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Chapter II – ABSTRACTS

The Role of Unit-Linked Insurance in Investment Portfolio

Flaviu Vasile Bălean[1] Marius Dan Gavrileteа[2]

Abstract

In the current economic context, characterized by uncertainty and volatility, the financial risk management and long-term financial security planning are becoming more and more relevant. This paper explores the importance and the usefulness of the unit-linked investment component of life insurance within the insurance companies' investment portfolios. First, Unit-Linked insurance offers a combination of financial protection and investment opportunities, thus offering double benefits: a support for loved ones in case of death of the policyholder and opportunities of capital growth through placements in various investment funds. By integrating this financial solution into the personal portfolio, investors can benefit from personalized protection, on the one hand, and a diversification of financial assets, on the other hand, thereby increasing its long-term financial stability. There will be an analysis of the investments funds returns for the last years, to see how the recent turmoil in the financial markets affected these results. Based on this analysis we will try to estimate future evolutions based on different scenarios.

Keywords: Unit-linked insurance, investment.

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Navigating the Future of Supply Chains: Asset Tokenization and Its Implications

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Abstract

In the rapidly evolving landscape of global supply chain management, blockchain technology and its application through the tokenization of assets are recognized as transformative forces. This innovative technology enables the digital representation of physical assets on a blockchain. Moreover, it significantly enhancing transparency, efficiency, and traceability on an international scale. Such advancements align with broader ICT development goals, including infrastructure enhancement, policy formulation, and workforce skill improvement across diverse global markets. While the theoretical benefits - such as improved visibility across the supply chain, increased automation, and reduced need for intermediation - are widely acknowledged, the practical challenges and potential disadvantages of integrating blockchain tokenization within existing systems remain underexplored. This is particularly true in varying economic and regulatory environments around the world.

This research seeks to bridge the theoretical and practical realms by conducting semi-structured interviews with supply chain managers who are either experienced in or are transitioning to token-based systems. Through these interviews, the study will delve into both the advantages and the challenges faced by these professionals. This approach provides a comprehensive view of the operational impacts of asset tokenization technology in global supply chain management. By exploring these real-world experiences and insights, the study aims to contribute to the ongoing discourse on ICT development. The focus will particularly be on regulatory needs, infrastructure requirements, and the necessary digital skills for effective implementation across different countries. The findings are anticipated to offer a nuanced understanding of asset tokenization's role in supply chain operations. This will serve as a valuable resource for refining current practices and shaping future technological deployments in this critical sector.

To explore the potential future implementation of asset tokenization within supply chains, our methodology begins with a literature review focused on theoretical applications and predicted impacts of blockchain in asset management. We will identify and interview supply chain managers and industry experts who are knowledgeable about blockchain's potential, despite not having implemented such systems yet. The interview guide will include questions on expected benefits, perceived barriers, and strategic considerations. It will also include hypothetical scenarios to probe decision-making processes related to the adoption of blockchain technology. Interviews will be exploratory and semi-structured. Data analysis will involve extracting themes around anticipated challenges and the scalability of asset tokenization. This will be followed by validation through additional expert consultations and a review of recent technological advancements. The findings will be synthesized into a narrative that provides a roadmap for future research and practical considerations for businesses looking at blockchain adoption.

Keywords: Asset tokenization, supply chain management, ICT development, blockchain techonology.

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Financial Development and Economic Growth: Empirical Evidence from Russian Federation

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Abstract

Financial development has been suggested as a driver of economic growth through enhancing savings, fund mobilization, and efficiently allocation of the funds. This study investigates the causal relationship between financial development and economic growth in Russia by means of causality test. The results of the causality test unravel a feedback interaction between financial development and economic growth. In other words, both financial sector development and economic growth significantly affects each other.

Keywords: Financial development, economic growth, causality analysis, Russian Federation.

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Green Tax Reform: The Role of Empirical Evidence in the Slovenian Development Strategy

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Abstract

Global sustainable development Agenda 2030 and EU regional initiatives set the broader context for Slovenian development strategy. Financial crisis (2008), COVID19 (2020) and War in Ukraine (2022-) have shown that countries have to develop more resilient and agile strategy. Slovenian government decided to upgrade its strategy in order to adequately respond to pressing climate megatrends and potential disrupters.

