrado, R. and Reyer, C. P. O. 2025. Cascading Socio-Economic and Financial Impacts of the Russia-Ukraine War Differ Across Sectors and Regions. *Communications Earth & Environment*, 6, 194. DOI: 10.1038/s43247-025-02119-1.

Boehmer, E., Masumeci, J. and Poulsen, A. B. 1991. Event-Study Methodology under Conditions of Event-Induced Variance. *Journal of Financial Economics*, 30 (2), 253–272. DOI: 10.1016/0304-405X(91)90032-F.

Bossman, A. and Gubareva, M. 2023. Asymmetric Impacts of Geopolitical Risk on Stock Markets: A Comparative Analysis of the E7 and G7 Equities during the Russian-Ukrainian Conflict. *Heliyon*, 9 (2), e13626. DOI: 10.1016/j.heliyon.2023.e13626.

Boubaker, S., Goodell, J. W., Pandey, D. K. and Kumari, V. 2022. Heterogeneous Impacts of Wars on Global Equity Markets: Evidence from the Invasion of Ukraine. *Finance Research Letters*, 48, 102934. DOI: 10.1016/j.frl.2022.102934.

Boubaker, S., Nguyen, N., Trinh, V. Q. and Vu, T. 2023. Market Reaction to the Russian Ukrainian War: A Global Analysis of the Banking Industry. *Review of Accounting and Finance*, 22 (1), 123–153. DOI: 10.1108/RAF-10-2022-0294.

Brown, S. J. and Warner, J. B. 1980. Measuring Security Price Performance. *Journal of Financial Economics*, 8 (3), 205–258. DOI: 10.1016/0304-405X(80)90002-1.

Brown, S. J. and Warner, J. B. 1985. Using Daily Stock Returns: The Case of Event Studies. *Journal of Financial Economics*, 14 (1), 3–31. DOI: 10.1016/0304-405X(85)90042-X.

Cable, J. and Holland, K. 1999. Modelling Normal Returns in Event Studies: A Model-Selection Approach and Pilot Study. *The European Journal of Finance*, 5 (4), 331–341. DOI: 10.1080/135184799336993.

Campbell, C. J., Cowan, A. R. and Salotti, V. 2010. Multi-Country Event-Study Methods. *Journal of Banking & Finance*, 34 (12), 3078–3090. DOI: 10.1016/j.jbankfin.2010.07.016.

Chen, A. H. and Siems, T. F. 2007. The Effects of Terrorism on Global Capital Markets. In Brück, T. (ed.). *The Economic Analysis of Terrorism*. 1st ed. Routledge. DOI: 10.4324/9780203016633.

Chowdhury, E. K. and Khan, I. I. 2024. Reactions of Global Stock Markets to the Russia–Ukraine War: An Empirical Evidence. *Asia-Pacific Financial Markets*, 31 (3), 755–778. DOI: 10.1007/s10690-023-09429-4.

Covachev, S. and Fazakas, G. 2025. The Effects of the Russia–Ukraine War and the Wagner Group Coup on Defense Stocks in Europe: An Event Study Analysis. *Studies in Economics and Finance*, 42 (1), 31–42. DOI: 10.1108/SEF-11-2023-0675.

Davydov, D., Sihvonen, J. and Solanko, L. 2022. Who Cares About Sanctions? Observations from Annual Reports of European Firms. *Post-Soviet Affairs*, 38 (3), 222–249. DOI: 10.1080/1060586X.2022.2049563.

Defence News. 2022. *Top 100 | Defense News, News About Defense Programs, Business, and Technology* [online]. Available at: `https://people.defensenews.com/top-100/`. [Accessed 2024, April 19].

Demir, F. and Duan, Y. 2018. Bilateral FDI Flows, Productivity Growth, and Convergence: The North vs. the South. *World Development*, 101 (C), 235–249. DOI: 10.1016/j.worlddev.2017.08.006.

Dyckman, T., Philbrick, D. and Stephan, J. 1984. A Comparison of Event Study Methodologies Using Daily Stock Returns: A Simulation Approach. *Journal of Accounting Research*, 22, 1–30. DOI: 10.2307/2490855.

Elgin, C., Elveren, A. Y., Özgür, G. and Dertli, G. 2022. Military Spending and Sustainable Development. Review of Development Economics, 26 (3), 1466–1490. DOI: 10.1111/rode.12893.

Fama, E. F., Fisher, L., Jensen, M. C. and Roll, R. 1969. The Adjustment of Stock Prices to New Information. *International Economic Review*, 10 (1), 1–21. DOI: 10.2307/2525569.

Fang, Y. and Shao, Z. 2022. The Russia-Ukraine Conflict and Volatility Risk of Commodity Markets. *Finance Research Letters*, 50 (C), 103264. DOI: 10.1016/j.frl.2022.103264.

Gaio, L. E., Stefanelli, N. O., Pimenta, T., Bonacim, C. A. G. and Gatsios, R. C. 2022. The Impact of the Russia-Ukraine Conflict on Market Efficiency: Evidence for the Developed Stock Market. *Finance Research Letters*, 50 (C), 103302. DOI: 10.1016/j.frl.2022.103302.

Gheorghe, C. and Panazan, O. 2024. Investigating the Effect of Geopolitical Risk on Defense Companies' Stock Returns. *Heliyon*, 10 (24), e40974. DOI: 10.1016/j.heliyon.2024.e40974.

Gheorghe, C. and Panazan, O. 2025. Geopolitical Risk Contagion Across Strategic Sectors: Nonlinear Evidence from Defense, Cybersecurity, Energy, and Raw Materials. *PLoS One*, 20 (9), e0330557. DOI: 10.1371/journal.pone.0330557.

Grinius, M. and Baležentis, T. 2025. Impact of Geopolitical Turmoil in the Developing European Stock Markets vs. the Global Benchmark Indices: An Event Study Analysis of the Russo-Ukrainian War. *Contemporary Economics*, 19 (1), 121–131. DOI: 10.5709/ce.1897-9254.557.

Hu, Y., Corbet, S., Hou, Y., Lang, C. and Oxley, L. 2025. Tail Risk Connectedness during Geopolitical Shocks: Assessing the impact of Russian-Ukraine Conflict on G7 Stock Markets. *Applied Economics*, 57 (47), 7705–7733. DOI: 10.1080/00036846.2024.2393893.

Hudson, R. and Urquhart, A. 2015. War and Stock Markets: The Effect of World War Two on the British Stock Market. *International Review of Financial Analysis*, 40 (C), 166–177. DOI: 10.1016/j.irfa.2015.05.015.

IMF (International Monetary Fund). 2025. *Global Financial Stability Report: Shifting Ground Beneath the Calm (October 2025)* [online]. Available at: `https://www.imf.org/publications/GFSR`

Izzeldin, M., Muradoğlu, Y. G., Pappas, V., Petropoulou, A. and Sivaprasad, S. 2023. The Impact of the Russian-Ukrainian War on Global Financial Markets. *International Review of Financial Analysis*, 87 (C), 102598. DOI: 10.1016/j.irfa.2023.102598.

Joshi, N. A., Baker, H. K. and Aggarwal, A. 2023. The Russia-Ukraine War's Impact on Stock Markets in Asia-Pacific, the United States, and Europe. *Eurasian Journal of Business and Economics*, 16 (31), 39–53. DOI: 10.17015/ejbe.2023.031.03.

Joshipura, M. and Lamba, A. 2024. Asymmetric Impact of Russia–Ukraine War on Global Stock Markets. *The Journal of Prediction Markets*, 18 (1), 65–84. DOI: 10.5750/jpm.v18i1.2115.

Kakhkharov, J., Onur, I., Yalcin, E. and Zhu, R. 2024. Global Evidence on the Russia–Ukraine Conflict and Energy Stock Returns. *International Review of Economics & Finance*, 93 (B), 413–435. DOI: 10.1016/j.iref.2024.03.063.

Karaki, M. B. and Safieddine, H. 2023. Do Defense News Crowd Out Private Investment? *Economics Letters*, 233 (C), 111421. DOI: 10.1016/j.econlet.2023.111421.

Keleş, E. 2023. Stock Market Response to the Russia-Ukraine War: Evidence from an Emerging Market. *Journal of East-West Business*, 29 (3), 307–322. DOI: 10.1080/10669868.2023.2210121.

Leigh, A., Wolfers, J. and Zitzewitz, E. 2003. *What Do Financial Markets Think of War in Iraq?* NBER Working Paper No. w9587.

Licht, A. N. 2023. The Little Market That Could: Facilitating Cross-Listing through Unilateral Regulatory Recognition. In Chiu, I. H.-Y. and MacNeil, I. (eds.). *Research Handbook on Global Capital Markets Law*, Chapter 25, pp. 400–415. DOI: 10.4337/9781800379305.00036.

MacKinlay, A. C. 1997. Event Studies in Economics and Finance. *Journal of Economic Literature*, 35 (1), 13–39.

Maddodi, S. and Kunte, S. R. 2024. Market Resilience in Turbulent Times: A Proactive Approach to Predicting Stock Market Responses during Geopolitical Tensions. *Journal of Capital Markets Studies*, 8 (2), 173–194. DOI: 10.1108/JCMS-12-2023-0049.

Mann, H. B. and Whitney, D. R. 1947. On a Test of Whether One of Two Random Variables is Stochastically Larger than the Other. *The Annals of Mathematical Statistics*, 18 (1), 50–60. DOI: 10.1214/aoms/1177730491.

Martins, A. M. 2024. Stock Market Effects of Military Conflicts on Defence Industry. *International Journal of Islamic and Middle Eastern Finance and Management*, 17 (5), 1014–1026. DOI: 10.1108/IMEFM-01-2024-0019.

Martins, A. M., Correia, P. and Gouveia, R. 2025. War! Good News for Defense Firms? Analysis of the Impact of Russia–Ukraine Conflict. *Journal of Economic Studies*, 52 (2), 303–321. DOI: 10.1108/JES-11-2023-0667.

Memdani, L. and Shenoy, G. 2019. Impact of Terrorism on Stock Markets across the World and Stock Returns: An Event Study of Taj Attack in India. *Journal of Financial Crime*, 26 (3), 793–807. DOI: 10.1108/JFC-09-2018-0093.

Mishra, A. K., Ansari, Y., Bansal, R. and Maurya, P. K. 2024. Regional and Periodic Asymmetries in the Effect of Russia-Ukraine War on Global Stock Markets. *Heliyon*, 10 (7), e28362. DOI: 10.1016/j.heliyon.2024.e28362.

Mohamad, A. 2022. Safe Flight to Which Haven when Russia Invades Ukraine? A 48-Hour Story. *Economics Letters*, 216, 110558. DOI: 10.1016/j.econlet.2022.110558.

Nasouri, A. 2025. The Impact of Geopolitical Risks on Equity Markets and Financial Stress: A Comparative Analysis of Emerging and Advanced Economies. *International Journal of Economics and Business Administration* 13 (1), 30–41. DOI: 10.35808/ijeba/873.

Nemat, M., Rahat, B., Rossi, M. and Salloum, C. 2025. Global Trade and Finance Turmoil: The Ukraine–Russia War's Impact. *The Journal of Risk Finance*, 26 (3), 516–529. DOI: 10.1108/JRF-02-2025-0091.

Nerlinger, M. and Utz, S. 2022. The Impact of the Russia-Ukraine Conflict on Energy Firms: A Capital Market Perspective. *Finance Research Letters*, 50, 103243. DOI: 10.1016/j.frl.2022.103243.

Niederhoffer, V. 1971. The Analysis of World Events and Stock Prices. *The Journal of Business*, 44 (2), 193–219. DOI: 10.1086/295352.

Obi, P., Waweru, F. and Nyangu, M. 2023. An Event Study on the Reaction of Equity and Commodity Markets to the Onset of the Russia–Ukraine Conflict. *Journal of Risk and Financial Management*, 16 (5), 256. DOI: 10.3390/jrfm16050256.

Olejnik, Ł. W. and Kuna, J. 2025. Military Expenditures As a Part of Endogenous Fiscal Policy in 21 EU-NATO Countries: The Fiscal Consequences of Rising Defence Budgets. *Defence and Peace Economics*, in press. DOI: 10.1080/10242694.2025.2553245.

Patidar, A. K., Jain, P., Dhasmana, P. and Choudhury, T. 2024. Impact of Global Events on Crude Oil Economy: A Comprehensive Review of the Geopolitics of Energy and Economic Polarization. *GeoJournal*, 89 (2), 50. DOI: 10.1007/s10708-024-11054-1.

Rigobon, R. and Sack, B. 2005. The Effects of War Risk on US Financial Markets. *Journal of Banking & Finance*, 29 (7), 1769–1789. DOI: 10.1016/j.jbankfin.2004.06.040.

Schneider, G. and Troeger, V. E. 2006. War and the World Economy: Stock Market Reactions to International Conflicts. *Journal of Conflict Resolution*, 50 (5), 623–645. DOI: 10.1177/0022002706290430.

Schneider, G. and Tröger, V. E. 2004. *The Winners and Losers of War: Stock Market Effects of Armed Conflict, 1990–2000*. Estudio Working Paper No. 2004/205.

Sharma, K., Aulja, A., Mittal, K. and Kondle, R. 2024. The Russia-Ukraine Conflict: Implications for Global Food Security, Trade, and Economic Stability. *Food and Agri Economics Review*, 4 (2), 39–45. DOI: 10.26480/faer.02.2024.39.45.

Silva, T. C., Wilhelm, P. V. B. and Tabak, B. M. 2023. Trade Matters Except to War Neighbors: The International Stock Market Reaction to 2022 Russia's Invasion of Ukraine. *Research in International Business and Finance*, 65 (C), 101935. DOI: 10.1016/j.ribaf.2023.101935.

Smith, R. P. 2022. *Defence Acquisition and Procurement: How (Not) to Buy Weapons*. Elements in Defence Economics Series. Cambridge University Press. DOI: 10.1017/9781009189644.

Soare, D. 2025. European Defense and Current Hybrid Threats. In *Redefining Community in Intercultural Context*, 12 (1), 50–54.

Solarin, S. A. and Sahu, P. K. 2015. The Effect of Military Expenditure on Stock Market Development: Panel Evidence from System GMM Estimates. *Defence and Peace Economics*, 26 (3), 271–287. DOI: 10.1080/10242694.2014.898384.

Song, X. Y., Su, C. W. and Qin, M. 2025. Geopolitical Storm Approaches: Can Defence Stocks Serve As a Safe Haven? *Defence and Peace Economics*, in press. DOI: 10.1080/10242694.2025.2573012.

Statista. 2025. *Market Share of the Leading Exporters of Major Weapons 2020–2024* [online]. Available at: `https://www.statista.com/statistics/267131/market-share-of-the-leadings-exporters-of-conventional-weapons/?srsltid=AfmBOoqPhVKLSdQwuSYK7WC1G5tMuy3TFMKqrpIhrh869fclLAJcijfN`. [Accessed 2025, November 19].

Sun, M., Song, H. and Zhang, C. 2022. The Effects of 2022 Russian Invasion of Ukraine on Global Stock Markets: An Event Study Approach. *SSRN Electronic Journal*. DOI: 10.2139/ssrn.4051987.

Swain, A. 2024. *Climate Security*. 1st ed. SAGE Publications. ISBN 978-1-5296-7084-4.

Thielicke, H. 2024. *SIPRI Yearbook 2024: Armaments, Disarmament and International Security* [online]. Available at: `https://reliefweb.int/report/world/sipri-yearbook-2024-armaments-disarmament-and-international-security-summary-enarruzhukfajpkrsvnlca`

Wang, M. and Su, Y. 2023. How Russian-Ukrainian Geopolitical Risks Affect Chinese Commodity and Financial Markets? *Finance Research Letters*, 56, 104179. DOI: 10.1016/j.frl.2023.104179.

Wilcoxon, F. 1945. Individual Comparisons by Ranking Methods. *Biometrics Bulletin*, 1 (6), 80–83. DOI: 10.2307/3001968.

Yang, R., Zhang, Y., Teng, X. and Sun, Z. 2023. The Impact of Russia-Ukraine Conflict and Shanghai Lockdown on Chinese Stock Market. In *Proceedings of the 2nd International Conference on Business and Policy Studies*, pp. 1555–1568. DOI: 10.1007/978-981-99-6441-3_139.

Yousaf, I., Patel, R. and Yarovaya, L. 2022. The Reaction of G20+ Stock Markets to the Russia–Ukraine Conflict "Black-Swan" Event: Evidence from Event Study Approach. *Journal of Behavioral and Experimental Finance*, 35, 100723. DOI: 10.1016/j.jbef.2022.100723.

Yudaruddin, R. and Lesmana, D. 2024. The Market Reaction of Energy Companies to the Announcement of the Russian–Ukrainian Invasion. *European Journal of Management and Business Economics*, in press. DOI: 10.1108/EJMBE-01-2023-0006.

Zehri, C., ben Ammar, L. S. and Youssef, W. A. B. 2025. Geopolitical Risks and Global Capital Flows: Divergent Vulnerabilities in Emerging and Advanced Economies. *Eurasian Economic Review*, 15 (4), 1135–1165. DOI: 10.1007/s40822-025-00326-x.

Zhang, Z., Bouri, E., Klein, T. and Jalkh, N. 2022. Geopolitical Risk and the Returns and Volatility of Global Defense Companies: A New Race to Arms? *International Review of Financial Analysis*, 83, 102327. DOI: 10.1016/j.irfa.2022.102327.

AUTHOR'S ADDRESS

ATM Adnan, Faculty of Business Studies, BGMEA University of Fashion & Technology, Dhaka 1230, Bangladesh, e-mail: atmadnan@buft.edu.bd (corresponding author)

Md Arif Hasan Khan, Department of Business Administration, Northern University of Business and Technology, Khulna, Bangladesh, e-mail: arifhasan.bangor.uk@gmail.com

Md Tapan Mahmud, Department of Accounting and Information Systems, Bangladesh University of Professionals, Dhaka 1216, Bangladesh, e-mail: mahmud.tapan@bup.edu.bd

Sabira Kumkum, Faculty of Business Studies, Bangladesh University of Professionals, Dhaka 1216, Bangladesh, e-mail: sabira.kumkum@gmail.com

Abdullah Al-Mamun, School of Business, University of Wollongong, North Fields Ave, Wollongong, Australia, e-mail: abdullah_mamun@uow.edu.au, ORCID: 0000-0003-1939-2393

NONLINEAR EFFECTS OF INFLATION AND WAGE POLICY ON FIRM SUSTAINABLE GROWTH IN VIETNAM

Nguyen Huu Anh[1], Duong Thi Chi[1]✉

[1] *National Economics University, Hanoi, Vietnam*

EUROPEAN JOURNAL OF BUSINESS SCIENCE AND TECHNOLOGY

Volume 11 Issue 2
ISSN 2694-7161
www.ejobsat.com

ABSTRACT

This study examines the effects of consumer price index (CPI) and regional minimum wage policy on firms' sustainable growth from both economic and social perspectives. Using a balanced panel of 146 agricultural and manufacturing firms in Vietnam over 2011–2022 (1,752 firm-year observations), the analysis employs panel data regression models to estimate both linear and nonlinear effects. The results reveal clear evidence of inverted U-shaped relationships between CPI and the economic aspect of firm sustainable growth, indicating that moderate inflation promotes growth while excessive inflation constrains it. For the social aspect—measured by employees' income growth, minimum wage policy show positive effects within certain thresholds, but the effects weaken beyond those levels. To ensure robustness, the system GMM approach is applied, and the results remain consistent. Overall, the findings provide firm-level evidence on how inflation and wage policies influence sustainable growth and offer implications for balanced policy design in emerging markets.

KEY WORDS

inflation, minimum wage policy, economic aspect of firm sustainable growth, social aspect of firm sustainable growth

JEL CODES

E60, M21, L25

1 INTRODUCTION

In recent decades, the concept of firm sustainable growth has been conceptualized through three pillars: economic, social, and environmental development (Wang et al., 2022). The economic pillar emphasizes efficiency, competitiveness, and profitability; the social pillar highlights employee well-being, fair labor practices; and the environmental pillar focuses on lowering resource and energy intensity, reducing emissions and waste, and meeting

NGUYEN, Huu Anh, and DUONG, Thi Chi. 2025. Nonlinear Effects of Inflation and Wage Policy on Firm Sustainable Growth in Vietnam. *European Journal of Business Science and Technology,* 11 (2): 250–269. ISSN 2694-7161, DOI 10.11118/ejobsat.2025.012.

environmental standards. Yet prior research has mainly concentrated on the economic and environmental dimensions (Baumgartner and Ebner, 2010; Carroll, 2016), with limited attention to how firms strategically align economic and social objectives (Golicic et al., 2020). This study addresses this gap by examining firm sustainable growth through both the economic and social pillars, whereby the economic pillar is measured by a firm's ability to finance growth internally through retained earnings, commonly captured by the sustainable growth rate proposed by Higgins (1977), and the social pillar is measured by improvements in employees' income.