In the article we will present main challenges and good practices (as Government project office) that were implemented by the Slovenian government. Our experience shows that strong political commitment, project management approach and coordinated action of all stakeholders were the most crucial elements. We will explain why Slovenian government was not able to fully implement certain ideas (etc. green tax reform, program budget).

One of the most important government projects was a comprehensive green tax reform (GTR). The main goal of GTR is to tax bad things (pollution) instead of good ones (income, capital) in order to ensure fiscal neutrality and to improve the situation in an environmental and economic sense (double dividend). The first (environmental) dividend is linked to the reduction of emissions and the second (economic) to the reduction of social contributions or/and income tax which leads to lower labor costs and greater competitiveness.

Experience of many European countries shows that the effects of the GTR were mainly positive. In the article two scenarios will be presented. Baseline scenario where the green tax is not introduced and projections that assumes the introduction of the specific green tax with evaluation of its impacts on GDP, unemployment and consumption. The comparison between scenarios shows a relatively minor impact of the green tax on the chosen variables.

Keywords: Sustainable development, national strategy, green tax reform.

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ICT Penetration and Innovation as Driving Forces in the Adoption of Circular Economy from the Perspective of 'Twin Transition'

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Abstract

In recent years, Circular Economy (CE) has been gaining increasing attention worldwide as a better alternative to linear economy. CE is generally defined as a system solution framework to struggle global challenges such as climate crisis, loss of bio-diversity, rising waste and pollution rates. Increasing resource and energy saving, establishing a circular economy and protecting the environment with effective policies based on synergistic transitions in the green and digital context are considered a necessity to address the challenges of reducing environmental impact. At this point, it is thought that the provision of this synergistic structure is related to the environmental efficiency creation potential of ICT penetration and innovation. The importance of the "twin transition" linked to circular and digital economy is emphasized within the scope of both the EU green deal and the United Nations Agenda 2030 in the context of sustainable development. In particular, the EU's initiatives to play a leading role in policy designs that include both a circular economy and sustainable green and digital standards are the reasons why the country group was selected for the research. In this context, the main purpose of the study is to reveal the importance of ICT penetration and innovation as a driving force in the adoption of circular economy from the perspective of 'twin transition'. This study also aims to provide empirical evidence for the synergistic relationship between circular and digital processes. For this purpose, panel data analysis is carried out with the extended STIRPAT approach for the period 2010-2022 for 14 EU member states before the 2004 enlargement process.

Keywords: Sustainable development, twin transition, circular economy, ICT penetration, innovation.

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Is Virtual Reality Training a Sustainable and Innovative Approach to Occupational Safety Training in Energy Sector Industry?

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Abstract

Sustainability and workplace safety are deeply interconnected, both playing a crucial role in fostering a healthy and responsible work environment. In the realm of workplace safety, sustainability encompasses practices and policies designed to protect employee well-being, safeguard the environment, and ensure the organization's long-term success. In the Energy sector, preventable electrical safety accidents claim lives every year - tragic incidents that could be avoided through proper safety training and heightened awareness of electrical risks.

This paper aims to provide answers to the following research question: is virtual reality training an innovative and sustainable approach to occupational safety training in energy sector industry? The objectives of this paper are to identify relevant literature in virtual reality training domain, to conduct scientometric analysis of these studies, and to identify gaps in the existing literature and provide recommendations to fill them.

In this paper we evaluate the innovative approach aspect of occupational safety training in energy sector industry by meaning of a comprehensive literature review conducted in the main scientific data bases (Scopus Elsevier, Web of Science, Google Scholar) and taking into account that an innovative approach disrupts the status quo by introducing new technologies, methodologies, or processes that offer superior outcomes. VR training is innovative because it introduces a completely immersive, interactive, and highly adaptable learning platform that challenges traditional safety training methods, making it more engaging, effective, and future-ready. This approach enhances safety training through active learning, real-time feedback, cost-effectiveness, and the ability to simulate high-risk situations without any physical danger. We also are taking into account the three major aspects of sustainability: economic sustainability, social sustainability and ecological sustainability. To conduct a systematic literature review on sustainability and innovative approach to virtual reality occupational safety training in energy sector industry it was used The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA).

This study provides a state-of-the-art analysis of virtual reality training as both sustainable and innovative approach to occupational safety training in energy sector, employing a dual scientometric and systematic review approach.