Early academic research has acknowledged that firm sustainable growth is shaped by both internal and external forces. However, the majority of prior studies have concentrated predominantly on internal determinants such as capital structure, dividend policy, profitability, asset efficiency, liquidity, firm size, and firm age (Burger et al., 2017; Canarella and Miller, 2018; Hartono and Utami, 2016; Lim and Rokhim, 2021). In contrast, the influence of external factors, such as inflation measured by the CPI, on firms' economic sustainable growth remains relatively underexplored. Notably, whether such factors support or constrain firm sustainable growth continues to be a subject of debate. Several scholars argue that the effect of these conditions may be positive, negative, or neutral, depending on whether a certain threshold is crossed (Blakley and Sti, 1989; Khan and Senhadji, 2001; Danladi, 2013). This motivates the present study to investigate the nonlinear impacts of inflation on firm sustainable growth and to identify the critical turning points where its effects change direction.

In addition to inflation, minimum wage policy is another external determinant of sustainability. According to the minimum wage theory, when governments set official minimum wage levels, firms are required to raise the pay of low-paid employees, with effects often spreading to groups earning slightly above the minimum. Minimum wage policy, therefore, represents an important external factor shaping employee welfare. Yet empirical evidence remains mixed, suggesting that the impact of wage policy is not linear but depends on the scale of the increase. When increases are moderate, firms often manage the higher labor costs by raising pay for low-paid and near-minimum employees, thereby improving overall income distribution (Autor et al., 2016; Cengiz et al., 2019). However, once the minimum wage is raised beyond a critical threshold, firms respond in less favorable ways: cutting bonuses, allowances, or non-wage benefits (Harasztosi and Lindner, 2019), restructuring internal wage structures, particularly in financially constrained firms (Arabzadeh et al., 2024), or reducing investments in training and welfare programs (Doh et al., 2025). Drawing on these mixed findings, the present study investigates whether a threshold effect of minimum wage policy exists in determining firms' wage growth rate.

Based on the arguments above, this research addresses the gap in understanding the balance between the economic and social dimensions of sustainability by focusing on Vietnam—a rapidly developing economy where firms face increasing pressure to achieve both financial performance and social accountability. The agriculture and manufacturing sectors were selected due to their significant contributions to Vietnam's GDP and employment, as well as their labor-intensive nature, which makes them particularly relevant for examining social sustainability practices. Moreover, given the availability of data in Vietnam, addressing sustainability challenges in these sectors requires a comprehensive approach that accounts for the interconnected dimensions of sustainable growth. This study emphasizes the economic and social aspects, highlighting a component that is often overlooked in sustainability performance measurement frameworks and corporate reporting. Social sustainability, in particular, is a critical area of focus in many ongoing national and international initiatives related to sustainable development and corporate responsibility. By investigating how firms in these key sectors navigate the dual priorities of economic growth and social responsibility, the study contributes to a more nuanced understanding of sustainable growth in the Vietnamese context.

Specifically, this study tests and quantifies the effects of inflation and minimum wage policy on firms' sustainable growth using a panel dataset of 146 firms over 2011–2022 (1,752 firm-year observations). It addresses two main questions: (1) to what extent do inflation and minimum wage policy affect the economic and social dimensions of firm sustainable growth? and (2) do these effects exhibit threshold behavior, indicating a nonlinear inverted U-shaped relationship?

2 LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1 The Overview of Sustainable Growth and Measurement

The term sustainable growth is widely used in both academic and business contexts, though its definition varies across studies (Barney et al., 2010). Literature shows uncertainty on whether it is a two, three-dimensional, or synonymous construct. As noted by Callens and Tyteca (1999) and Barney et al. (2010), it is complex and difficult to measure directly, so scholars have developed indirect indicators (Husgafvel et al., 2015). Economic aspects are often measured by financial ratios such as profitability, market share, turnover, and risk; social aspects by employment, salary, training, and health and safety; and environmental aspects by natural resource use, waste, and pollution.

Firm-level sustainability growth provides multidimensional insights that enhance performance management and decision-making, supporting long-term competitive advantage. Sub-indices can combine qualitative and quantitative data, but measurement depends heavily on data availability, which is limited in many developing countries (den Hond et al., 2007). Environmental dimensions are more commonly studied (Montiel and Delgado-Ceballos, 2014). However, little attention has been paid to the social aspect of sustainable growth, as it is difficult to quantify and therefore often overlooked when developing sustainability metrics based on numerical evaluation methods.

Based on all the arguments above, and available data in Vietnam, tackling sustainable growth challenges in the process agriculture and manufacturing industry necessitates a holistic approach that considers interconnected dimensions and elements of sustainable growth. Moreover, socially sustainable growth is a key focus area in many ongoing initiatives related to sustainability and responsibility. Hence, our paper concentrates on the economic and social aspects.

2.2 Inflation, Wage Policy and Firm Sustainable Growth

Inflation and Firm Sustainable Growth (Economic Aspect)

While previous literature primarily emphasizes the impact of internal factors, there remain gaps in existing research concerning firm sustainable growth and external factors. In addition to internal factors, an increasing amount of emerging literature highlights the significance of external factors such as the institutional environment and socio-economic aspects. These factors are relevant because the dynamics of a sector, country, city, or region can vary and influence firm growth and performance (Abaidoo and Agyapong, 2023; Anarfi et al., 2016; Fadahunsi, 2012; Gupta et al., 2013; Ramli et al., 2022; Vaz, 2021).

Macroeconomic theory emphasizes that inflation, often captured by CPI, has profound implications for firm performance. Inflation affects profitability through its impact on purchasing power, sales volume, production costs, and borrowing rates, thereby influencing firms' capacity to allocate resources efficiently (Boyd et al., 2001). Egbunike and Okerekeoti (2018) further find that inflation significantly alters firm financial performance, which is central to sustaining growth trajectories. Tarkom and Ujah (2023)

show that macroeconomic indicators, including CPI, indirectly shape firm strategies and operations, with inflation introducing uncertainty that weakens investment decisions. However, existing studies largely employ national-level indicators, overlooking local variations in inflation across provinces or regions (Aginta and Someya, 2022). Moreover, most research focuses on the effects of macroeconomic factors on firm growth or performance, with little attention given to the CPI and firm sustainable growth. This highlights a significant gap in the literature, as understanding the role of CPI is essential for assessing the economic foundations of long-term sustainability (Doane and MacGillivray, 2001).

Minimum Wage Policy and Employee Income (Social Aspect)

The social dimension of sustainable growth emphasizes how firms promote employee welfare, human rights, and fair compensation. Enhancing human capital through retraining, retention, and employee satisfaction has been identified as a central social objective that supports long-term survival and job creation (Maletič et al., 2015). Protecting workers' rights, ensuring fair wages, and providing adequate benefits such as insurance are also increasingly regarded as essential to socially sustainable business practices (Campbell, 2007; Matten and Moon, 2008). Employee satisfaction and income growth are therefore directly linked to firms' social responsibilities, since they reflect both fair treatment of employees and redistribution of economic gains within organizations. Accordingly, this study adopts employee income growth as the primary indicator for measuring the social aspect of sustainable growth.

Beyond internal firm practices, external macroeconomic factors also play a critical role in shaping employee income, with minimum wage policy standing out as a central determinant. Kidanu (2010) and Fatula (2018) emphasize that minimum wage regulation, overall price levels, and GDP composition are strongly associated with employees' earnings. From an institutional perspective, Kaufman (2010) identifies four justifications for minimum wage legislation: establishing a wage floor to correct unequal bargaining power, stabilizing labor markets and employment, fostering long-term efficiency, and addressing externalities and social costs. Building on this, recent studies argue that under certain conditions, minimum wage increases may also promote broader corporate social sustainability (Ni and Kurita, 2020; Zhang et al., 2024).

Evidence from Vietnam provides further support for these findings. ILO (2024) finds that minimum wage hikes significantly raise the earnings of low-wage workers, with estimates suggesting that a 1% increase in the minimum wage results in a 0.83% increase in monthly wages for this group. However, they also note that the positive effect on overall wages has weakened over time, and excessive increases may generate risks for employment and labor market participation. Similarly, Dung (2017) shows that wage increases are transmitted to workers' income in micro, small, and medium enterprises, but the effect is not uniform; while many firms raise wages, smaller enterprises face disproportionate adjustment costs, limiting their ability to fully translate higher statutory wages into increased employee income. By contrast, Nguyen (2025), using a large labor force dataset, finds no significant impact of minimum wage increases on average wages or employment outcomes, though working hours decline slightly. This inconsistency across studies highlights the heterogeneity of minimum wage effects and suggests the possibility of threshold conditions under which the policy's impact on employee income growth changes direction.

Overall, the evidence shows that minimum wage policies play a crucial role in promoting socially sustainable growth through employee income growth. At the same time, results vary across sectors and regions, suggesting the possibility of a threshold effect: changes in minimum wage policy may initially increase the rate of wage growth within firms, but once increases exceed firms' financial capacity, the effect can weaken or even reverse.

Given the preceding discussion, this study aims to investigate how inflation and minimum wage policy influence the sustainable growth of

firms. It integrates and expands upon existing research in the following areas.

First, previous research has given minimal attention to the social aspect of sustainable growth. Scholars have pointed out that measuring the social aspect of sustainable growth is quite complex, as it varies and differs across countries. Therefore, it is difficult to have a measurement that can be universally applied to all countries. To enrich the literature and based on the practical aspects of the Vietnamese market, in addition to the economic aspect of sustainability, this study aims to provide further development of the social aspect of sustainable growth by using the employees' income growth at the firm level. In other words, two combinations of dimensions of sustainable growth have been used in our study, with their various specific aspects that have not been explored in prior research.

Second, the relationship between sustainable growth and firm characteristics is well-understood and aids firms in making long-term strategic decisions. However, the exploration of firm sustainable growth in relation to external factors (inflation and minimum wage policy) is relatively recent, indicating a gap in the current literature. It is also believed that inflation and minimum wage policy impacting firm sustainable growth indeed operate at multiple levels, including both national and provincial levels. These factors' impact varies across different geographical locations (Callens and Tyteca, 1999). Additionally, there is a limited understanding of how firm sustainable growth relates to local environments within a home country's subnational settings. To address this gap and enhance the literature, this study aims to consider inflation and minimum wage policy at the local and national levels, which can usually simultaneously affect firm sustainable growth.

Third, international scholars have indicated that the impact of factors on sustainable development depends on specific circumstances, which can have either negative or positive effects. This implies that the relationship between variables is not always linear. For example, Higgins (1981) suggests that, in certain situations, the real sustainable growth rate may inversely vary with inflation. This has led us to propose that the relationship between inflation, minimum wage policy, and firm sustainable growth might depend on a specific threshold. Currently, there is little empirical evidence of a curvilinear relationship between inflation, minimum wage policy, and firm sustainable growth. Therefore, this study examines the effect of CPI and regional minimum wage policy on sustainable growth using both linear and nonlinear regression to explore this relationship in greater detail.

Overall, based on the above discussions, we propose the following hypothesis:

H_1: *There is a relationship between CPI and firm sustainable growth (economic aspect).*

H_2: *There is an existence of threshold effects in the relationship between CPI and firm sustainable growth (economic aspect).*

H_3: *There is a relationship between CPI, regional minimum wage policy and firm sustainable growth (social aspect).*

H_4: *There is the existence of threshold effects in the relationship between regional minimum wage policy and firm sustainable growth (social aspect).*

3 METHODOLOGY AND DATA

3.1 Sample Selection

This study analyzes data from listed firms of agriculture and manufacturing industries on both the HoChiMinh Stock Exchange (HOSE) and Hanoi Stock Exchange (HNX) between 2011 and 2022. This study focuses on agricultural and manufacturing firms, which represent two key sectors in Vietnam. These industries contribute substantially to GDP and employment and are highly labor-intensive, making them suitable for examining the social dimension of sustainable growth (Gray and Jones, 2022). In addition, they are among the sec-

tors most directly affected by macroeconomic policies such as inflation and regional minimum wage regulations, since labor and input costs account for a large share of their expenses. They also play a crucial role in Vietnam's global value chains, particularly in exports of agricultural products and manufactured goods, which underscores the practical relevance of studying their sustainable growth. Furthermore, data availability for these industries is relatively reliable compared to other sectors, allowing for consistent empirical analysis. The final sample consists of 146 firms in 12 years with 1752 observations.

Data related to internal factors (firm characteristics) and firm sustainable growth were manually collected from financial statements and annual reports available on the HOSE and HNX websites, along with data from the FIINGROUP Vietnam source. Data on external factors, including the CPI and regional minimum wage policy, were sourced from the annual Provincial Competitiveness Index report and the Vietnam Statistical Yearbook published by the General Statistics Office.

3.2 Research Models

3.2.1 Variables and Theoretical Justification

The theoretical foundations underlying the main variables—CPI and minimum wage policy—have been discussed in the literature review, drawing on the macroeconomic theory, the institutional perspective, and minimum wage theory. Accordingly, this section focuses on the theoretical justification and measurement of the control variables included in the model. These control variables are incorporated to account for firm-specific characteristics that may influence sustainable growth, ensuring that the estimated effects of the main variables are more robust and reliable.

Firm characteristics are important determinants of sustainable growth, and several theoretical foundations have been employed by scholars to explain this relationship. The Resource-Based View highlights firm age, size, liquidity, cash flow, and profitability as key resources for long-term competitiveness (Barney, 1991; Vaz, 2021). The Pecking Order Theory shows that leverage and liquidity influence financing choices, with stronger internal cash flows reducing reliance on debt (Ibrahimov et al., 2025; Ramli et al., 2022). The Slack Resources Theory suggests that profitability provides discretionary resources for sustainable strategies, consistent with evidence linking profitability and sustainability outcomes (Ibrahimov et al., 2025; Waddock and Graves, 1997). Empirical research further confirms that these firm-level factors significantly affect differences in sustainable growth across firms and contexts (Abaidoo and Agyapong, 2023; Fadahunsi, 2012). In line with these theories and previous studies, firm characteristics are included in our analysis as control variables, as specified in Model 1 and Model 2.

Since sustainable growth indicators are derived from audited financial statements, audit quality plays a crucial role in their reliability. Agency theory (Jensen and Meckling, 1976) views auditing as a monitoring tool that reduces information asymmetry and constrains opportunism, while signaling theory suggests that engaging high-quality auditors, such as Big4, sends a credible signal of transparency and accountability. Together, these perspectives imply that audit quality enhances the credibility of financial information and signals a firm's commitment to ESG compliance and sustainable growth.

According to social embeddedness theory (Granovetter, 1985), firms' economic behavior is shaped by the social context and community norms in which they are embedded. Hence, when local average income levels are high, societal and employee expectations for wages are also elevated, pushing firms to adjust compensation policies to attract and retain talent (Jardim et al., 2024). Conversely, in regions with lower income levels, social pressure and labor market competition are weaker, allowing firms to offer lower wages. This perspective suggests that local average income can influence firm-level wage growth and thereby affect the social dimension of sustainable growth.

3.2.2 Measure of Firm Sustainable Growth

Economic Aspects

We follow the convention in the sustainable growth rate model developed by Higgins (1977), Wang et al. (2023) to define sustainable growth of firms using their own funds without external financing, as follows:

$$\mathrm{ESGR}_{i,t} = \frac{p_{i,t}(1-d_{i,t})(1+L_{i,t})}{t_{i,t} - p_{i,t}(1-d_{i,t})(1+L_{i,t})},$$

where:

- $\mathrm{ESGR}_{i,t}$ is economic of sustainable growth rate of firm i in year t;
- $P_{i,t}$ is profit margin of firm i in year t;
- $d_{i,t}$ are dividends divided by profits of firm i in year t (dividend payout ratio);
- $L_{i,t}$ is debt to equity ratio of firm i in year t;
- $T_{i,t}$ is measured by total assets to sales of firm i in year t.

Social Aspects

In Vietnam, listed firms must publish annual reports that include a Social-Governance section covering labor policies such as wages, bonuses, insurance, and training. Since social insurance contributions are standardized and based on wages, the wage system serves as the most reliable quantitative indicator of employee benefits. A sustainable company must ensure good employee policies and retention; therefore, following Maletič et al. (2015) and data availability, this study uses the firm's annual salary growth rate to measure social sustainable growth (SSGR), consistent with DeLuca and Van Zandweghe (2023) and Kelle (2016), as follows:

$$\mathrm{SSGR}_{i,t} = \frac{\mathrm{ASF}_{i,t} - \mathrm{ASF}_{i,t-1}}{\mathrm{ASF}_{i,t-1}} \cdot 100,$$

where $\mathrm{ASF}_{i,t}$ is average salary of firm.

3.2.3 Measure of Consumer Price Index, Regional Minimum Wage Policy

Consumer Price Index

In Vietnam, the calculation of the Consumer Price Index (CPI) involves the General Statistics Office (GSO) selecting a range of commonly consumed goods and services, collectively known as a "basket." This basket, representing typical consumption patterns, is used to collect monthly price data. The GSO assigns specific weights to these items to compute the CPI at provincial, regional, and national levels. The annual CPI growth data at the provincial level, provided by the GSO, have been utilized in our study.

Regional Minimum Wage Policy

The regional minimum wage policy in Vietnam is a government-mandated regulation that sets the minimum wage levels that employers must pay their employees, depending on the geographic region where the employees work. These regions are classified into four categories, often referred to as Region 1, Region 2, Region 3, and Region 4, based on the cost of living, economic development, and industrial concentration. The wage levels are determined annually by the government, based on recommendations from the National Wage Council, which considers factors like inflation, economic growth, and the living standards of workers.

This study uses the regional minimum wage growth rate as a measure. It is calculated as

$$\frac{\mathrm{RMW}_c - \mathrm{RMW}_p}{\mathrm{RMW}_p},$$

where RMW_c is regional minimum wage in the current period and RMW_p is regional minimum wage in the previous period.

3.2.4 Research Models

Based on the theoretical framework and prior studies, this study proposes a model examining the effects of local CPI and minimum wage policy on firms' sustainable growth. Following Higgins (1981)'s argument, we propose that a potential non-linear relationship between CPI

Tab. 1: Variable definition

Variable	Measurement
$\text{ESGR}_{i,t}$	The sustainable growth rate of in i in year t (economic aspect)
$\text{SSGR}_{i,t}$	The sustainable growth rate of in i in year t (social aspect) − annual salary growth rate of firm i in year t
$\text{Age}_{i,t}$	Logarithm of age of firm i in year t
$\text{AE}_{i,t}$	Asset efficiency of firm i in year t, measured by sales/total assets
$\text{CFO}_{i,t}$	Cash flow of firm i in year t
$\text{Firmsize}_{i,t}$	Logarithm of total assets of firm i in year t
$\text{Liq}_{i,t}$	The value of current assets of firm i divided by current liabilities in year t
$\text{Lev}_{i,t}$	Total liabilities to total assets of firm i in year t
$\text{ROA}_{i,t}$	Return on total assets of firm i in year t
$\text{GRLabour}_{i,t}$	Growth rate of number labour of firm i in year t
$\text{dumESGR}_{i,t}$	Dummy variable, equals 1 if firm sustainable growth (economics aspect) in year t is positive, and zero otherwise
$\text{Big4}_{i,t}$	A proxy for audit quality, equals one if the firm's auditor is one of the Big4 in year t, and zero otherwise
$\text{CPI}_{i,t}$	Consumer Price Index growth by province for firm i in year t
$\text{CPI}^2_{i,t}$	Squared term of CPI by province for firm i in year t
$\text{Regimini}_{i,t}$	Regional minimum wage growth rate for the region of firm i in year t
$\text{Regimini}^2_{i,t}$	Squared term of regional minimum wage of firm i in year t
$\text{Localincome}_{i,t}$	Local average income by province in which firm located (thousand VND)

and sustainable growth may exist; the impact—whether positive or negative—depends on certain thresholds. Therefore, Model 1 includes CPI^2 to capture this non-linearity.

Model 1

$$\begin{aligned}\text{ESGR}_{i,t} = {} & \alpha_0 + \alpha_1\,\text{Age}_{i,t} + \\ & + \alpha_2\,\text{AE}_{i,t} + \alpha_3\,\text{CFO}_{i,t} + \\ & + \alpha_4\,\text{Firmsize}_{i,t} + \alpha_5\,\text{Liq}_{i,t} + \\ & + \alpha_6\,\text{Lev}_{i,t} + \alpha_7\,\text{ROA}_{i,t} + \\ & + \alpha_8\,\text{GRLabour}_{i,t} + \\ & + \alpha_9\,\text{Big4}_{i,t} + \\ & + \alpha_{10}\,\text{CPI}_{i,t} + \alpha_{11}\,\text{CPI}^2_{i,t} + \\ & + \alpha_{12}\,\text{Localincome}_{i,t} + \epsilon_{i,t}\end{aligned} \tag{1}$$

According to Callens and Tyteca (1999), the measurement perspectives of sustainable growth are not independent but are related to each other. For example, the employment rate might be reduced from a business standpoint—due to cost-saving measures—but it should be maximized from a social perspective. Hence, the dummy variable related to the economic aspects of sustainable growth was added to Model 2 to control for the relationship between these two aspects. Moreover, based on the argument in the previous section, minimum wage policy is one of the macroeconomic policies that might impact the social aspect of firm sustainable growth (Zhang et al., 2024; Ni and Kurita, 2020). Therefore, in addition to the variables in Model 1, the variable for regional minimum wage policy has been included in Model 2 with both linear and quadratic terms.