Keywords: Occupational safety, virtual reality training, sustenability, innovative approch, e-training.

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Chapter II – FULL PAPERS

The Amendments in Bulgarian Accounting Legislation due to the New European Union's Requirements for Disclosure of Sustainability – related Information

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Abstract

The paradigm for sustainability development is deemed to be the "engine" for sustainable economic growth. The sustainability accounting concept is considered to be a logical continuity to the concept for sustainability development. It is observed the need of reporting not only information of the traditional accounting aspects. This information could be enhanced by information for sustainability matters. On one hand, sustainability information presents how the reporting entity affects the sustainability impacts, risks and opportunities, and on the other hand, how sustainability matters impact on the entity's financial performance, financial position, cash flows, its access to finance and cost of capital.

The European Union's legislation requires disclosing of sustainability information. It is observed amendments in its legislation and one of the reasons is the European Green Deal, which is the European Union's new strategy for economic growth. The core goal of the Green Deal is achieving a modern, resource – efficient and competitive economy with zero net emissions of greenhouse gases up to 2050. Regarding the amendments in the EU's legislation, a new directive known as Corporate Sustainability Reporting Directive was issued in 2022. In compliance with the Corporate Sustainability Reporting Directive, the EU's countries should have transposed it up to 6 July 2024 in their accounting legislation. In Bulgaria the above – mentioned Directive has been transposed by the Law for Accounting. In compliance with the Directive sustainability information should be reported in the sustainability statement, which should be prepared in accordance with the European Sustainability Reporting Standards.

Keywords: Corporate sustainability reporting directive, European Sustainability Reporting Standards, Bulgarian Law for Accounting; Sustainability information; Sustainability matters, ESG matters, Sustainability statement.

1. Introduction

The paradigm for sustainability development is dominant nowadays. It could be deemed that the sustainability accounting concept is a continuity to the sustainability development. It is observed an increasing need for reporting of information by companies for each material sustainability matter. Regarding sustainability matters, the European Union has own strategy for economic growth and enhancing the life of its citizens. Namely, the European Green Deal is the new strategy for sustainable economic growth of the European Union.

The Green Deal is one of the reasons, which has given rise to the amendments in the European legislation about reporting of sustainability – related information by companies. It aims to achieve a modern, resource – efficient and competitive economy in the European Union with zero net emissions of greenhouse gases up to 2050. In achieving sustainable economic growth there is a need where companies should disclose information about material sustainability matters, which affect their financial position, financial performance, cash flows, their access to finance and cost of capital over the short –, medium – and long – term. These are some of the reasons for issue of Directive 2022/2464 of the European Parliament and of the Council, known as Corporate Sustainability Reporting Directive (CSRD), which amends Directive 2014/95/EU,

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known as Non – Financial Reporting Directive (NFRD), about disclosure of information for sustainability matters. As a result of coming into force, CSRD emerges European Sustainability Reporting Standards, (ESRS). The ESRS are developed by the European Sustainability Reporting Advisory Group (EFRAG). During the development process EFRAG considered the discussions between the Global Reporting Initiative (GRI) and the International Sustainability Standards Board (ISSB). As a result, the ESRS are officially issued on 31 July 2023.

The CSRD is mandatory for all countries from the European Union, and they should have transposed it until 6 July 2024 within their accounting legislation for disclosing of information for sustainability matters. In Bulgaria the implementation of the CSRD has been transposed by the Law for Accounting regarding the reporting of sustainability information and by the Law for Independent Financial Audit regards regulations for expressing an assurance over sustainability.

Current paper aims to perform a theoretical study which presents the amendment in Bulgarian accounting legislation for disclosure of sustainability – related information by entities due to the amendment of the Non – Financial Reporting Directive with the Corporate Sustainability Reporting Directive. The authors achieve this goal by identifying the weaknesses of the Non – Financial Reporting Directive and brief researching of the Corporate Sustainability Reporting Directive, the European Sustainability Reporting Standards and the regulations of the Bulgarian Law for Accounting regarding the disclosure of information for sustainability matters. Current study does not research the amendments in the Bulgarian Law for Independent Financial Audit.