Model 2

$$\begin{aligned}\text{SSGR}_{i,t} = {} & \alpha_0 + \alpha_1\,\text{Age}_{i,t} + \\ & + \alpha_2\,\text{AE}_{i,t} + \alpha_3\,\text{CFO}_{i,t} + \\ & + \alpha_4\,\text{Firmsize}_{i,t} + \alpha_5\,\text{Liq}_{i,t} + \\ & + \alpha_6\,\text{Lev}_{i,t} + \alpha_7\,\text{ROA}_{i,t} + \\ & + \alpha_8\,\text{GRLabour}_{i,t} + \\ & + \alpha_9\,\text{Big4}_{i,t} + \\ & + \alpha_{10}\,\text{dumESGR}_{i,t} + \\ & + \alpha_{11}\,\text{CPI}_{i,t} + \\ & + \alpha_{12}\,\text{Regimini}_{i,t} + \\ & + \alpha_{13}\,\text{Regimini}^2_{i,t} + \\ & + \alpha_{14}\,\text{Localincome}_{i,t} + \epsilon_{i,t}\end{aligned} \tag{2}$$

4 RESULTS AND DISCUSSION

4.1 Descriptive Statistics

Tab. 2 describes descriptive statistics of variables in the two models. The average expected rate of economic sustainable growth is approximately 0.1156. There is considerable variability in ESGR, as indicated by the standard deviation of 0.2227, with ESGR values ranging from a minimum of −2.7041 to a maximum of 3.4654, showing that some firms experience significant declines or growth. Moreover, the average sustainable growth rate (annual salary growth rate) is approximately 8.51%, and SSGR values range from −0.55 to 1.89, suggesting that while some firms are experiencing negative annual salary growth, others are growing at a rate of up to 189%. By comparison, the average regional minimum growth wage rate is about 14.25% and ranges from 0 to 68.67%, showing a wide range of minimum wage levels across different regions. The average CPI is 4.7% which has a standard deviation of 4.3%, indicating low variability in CPI across the sample.

Correlation Matrix for the Variables

Overall, ESGR, SSGR are positively correlated with variables CPI, Regimini. Moreover, ESGR and SSGR exhibit positive correlations with firm characteristics such as ROA, GRLabour, and asset efficiency. As anticipated by our theoretical framework, firms with strong performance tend to show a higher potential for sustainable growth. All correlation coefficients are less than 0.8 or greater than −0.8, indicating that multicollinearity is not a concern in the research models.

Variance Inflation Factors (VIF)

It is believed that the model includes both linear terms and the quadratic regression, which exacerbate higher VIF values. Hence, in order to reduce VIF, we use centering the squared terms of CPI and Regimini to mitigate multicollinearity and enhance the stability and reliability of the regression coefficients. In line with the approaches of Kyriazos and Poga (2023) and Iacobucci et al. (2016), we applied this technique to center CPI (becoming C.CPI and C.CPI^2) and Regimini (becoming C.Regimini and C.Regimini^2). Consequently, the VIF values are below 10 (Hair et al., 2009). Thus, our model is not affected by multicollinearity issues and yields the same results.

Tab. 2: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
ESGR	1,752	0.11560	0.22270	−2.7041	3.4654
SSGR	1,752	0.08500	0.15320	−0.5500	1.8900
Age	1,752	1.36540	0.22330	0.6021	1.8325
AE	1,752	1.31210	0.89110	0.0004	8.7488
CFO	1,752	9.02500e+07	3.81000e+08	−2.9200e+09	5.1800e+09
Firmsize	1,752	8.83350	0.62067	7.2652	10.7240
Liq	1,752	2.36350	3.23290	0.1500	52.2600
Lev	1,752	130.90100	365.14430	0.2700	14,025.8000
ROA	1,752	0.07000	0.07960	−0.3642	0.7219
GRLabour	1,752	0.00340	0.20030	−0.8200	2.2000
Big4	1,752	0.25390	0.43540	0.0000	1.0000
CPI	1,752	0.04700	0.04300	0.0051	0.1863
Regimini	1,752	0.14255	0.13989	0.0000	0.6867
Localincome	1,752	5,023.93000	1,905.52500	1,114.0000	10,401.0000

Tab. 3: Pairwise correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) ESGR	1													
(2) SSGR	0.101***	1												
(3) Age	−0.009	−0.025	1											
(4) AE	0.196***	0.065***	0.024	1										
(5) CFO	0.102***	−0.079***	0.031	−0.005	1									
(6) Firmsize	0.009	−0.009	0.110***	−0.308***	0.272***	1								
(7) Liq	−0.016	−0.033	−0.052**	−0.136***	−0.014	−0.196***	1							
(8) Lev	−0.153***	0.022	0.070***	−0.027	−0.029	0.099***	−0.115***	1						
(9) ROA	0.591***	0.059**	0.045*	0.205***	0.164***	−0.033	0.128***	−0.218***	1					
(10) GRLabour	0.067***	0.198***	−0.012	0.017	−0.023	0.126***	−0.069***	0.046*	0.057**	1				
(11) Big4	0.031	−0.002	0.011	−0.123***	0.249***	0.460***	−0.068***	0.028	0.103***	0.037	1			
(12) C.CPI	0.144***	0.165***	−0.234***	0.056**	−0.039*	−0.127***	−0.047**	0.002	0.057**	0.072***	−0.104***	1		
(13) C.Regimini	0.134***	0.157***	−0.277***	0.074***	−0.022	−0.156***	−0.075***	0.004	0.039*	0.081***	−0.107***	0.711***	1	
(14) Localincome	−0.048**	−0.048**	0.147***	−0.047**	0.049**	0.061**	0.095***	−0.010	0.030	−0.070***	0.074***	−0.361***	−0.464***	1

Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

All values of the collinearity Diagnostics, as shown in Tab. 4, have VIF less than 10, the conclusion is that multicollinearity is not a significant concern in the research models.

Tab. 4: Collinearity Diagnostics (Mean VIF = 2.56)

Variable	VIF	SQRT VIF	Tolerance
Age	1.14	1.07	0.8764
AE	1.24	1.11	0.8096
CFO	1.15	1.07	0.8720
Firmsize	1.62	1.27	0.6162
Liq	1.16	1.08	0.8632
Lev	1.08	1.04	0.9280
ROA	1.20	1.09	0.8358
GRLabour	1.04	1.02	0.9578
Big4	1.32	1.15	0.7549
C.CPI	8.82	2.97	0.1133
C.CPI^2	5.90	2.43	0.1694
C.Regimini	5.52	2.35	0.1810
C.Regimini^2	3.27	1.81	0.3059
Localincome	1.40	1.18	0.7146

Regression Results

This section will interpret the analysis of the selected model following the application of the Hausman test and the Breusch-Pagan Lagrangian test. Our study presents the chosen model after conducting all necessary tests. Furthermore, outliers present significant methodological challenges in empirical research, as even a few can distort research findings (Cousineau and Chartier, 2010). To address the outliers problem, we employed deletion as a handling technique. We recalculated the results for all models after excluding outliers using DFFITS, a metric that identifies prediction outliers in regression analysis.

For robustness checks, we conducted additional analyses using alternative regression methods. First, the sample was divided into two industry groups: agriculture and manufacturing. Second, to test for differences between firms with positive and negative sustainable growth, the sample was further split accordingly.

Tab. 5 illustrates the results of a regression analysis. We consistently observe that C.CPI positively influences firm sustainable growth

Tab. 5: Regression results of Model 1

Variable	ESGR Fixed-effects (within) regression: robust standard errors	Positive ESGR Fixed-effects (within) regression: robust standard errors	Negative ESGR POLS: robust standard errors
Age	−0.0165 (0.0439)	−0.0156 (0.0473)	0.0189 (0.0212)
AE	0.0140** (0.0066)	0.0162** (0.0068)	−0.0223*** (0.0079)
CFO	−0.0000 (0.0000)	−0.0000 (0.0000)	−0.0000 (0.0000)
Firmsize	0.0043 (0.0167)	−0.0006 (0.0152)	0.0220** (0.0090)
Liq	−0.0022 (0.0014)	−0.0015 (0.0011)	−0.0002 (0.0010)
Lev	0.0000 (0.0000)	0.0002*** (0.0000)	−0.0002*** (0.0000)
ROA	1.9654*** (0.0717)	1.8878*** (0.0813)	0.8459*** (0.1141)
GRLabour	−0.0145 (0.0103)	−0.0166* (0.0092)	−0.0554 (0.0344)
Big4	0.0020 (0.0129)	−0.0060 (0.0112)	−0.0067 (0.0128)
C.CPI	0.6804*** (0.1565)	0.6953*** (0.1607)	0.6510** (0.2628)
$C.CPI^2$	−3.6649*** (1.1432)	−4.2552*** (1.1423)	−3.6115* (2.1015)
Localincome	−0.0000 (0.0000)	−0.0000 (0.0000)	0.0000** (0.0000)
_cons	−0.0408 (0.1451)	−0.0056 (0.1235)	−0.2280*** (0.0874)
N	1684	1452	240
adj. R^2	0.6000	0.5600	0.6330
P	0.0000	0.0000	0.0000
Breusch and Pagan Lagrangian test	0.0000	0.0000	0.1592
Hausman (Prob)	0.0000	0.0000	
Test for heteroskedasticity	0.0000	0.0000	0.0000

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; C.CPI = value of centered CPI; $C.CPI^2$ = value of centered CPI^2.

at the 1% significance level across all models. This implies that higher CPI levels significantly boost firm economic sustainable growth in all cases. Firm growth is reliant on the cost of external financing, which is affected by the economic effectiveness. Interestingly, the coefficient for $C.CPI^2$ is significantly negative in all models, indicating a significant nonlinear (inverse U-shaped) relationship. Hence, H_1 is supported.

The inverse U-shaped approach is employed to assess the nonlinear relationship between CPI and ESGR, focusing on the turning point and boundary slopes within the observed range (Tab. 6 and Fig. 1).

Tab. 6 and Fig. 1 (Model 1) reveal a statistically significant reversed U-shaped relationship between CPI and ESGR. The estimated turning point occurs at CPI = 0.1398 (90% Fieller CI: 0.1216–0.1818), with the overall test confirming

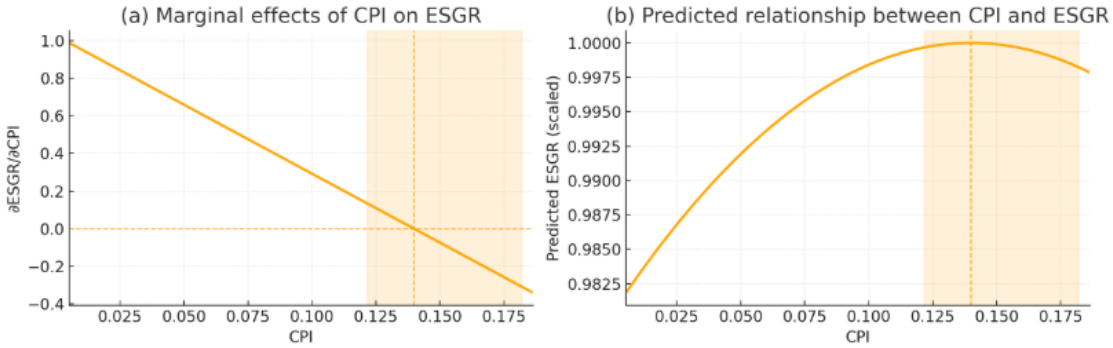


Fig. 1: Marginal and predicted effects of CPI on ESGR (Model 1)

nonlinearity at the 5% significance level. ESGR initially increases with CPI, reaches a peak around the turning point, and subsequently declines, supporting the presence of an inverse U-shaped association, providing support for H_2.

Tab. 6: Nonlinear reversed U shapes for Model 1: CPI

Statistic	**Value**
Slope at lower bound	0.6428***
Slope at upper bound	−0.6851*
Test	**Value**
Overall test of reversed U-shape (P-value)	0.0418
Turning point (CPI*)	0.1398
90% Fieller interval for turning point	[0.1216, 0.1818]

Notes: To ensure clarity and consistency in economic interpretation, all reported values are transformed from the centered CPI (C.CPI) to the original CPI scale; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In the full model, the coefficient of CPI is 0.2737, statistically significant at the 0.1% level. This indicates a strong positive relationship between CPI and SSGR. Similarly, C.Regimini exhibits a significant positive relationship with a coefficient of 0.2311. Moreover, C.Regimini^2 displays a significant negative quadratic effect, suggesting an inverse U-shaped relationship for Regimini. Consistent with the full model, the model for firms with positive growth has the same results, both CPI and Regimini having stronger positive relationships, and the quadratic term of Regimini showing a negative effect. In contrast, in the model of negative growth, the coefficient of these variables is not statistically significant, suggesting that the relationships between these variables and the dependent variable are weak or negligible for negative values.

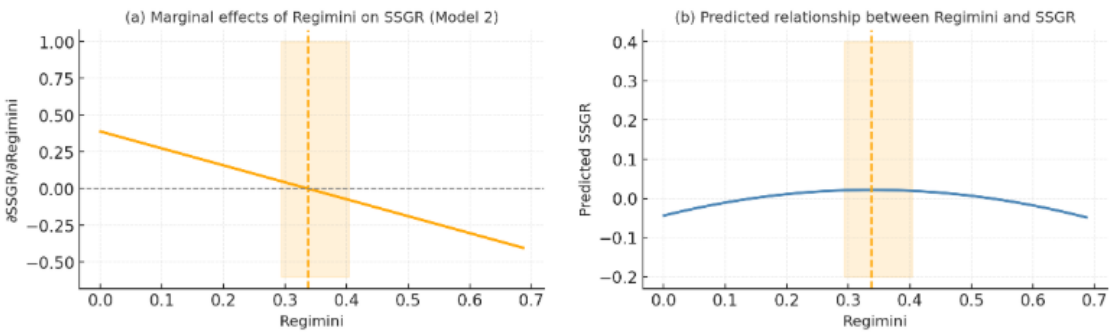


Fig. 2: Marginal and predicted effects of Regimini on SSGR (Model 2)

Tab. 7: Regression results of Model 2

Variable	SSGR Random-effects GLS regression: robust standard errors	Positive SSGR Random-effects GLS regression: robust standard errors	Negative SSGR POLS: robust standard errors
Age	0.0111 (0.0170)	0.0030 (0.0133)	0.0176 (0.0219)
AE	0.0050* (0.0030)	0.0031 (0.0029)	0.0043 (0.0057)
CFO	−0.0000*** (0.0000)	−0.0000*** (0.0000)	0.0000 (0.0000)
Firmsize	−0.0003 (0.0056)	−0.0033 (0.0060)	−0.0165* (0.0094)
Liq	−0.0008 (0.0008)	−0.0009 (0.0007)	0.0027 (0.0023)
Lev	0.0000*** (0.0000)	0.0000 (0.0000)	0.0000 (0.0001)
ROA	0.0711** (0.0353)	−0.0119 (0.0364)	−0.0222 (0.0731)
GRLabour	0.0946*** (0.0240)	0.0600*** (0.0192)	0.1310*** (0.0264)
Big4	0.0140** (0.0064)	0.0006 (0.0067)	0.0300** (0.0124)
dumESGR	0.0277*** (0.0080)	0.0257*** (0.0073)	0.0135 (0.0125)
CPI	0.2737*** (0.0893)	0.2666*** (0.0862)	−0.1074 (0.2185)
C.Regimini	0.2311*** (0.0424)	0.1396*** (0.0390)	−0.1178 (0.0731)
C.Regimini^2	−0.5375*** (0.1149)	−0.2168** (0.1094)	0.2625 (0.2577)
Localincome	0.0000 (0.0000)	0.0000 (0.0000)	0.0000* (0.0000)
_cons	0.0149 (0.0514)	0.1052* (0.0551)	−0.0313 (0.0945)
N	1653	1229	246
adj. R^2	0.1549	0.1047	0.2088
P	0.0000	0.0000	0.0000
Breusch and Pagan Lagrangian (Prob)	0.0030	0.0535	0.4238
Hausman (Prob)	0.1238	0.1788	
Test for heteroskedasticity	0.0000	0.0000	0.0128

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$; C.Regimini = value of centered Regimini; C.Regimini^2 = value of centered Regimini^2.

Overall, the results indicate significant linear and quadratic relationships for the full model and for only positive social sustainable growth values. Therefore, H_3 is supported only for firms with positive sustainable growth.

Similarly, the nonlinear reversed U-shaped association between Regimini and SSGR is reported in Tab. 8 and illustrated in Fig. 2 (Model 2). The estimated turning point is 0.3374, with the 90% Fieller confidence interval ranging from 0.2934 to 0.4035. The overall

test for the presence of a reversed U-shape is statistically significant at the 1% level, confirming a nonlinear pattern. This result indicates that as the regional minimum wage growth rate (Regimini) increases, SSGR initially rises, reaches its maximum at the turning point, and subsequently declines. These findings provide strong evidence supporting H_4.

Tab. 8: Nonlinear reversed U shapes for Model 2: Regimini

Statistic	**Value**
Slope at lower bound	0.2246***
Slope at upper bound	−0.5668***
Test	**Value**
Overall test of reversed U-shape (P-value)	0.0002
Turning point (Regimini*)	0.3374
90% Fieller interval for turning point	[0.2934, 0.4035]

Notes: To ensure consistency with the interpretation in the main text, all reported values are transformed from the centered Regimini (C.Regimini) to the original Regimini scale; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness Check for Each Industry

In this section, we further perform additional robustness assessments by dividing the sample for each industry. Tab. 9 presents results for two models examining the impact of CPI/Regimini on firm sustainable growth, and the estimation results remain quantitatively the same. Consistent with the above findings, a nonlinear, reversed U-shaped curve is identified between CPI and ESGR, Regimini and ESGR.

Robustness Check for Endogeneity

The study further tests the robustness of the results using the system GMM approach to address endogeneity. This dynamic panel method incorporates lagged dependent variables as regressors and instruments to control for endogeneity.

Findings from GMM (as shown in Tab. 10) are similar to the results above, indicating the existence of a nonlinear inverted U-shaped relationship between CPI and the economic aspect of firm sustainable growth, and between regional minimum wage growth rate and the social aspect of firm sustainable growth.

5 CONCLUSIONS

5.1 Discussion of Findings

This study investigates the effects of local CPI and minimum wage policy on firms' sustainable growth in both economic and social aspects, using a sample of 146 agricultural and manufacturing firms with 1,752 observations from 2011–2022. The economic aspect examines linear and nonlinear relationships between local CPI and ESGR, while the social aspect includes the squared term of the regional minimum wage policy to capture potential non-linear effects.

First, while most studies focus on the linear impact of inflation on firm growth or performance, our research contributes to the literature by exploring the nonlinear relationship between the CPI measured at the local level, a key inflation indicator, and the economic sustainable growth of firms. Our findings align with the concept of threshold effects noted in the studies by Blakley and Sti (1989), Khan and Senhadji (2001), Danladi (2013), demonstrating a nonlinear, inverted U-shaped relationship between CPI and firm sustainable growth. The empirical results indicate that CPI can positively influence firm growth up to a certain threshold, beyond which higher inflation tends to exert negative effects. This nonlinear pattern may also help explain why previous studies have not reached consensus on the inflation–growth relationship.

Second, in this study, we define the social aspect of sustainable growth as the extent to which a firm promotes and improves the quality of employees' income growth. Consistent with Kaufman (2010), Zhang et al. (2024), Ni and Kurita (2020), Fatula (2018), our study provides evidence to show the positive impact of CPI and Minimum Wage Policy on the social aspect of firm sustainable growth.

Tab. 9: Regression results of Model 1 and Model 2 for each industry

	Model 1: ESGR		Model 2: SSGR	
Variable	**Agriculture**	**Manufacturing**	**Agriculture**	**Manufacturing**
Age	0.0064	−0.0076	0.0303	0.0149
	(0.1416)	(0.0485)	(0.0304)	(0.0203)
AE	−0.0194	0.0199***	−0.0014	0.0056
	(0.0162)	(0.0074)	(0.0063)	(0.0035)
CFO	0.0000	−0.0000	−0.0000	−0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Firmsize	0.0308	−0.0123	−0.0009	0.0051
	(0.0415)	(0.0178)	(0.0117)	(0.0067)
Liq	−0.0022	−0.0008	−0.0032	−0.0000
	(0.0028)	(0.0010)	(0.0030)	(0.0010)
Lev	−0.0000	0.0001**	0.0000*	0.0000
	(0.0001)	(0.0000)	(0.0000)	(0.0000)
ROA	1.9249***	1.9740***	0.0996	0.0800*
	(0.1429)	(0.0765)	(0.0628)	(0.0475)
GRLabour	−0.0406*	−0.0161	0.1172***	0.0814***
	(0.0204)	(0.0131)	(0.0332)	(0.0278)
Big4	0.0091	0.0030	0.0326***	0.0085
	(0.0323)	(0.0127)	(0.0120)	(0.0073)
C.CPI	1.1378***	0.5962***		
	(0.3238)	(0.1729)		
C.CPI^2	−6.6039***	−2.9120**		
	(1.8106)	(1.3053)		
dumESGR			0.0118	0.0314***
			(0.0147)	(0.0082)
CPI			0.8403***	0.1676*
			(0.1719)	(0.0970)
C.Regimini			0.1512*	0.2691***
			(0.0774)	(0.0450)
C.Regimini^2			−0.4732**	−0.6265***
			(0.2230)	(0.1228)
Localincome	−0.0000	−0.0000	0.0000	0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
_cons	−0.2849	0.0799	−0.0270	−0.0295
	(0.3072)	(0.1513)	(0.1278)	(0.0576)
N	401	1285	389	1337
adj. R^2	0.6830	0.5790	0.2060	0.1201
P	0.0000	0.0000	0.0000	0.0000
Breusch and Pagan Lagrangian test (Prob)	0.0003	0.0000	1.0000	0.0000
Hausman (Prob)	0.0000	0.0000		0.5613
Test for heteroskedasticity (Prob)	0.0000	0.0000	0.6302	0.0000