2. Literature Review

2.1. Corporate Sustainability Reporting Directive (CSRD) and its transposition in Bulgarian Law for Accounting

Research (Bacheva, Pozharevska, 2023) identifies that some of the reasons for amendments in the EU's legislation regarding the disclosure of sustainability information are lack of consistency and relevance of the disclosed information, as well as the asymmetry between the information needs of the primary users of general – purpose financial reports and the disclosed information.

The weaknesses of the Non – Financial Reporting Directive's regulations have been enhanced in the Corporate Sustainability Reporting Directive. A study (Veysel, 2023) identifies that the requirements of the NFRD are not enough for disclosure of environmental, social and governance (ESG) matters and there is no consistent guidance for such disclosure due to the lack of conventional sustainability reporting framework. It is identified amendments in the CSRD's terminology compared to the NFRD one's. In CSRD the term "non – financial information" is substituted by "sustainability information". It is considered inaccurate to refer to "non – financial information", which means the information has no financial relevance. But in many cases the sustainability information has financial impact.

Research (Oreshkova, 2024) observes that the CSRD "increases transparency and accountability of entities' sustainability practices within the European Union". There is a need where financial information should be enhanced by information for sustainability matters. By disclosing of sustainability information from the entity, the primary users of general – purpose financial reports will have an extensive view of the entity's financial position, financial performance and cash flows, its access to finance and cost of capital for these aspects which traditional accounting is not able to provide.

The NFRD was transposed in the Bulgarian accounting legislation by the Law for Accounting. The requirement for disclosing non – financial information was effective as of 1 January 2017. Until 2023 the reporting entities, which were in the scope of the NFRD, should have disclosed

information for ESG matters through a non – financial declaration. But for reporting periods started as of 1 January 2024 and thereafter the CSRD amends the requirement for preparing of non – financial declaration with sustainability statement.

The CSRD is applicable for reporting periods started on or after 1 January 2024. In accordance with the CSRD, large entities which have listings in the EU and are not micro – entities should adopt the ESRS for reporting periods started on or after 1 January 2024 for financial reports published in 2025. Small and medium entities, which have listings in the EU, should apply the ESRS for reporting periods started on or after 1 January 2025 for financial reports published in 2026. Small and medium entities are allowed not to adopt ESRS, but to apply ESRS for small and medium entities from 2028, which are in process of developing by EFRAG.

As mentioned above, in compliance with the CSRD the reporting entity should prepare sustainability statement for disclosure of sustainability – related information. The general requirements for preparing the sustainability statement are described in the Bulgarian Law for Accounting. Prior to the amendment of the NFRD, public – interest entities should have prepared non – financial declaration as mentioned above, which comprised information about their performance and their impact on ecological and social matters, as well as matters related to their employees, human rights, anticorruption and antibribery issues. Micro –, small and medium entities were not obliged to prepare non – financial declaration. The non – financial declaration did not have strong determined structure and was not prepared in accordance with mandatory sustainability reporting framework compared to the sustainability statement. The sustainability statement contains information for the entity's impacts on the sustainability matters, as well as comprehensive information about the impacts of sustainability matters on entity's development, financial position and financial performance. The sustainability statement should comprise concise description of the entity's business model and its strategy, including their flexibility to sustainability – related risks and opportunities, as well as the entity's strategy for sustainable economy and limitation of global warming. It also includes information about the role of the entity's management for the sustainability matters and information about the entity's policies about ESG matters. The information included in the sustainability statement should be presented in short –, medium – and long – term and should be in accordance with ESRS. Also, the sustainability statement should cover the same reporting period as the general – purpose financial reports.

The sustainability statement could be individual or consolidated. The CSRD requires the parent entity of a large group to prepare a consolidated sustainability statement, which contains information for the group's impacts on the sustainability matters, also information, which observes how sustainability matters impact the group's performance, financial results and financial position. The consolidated sustainability statement comprises the same information as the individual one, but on a group level. If the parent entity is also a subsidiary entity, the CSRD allows it not to prepare a consolidated sustainability statement, in case the subsidiary entity is included in the consolidated sustainability statement of another entity.

In compliance with the CSRD, there are requirements for independent audit of the sustainability statement. The sustainability statement of large and public – interest entities should be audited by certified public auditor. Large entities and public – interest entities are obliged to disclose information in the notes about the amounts paid to the registered auditors separately for the independent financial audit and for the engagement for expressing an assurance for sustainability. It could be deemed that the CSRD plays leading role in the sustainability accounting regulations across the European Union.