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Tab. 10: Dynamic Panel System GMM for Model 1 and Model 2

Variables	Model 1 (ESGR)	Variables	Model 2 (SSGR)
L.ESGR	0.1879***	L.SSGR	−0.0736**
	(0.0085)		(0.0356)
Age	0.0346	Age	0.0322
	(0.0359)		(0.0257)
AE	−0.0029	AE	0.0061
	(0.0106)		(0.0085)
CFO	0.0000	CFO	−0.0000*
	(0.0000)		(0.0000)
Firmsize	−0.0440**	Firmsize	−0.0030
	(0.0176)		(0.0173)
Liq	−0.0020	Liq	−0.0016
	(0.0017)		(0.0016)
Lev	0.0001***	Lev	−0.0000*
	(0.0000)		(0.0000)
ROA	1.9905***	ROA	−0.1632
	(0.1078)		(0.2458)
GRLabour	0.0296	GRLabour	0.1043*
	(0.0375)		(0.0737)
Big4	0.0042	Big4	0.0256*
	(0.0207)		(0.0288)
		dumESGR	0.0126*
			(0.0336)
		CPI	0.4776
			(0.7945)
C.CPI	1.2699***	C.Regimini	0.3680**
	(0.2660)		(0.1628)
$C.CPI^2$	−12.7542**	$C.Regimini^2$	−0.9037***
	(6.2411)		(0.2697)
Localincome	0.0000***	Localincome	0.0000*
	(0.0000)		(0.0000)
N	1460	*N*	1606
Arellano-Bond Test		Arellano-Bond Test	
Order 1 *p*-value	0.0000	Order 1 *p*-value	0.0000
Order 2 *p*-value	0.1670	Order 2 *p*-value	0.1090
Hansen Chi-Square	0.2930	Hansen Chi-Square	0.7360

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Specifically, for the minimum wage policy, this positive effect is only observed within a certain threshold. Beyond this threshold, the impact reverses. However, this effect is only applicable to firms with positive growth, as these policies do not impact firms with negative growth.

5.2 Limitations and Further Research

While our research has provided several valuable insights, it also has certain limitations. Firstly, this study relies on the Higgins (1977) models to represent sustainable growth from a financial perspective and an annual salary growth rate to represent for social aspect. It does not address other dimensions, such as quality and social factors considerations. Measurement approaches related to labor training, community engagement, or social responsibility programs have not been studied due to limitations in data availability from corporate disclosures. Secondly, although our analysis identifies nonlinear relationships and threshold effects

for macroeconomic factors such as inflation and minimum wage policy, these thresholds are estimated from sample-specific data. They may not be stable across time, sectors, or broader datasets. Therefore, interpreting them as indicative rather than prescriptive is important. Future research could adopt a more comprehensive framework with richer indicators of firm sustainable growth and explicitly test the temporal stability and policy relevance of threshold estimates.

5.3 Practical Implications

The findings reveal nonlinear inverted U-shaped relationships between CPI and the economic aspect of firm sustainable growth, and between minimum wage policy and the social aspect. These results offer several implications for firms and policymakers in emerging markets:

First, CPI affects firm sustainable growth not only at the national level but also at the provincial level, highlighting the significant role of local governments in shaping the business environment. In countries such as Vietnam, coordination between central and provincial authorities is crucial for maintaining stability and supporting sustainable development.

Second, while moderate inflation may support firm sustainable growth, excessive inflation can undermine performance. This underscores the importance of careful coordination of monetary and fiscal policies, along with timely information sharing across regions, to sustain a stable business environment.

Third, reasonable adjustments in minimum wages can positively affect employee welfare, whereas overly rapid increases may impose burdens on firms. Policymakers may therefore consider gradual adjustments and broader consultation with businesses to balance social protection with economic sustainability.

Finally, for listed firms in emerging economies, inflation volatility remains a major challenge. Rather than exerting uniformly positive or negative effects, inflation influences firms differently at different levels. This highlights the need for firms to strengthen resilience through adaptive strategies, such as flexible pricing, efficient resource allocation, and scenario planning, particularly in environments where institutional capacity to stabilize inflation is limited.

6 REFERENCES

Abaidoo, R. and Agyapong, E. K. 2023. Inflation Uncertainty, Macroeconomic Instability and the Efficiency of Financial Institutions. *Journal of Economics and Development*, 25 (2), 134–152. DOI: 10.1108/JED-09-2022-0166.

Aginta, H. and Someya, M. 2022. Regional Economic Structure and Heterogeneous Effects of Monetary Policy: Evidence from Indonesian Provinces. *Journal of Economic Structures*, 11 (1). DOI: 10.1186/s40008-021-00260-6.

Anarfi, D., Boateng, K. A. and Ababio, K. A. 2016. Determinants of Return on Equity for a Sustainable Growth of the Manufacturing Industry in the Czech Republic. *European Journal of Business Science and Technology*, 2 (1), 43–52. DOI: 10.11118/ejobsat.v2i1.54.

Arabzadeh, H., Balleer, A., Gehrke, B. and Taskin, A. A. 2024. Minimum Wages, Wage Dispersion and Financial Constraints in Firms. *European Economic Review*, 163, 104678. DOI: 10.1016/j.euroecorev.2024.104678.

Autor, D. H., Manning, A. and Smith, C. L. 2016. The Contribution of the Minimum Wage to US Wage Inequality over Three Decades: A Reassessment. *American Economic Journal: Applied Economics*, 8 (1), 58–99. DOI: 10.1257/app.20140073.

Barney, J. 1991. Firm Resources and Sustained Competitive Advantage. *Journal of Management*, 17 (1), 99–120. DOI: 10.1177/014920639101700108.

Barney, J. B., Ketchen, D. J., Wright, M., Hart, S. L. and Dowell, G. 2010. Invited Editorial: A Natural-Resource-Based View of the Firm: Fifteen Years After. *Journal of Management*, 37 (5), 1464–1479. DOI: 10.1177/0149206310390219.

Baumgartner, R. J. and Ebner, D. 2010. Corporate Sustainability Strategies: Sustainability Profiles and Maturity Levels. *Sustainable Development*, 18 (2), 76–89. DOI: 10.1002/sd.447.

Blakley, D. L. and Sti, A. D. 1989. Inflation and Firm Growth: A Reassessment. *Rivista di matematica per le scienze economiche e sociali*, 12 (1), 7–23. DOI: 10.1007/BF02085589.

Boyd, J. H., Levine, R. and Smith, B. D. 2001. The Impact of Inflation on Financial Sector Performance. *Journal of Monetary Economics*, 47 (2), 221–248. DOI: 10.1016/S0304-3932(01)00049-6.

Burger, A., Damijan, J. P., Kostevc, Č. and Rojec, M. 2017. Determinants of Firm Performance and Growth During Economic Recession: The Case of Central and Eastern European Countries. *Economic Systems*, 41 (4), 569–590. DOI: 10.1016/j.ecosys.2017.05.003.

Callens, I. and Tyteca, D. 1999. Towards Indicators of Sustainable Development for Firms: A Productive Efficiency Perspective. *Ecological Economics*, 28 (1), 41–53. DOI: 10.1016/S0921-8009(98)00035-4.

Campbell, J. L. 2007. Why Would Corporations Behave in Socially Responsible Ways? An Institutional Theory of Corporate Social Responsibility. *Academy of Management Review*, 32 (3), 946–967. DOI: 10.5465/amr.2007.25275684.

Canarella, G. and Miller, S. M. 2018. The Determinants of Growth in the U.S. Information and Communication Technology (ICT) Industry: A Firm-Level Analysis. *Economic Modelling*, 70, 259–271. DOI: 10.1016/j.econmod.2017.11.011.

Carroll, A. B. 2016. Carroll's Pyramid of CSR: Taking Another Look. *International Journal of Corporate Social Responsibility*, 1, 3. DOI: 10.1186/s40991-016-0004-6.

Cengiz, D., Dube, A., Lindner, A. and Zipperer, B. 2019. The Effect of Minimum Wages on Low-Wage Jobs. *The Quarterly Journal of Economics*, 134 (3), 1405–1454. DOI: 10.1093/qje/qjz014.

Cousineau, D. and Chartier, S. 2010. Outliers Detection and Treatment: A Review. *International Journal of Psychological Research*, 3 (1), 58–67. DOI: 10.21500/20112084.844.

Danladi, J. D. 2013. Inflation and Sustainable Output Performance in the West African Sub-Region: The Threshold Effect. *American Journal of Economics*, 3 (6), 252–259. DOI: 10.5923/j.economics.20130306.02.

DeLuca, M. and Van Zandweghe, W. 2023. *Postpandemic Nominal Wage Growth: Inflation Pass-Through or Labor Market Imbalance?* Federal Reserve Bank of Cleveland, Economic Commentary 2023-13. DOI: 10.26509/frbc-ec-202313.

den Hond, F., de Bakker, F. G. A. and Neergaard, P. (eds.) 2007. *Managing Corporate Social Responsibility in Action: Talking, Doing and Measuring*. 1st ed. London: Routledge. DOI: 10.4324/9781315593494.

Doane, D. and MacGillivray, A. 2001. *Economic Sustainability: The Business of Staying in Business* [online]. The SIGMA Project, R&D Report. Available at: `https://www.researchgate.net/profile/Deborah-Doane/publication/237302235_Economic_Sustainability_The_business_of_staying_in_business/links/5440f98d0cf2a6a049a356ff/Economic-Sustainability-The-business-of-staying-in-business.pdf`

Doh, T., Kim, K.-I., Kim, S., Lee, H. and Song, K. 2025. *The Economic Effects of a Rapid Increase in the Minimum Wage: Evidence from South Korea Experiments*. Research Working Paper No. 22-13. Federal Reserve Bank of Kansas City. DOI: 10.18651/RWP2022-13.

Dung, P. K. 2017. *The Effects of Minimum Wage Hikes on Employment and Wages in Vietmam's Micro, Small, and Medium Enterprises*. WIDER Working Paper No. 95/2017. DOI: 10.35188/UNU-WIDER/2017/319-6.

Egbunike, C. F. and Okerekeoti, C. U. 2018. Macroeconomic Factors, Firm Characteristics and Financial Performance. *Asian Journal of Accounting Research*, 3 (2), 142–168. DOI: 10.1108/AJAR-09-2018-0029.

Fadahunsi, A. 2012. The Growth of Small Businesses: Towards A Research Agenda. *American Journal of Economics and Business Administration*, 4 (1), 105–115. DOI: 10.3844/ajebasp.2012.105.115.

Fatula, D. 2018. Selected Micro- and Macroeconomic Conditions of Wages, Income and Labor Productivity in Poland and Other European Union Countries. *Contemporary Economics*, 12 (1), 17–32. DOI: 10.5709/ce.1897-9254.261.

Golicic, S. L., Lenk, M. M. and Hazen, B. T. 2020. A Global Meaning of Supply Chain Social Sustainability. *Production Planning & Control*, 31 (11–12), 988–1004. DOI: 10.1080/09537287.2019.1695911.

Granovetter, M. 1985. Economic Action and Social Structure: The Problem of Embeddedness. *American Journal of Sociology*, 91 (3), 481–510. DOI: 10.1086/228311.

Gray, E. and Jones, D. 2022. *Innovation, Agricultural Productivity and Sustainability in Viet Nam* [online]. OECD Food, Agriculture and Fisheries Paper No. 181. Available at: https://www.oecd.org/content/dam/oecd/en/publications/reports/2022/06/innovation-agricultural-productivity-and-sustainability-in-viet-nam_409407ce/9cc1f47a-en.pdf

Gupta, P. D., Guha, S. and Krishnaswami, S. S. 2013. Firm Growth and Its Determinants. *Journal of Innovation and Entrepreneurship*, 2, 15. DOI: 10.1186/2192-5372-2-15.

Hair, J. F., Black, W. C., Babin, B. J. and Anderson, R. E. 2009. *Multivariate Data Analysis*. 7th ed. Prentice Hall.

Harasztosi, P. and Lindner, A. 2019. Who Pays for the Minimum Wage? *American Economic Review*, 109 (8), 2693–2727. DOI: 10.1257/aer.20171445.

Hartono, G. C. and Utami, S. R. 2016. The Comparison of Sustainable Growth Rate, Firm' Performance and Value Among the Firms in Sri Kehati Index and IDX30 Index in Indonesia Stock Exchange. *International Journal of Advanced Research in Management and Social Sciences*, 5 (5), 68–81.

Higgins, R. C. 1977. How Much Growth Can a Firm Afford? *Financial Management*, 6 (3), 7–16. DOI: 10.2307/3665251.

Higgins, R. C. 1981. Sustainable Growth under Inflation. *Financial Management*, 10 (4), 36–40. DOI: 10.2307/3665217.

Husgafvel, R., Pajunen, N., Virtanen, K., Paavola, I.-L., Päällysaho, M., Inkinen, V., Heiskanen, K., Dahl, O. and Ekroos, A. 2015. Social Sustainability Performance Indicators – Experiences from Process Industry. *International Journal of Sustainable Engineering*, 8 (1), 14–25. DOI: 10.1080/19397038.2014.898711.

Iacobucci, D., Schneider, M. J., Popovich, D. L. and Bakamitsos, G. A. 2016. Mean Centering Helps Alleviate "Micro" But Not "Macro" Multicollinearity. *Behaviour Research Methods*, 48 (4), 1308–1317. DOI: 10.3758/s13428-015-0624-x.

Ibrahimov, O., Vancsura, L. and Parádi-Dolgos, A. 2025. The Impact of Macroeconomic Factors on the Firm's Performance—Empirical Analysis from Türkiye. *Economies*, 13 (4), 111. DOI: https://doi.org/10.3390/economies13040111.

ILO (International Labour Organization). 2024. *The Impacts of Minimum Wage Increases on Employment and Labour Productivity in Viet Nam* [online]. Available at: https://www.ilo.org/sites/default/files/2024-11/Layout%20Minimum%20Wage%20eng%2022.8.pdf

Jardim, E., Long, M. C., Plotnick, R., Vigdor, J. and Wiles, E. 2024. Local Minimum Wage Laws, Boundary Discontinuity Methods, and Policy Spillovers. *Journal of Public Economics*, 234, 105131. DOI: https://doi.org/10.1016/j.jpubeco.2024.105131.

Jensen, M. C. and Meckling, W. H. 1976. Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure. *Journal of Financial Economics*, 3 (4), 305–360. DOI: 10.1016/0304-405X(76)90026-X.

Kaufman, B. E. 2010. Institutional Economics and the Minimum Wage: Broadening the Theoretical and Policy Debate. *Industrial and Labor Relations Review*, 63 (3), 427–453. DOI: 10.2307/40649711.

Kelle, M. 2016. *Wage Growth, Urbanization, and Firm Characteristics: Evidence for Germany*. Ruhr Economic Paper No. 631. DOI: 10.4419/86788733.

Khan, M. S. and Senhadji, A. S. 2001. *Threshold Effects in the Relationship between Inflation and Growth* [online]. IMF Working Paper. Available at: https://www.imf.org/external/pubs/ft/wp/2000/wp00110.pdf

Kidanu, D. 2010. *The Effect of Firms' Growth Dynamism on the Income of Their Employees: A Case Study of Medium and Large-Scale Manufacturing Enterprises in Tigray, Ethiopia*. Master thesis. The University of Agder, Kristiansand, Norway.

Kyriazos, T. and Poga, M. 2023. Dealing with Multicollinearity in Factor Analysis: The Problem, Detections, and Solutions. *Open Journal of Statistics*, 13 (3), 404–424. DOI: 10.4236/ojs.2023.133020.

Lim, H. and Rokhim, R. 2021. Factors Affecting Profitability of Pharmaceutical Company: An Indonesian Evidence. *Journal of Economic Studies*, 48 (5), 981–995. DOI: 10.1108/JES-01-2020-0021.

Maletič, M., Maletič, D., Dahlgaard, J., Dahlgaard-Park, S. M. and Gomišček, B. 2015. Do Corporate Sustainability Practices Enhance Organizational Economic Performance? *International Journal of Quality and Service Sciences*, 7 (2–3), 184–200. DOI: 10.1108/IJQSS-02-2015-0025.

Matten, D. and Moon, J. 2008. "Implicit" and "Explicit" CSR: A Conceptual Framework for a Comparative Understanding of Corporate Social Responsibility. *Academy of Management Review*, 33 (2), 404–424. DOI: 10.5465/AMR.2008.31193458.

Montiel, I. and Delgado-Ceballos, J. 2014. Defining and Measuring Corporate Sustainability: Are We There Yet? *Organization & Environment*, 27 (2), 113–139. DOI: 10.1177/1086026614526413.

Nguyen, C. V. 2025. The Impact of Minimum Wages on Employment: Evidence From a Lower Middle-Income Country. *The Developing Economies*, 63 (2), 137–182. DOI: 10.1111/deve.12419.

Ni, B. and Kurita, K. 2020. The Minimum Wage, Exports, and Firm Performance: Evidence from Indonesia. *Journal of Asian Economics*, 69, 101218. DOI: 10.1016/j.asieco.2020.101218.

Ramli, N. A., Rahim, N., Mat Nor, F. and Marzuki, A. 2022. The Mediating Effects of Sustainable Growth Rate: Evidence from the Perspective of Shariah-Compliant Companies. *Cogent Business & Management*, 9 (1), 2078131. DOI: 10.1080/23311975.2022.2078131.

Tarkom, A. and Ujah, N. U. 2023. Inflation, Interest Rate, and Firm Efficiency: The Impact of Policy Uncertainty. *Journal of International Money and Finance*, 131, 102799. DOI: 10.1016/j.jimonfin.2022.102799.

Vaz, R. 2021. Firm Growth: A Review of the Empirical Literature. *Revista Galega de Economía*, 30 (2), 1–20. DOI: 10.15304/rge.30.2.7190.

Waddock, S. A. and Graves, S. B. 1997. The Corporate Social Performance–Financial Performance Link. *Strategic Management Journal*, 18 (4), 303–319. DOI: 10.1002/(SICI)1097-0266(199704)18:4<303::AID-SMJ869>3.0.CO;2-G.

Wang, L., Tian, Z., Wang, X. and Peng, T. 2023. C.E.O. Academic Experience and Firm Sustainable Growth. *Economic Research-Ekonomska Istraživanja*, 36 (2), 2135553. DOI: 10.1080/1331677X.2022.2135553.

Wang, X., Yang, M., Park, K., Um, K.-H. and Kang, M. 2022. Social Sustainability of a Firm: Orientation, Practices, and Performances. *International Journal of Environmental Research and Public Health*, 19 (20), 13391. DOI: 10.3390/ijerph192013391.

Zhang, M., Wu, D. and Huang, G. 2024. Minimum Wage Level and Corporate ESG Performance. *Finance Research Letters*, 67 (A), 105783. DOI: 10.1016/j.frl.2024.105783.

AUTHOR'S ADDRESS

Nguyen Huu Anh, School of Accounting and Auditing, National Economics University, Hanoi, Vietnam, ORCID: 0000-0003-3844-9826

Duong Thi Chi, School of Accounting and Auditing, National Economics University, Hanoi, Vietnam, e-mail: duongchi@neu.edu.vn, ORCID: 0000-0001-5254-8607 (corresponding author)

CALL FOR PAPERS

Your opportunity to publish research papers.

Open access journal for researchers and specialists from around the world.

European Journal of Business Science and Technology (EJOBSAT) is an English-language, open access, double-blind refereed journal published by Mendel University in Brno, Faculty of Business and Economics.

We provide special services to the authors, namely open access, free PDFs and liberal copyright policy.

The journal is distributed online via its web page or in printed form.

There are no submission and publication fees.
Rejection rate is 92.5% (2022), 92.6% (2023), 94.2% (2024) and 93.5% for the year 2025.

If you are interested in receiving the printed version of the journal, please contact `subscription@ejobsat.cz`. Please provide the volume number, issue number and shipping address. Subscription of the printed version is for free.

Subjects covered by EJOBSAT

The EJOBSAT covers the broad range areas related to empirical business sciences and empirical finance including interdisciplinary topics and newly developing areas of business, especially implementing new technology. Empirical advances in buyer behavior, organizational behavior, marketing, business decisions, processes and activities, including corporate finance, risk, investments and business financing are evaluated on a regular basis.

Abstracting & indexing

- Scopus
- RePEc
- DOAJ

Journal information

- ISSN 2336-6494 (Print)
- ISSN 2694-7161 (Online)
- Online submission, open access, double blind referred
- Free of charge submission and no publication fees
- EJOBSAT is published twice a year (submissions are accepted throughout the year)
- Registered members are informed about new papers
- Liberal copyright policy
- Submissions are accepted in English, in Word and TEX/LATEX

www.ejobsat.cz