2.2. Brief Overview of the European Sustainability Reporting Standards

The implementation of the sustainability accounting concept by entities plays leading role in the overall performance of the entity. An article observes (Zlatareva, 2024) that "an entity creates each value with sustainable strategy, which leads to the company's success over the long – term". A study (Dimcheva, 2023) proves the value – added amount to the information provided by the sustainability accounting, which traditional accounting aspects are not able to. Another study (Bacheva, Pozharevska, 2024) identifies that the reporting entity should disclose only sustainability – related financial information in accordance with IFRS S1 General Requirements for Disclosure of Sustainability – related Financial Information, which is useful to primary users of general – purpose financial reports in making economic decisions. In compliance with IFRS S1 General Requirements for Disclosure of Sustainability – related Financial Information, the entity should disclosure only sustainability – related financial information, which is material to the entity. Similar to the implementation of the materiality concept in IFRS S1 General Requirements for Disclosure of Sustainability – related Financial Information, the European Sustainability Reporting Standards (ESRS) are based on the double materiality concept, which comprises two dimensions, namely impact materiality and financial materiality. Impact materiality is related to a material sustainability matter which gives rise to material actual or potential, positive or negative impacts on people or the environment over the short –, medium – and long – term. Financial materiality is linked to the identification of material information which affects the economic decisions of primary users of general – purpose financial reports. The information for sustainability matters disclosed in the sustainability statement is considered material if its omitting, misstating or obscuring could reasonably influence the economic decisions of primary users of general – purpose financial reports. A study related to the materiality assessment in sustainability reporting in compliance with ESRS (Bachev, 2024) observes that the reporting entity should assess its materiality considering its specific business model and its environment.

The ESRS are divided into three categories, namely:

- cross – cutting standards;
- topical standards (environmental, social and governance);
- sector – specific standards.

Cross – cutting and topical standards are not related to a specific sector. Cross – cutting standards relate to general requirements. Topical standards are linked to a specific sustainability matter. Sector – specific standards covered sustainability matters, which are specific to the entire sector. Cross – cutting and topical standards are twelve, namely:

- ESRS 1 General requirements
- ESRS 2 General disclosures
- ESRS E1 Climate change
- ESRS E2 Pollution
- ESRS E3 Water and marine resources
- ESRS E4 Biodiversity and ecosystems
- ESRS E5 Resource use and circular economy
- ESRS S1 Own workforce
- ESRS S2 Workers in the value chain
- ESRS S3 Affected communities
- ESRS S4 Consumers and end – users
- ESRS G1 Business conduct

The cross – cutting standards are ESRS 1 General requirements and ESRS 2 General disclosures. ESRS 1 General requirements describes general concepts and principles for applying the ESRS. ESRS 2 General disclosures determines material information, which should be disclosed for each material sustainability aspect. ESRS 2 General disclosures is mandatory for all entities, which have adopted the ESRS. Topical standards should be applied by entities only for the material aspects of the sustainability accounting concept.

Each ESRS has the following reporting areas, namely:

- **Governance** (GOV), which comprises the governance processes, controls and procedures used to monitor, manage and oversee impacts, risks and opportunities;
- **Strategy** (SBM), which presents how the entity's strategy and business model interacts with its impacts, risks and opportunities;
- **Impact, risk and opportunity management** (IRO), which includes the processes by which the entity identifies impacts, risks and opportunities and assesses their materiality, as well as how the entity manages material sustainability matters through policies and actions;
- **Metrics and targets** (MT), which shows the entity's performance, as well as targets that it has set and progress towards them (ESRS 1, par. 12, p. 6).

The disclosed information in the sustainability statement should contain the above – mentioned reporting areas.

In addition, the disclosed sustainability – related information should be relevant and faithful represented, and these are its fundamental qualitative characteristics, also it needs to be comparable, verifiable and understandable and these are its enhancing qualitative characteristics. The sustainability information is relevant in case the primary users could make a difference when they make economic decisions under the double materiality concept. The sustainability information is relevant when it has confirmatory or predictive value or both. The information has confirmatory value when it could provide feedback about previous evaluations. Predictive value is observed if it can be used from primary users to predict future outcomes.

Faithfully represented sustainability information is complete, neutral and accurate. It is complete if it contains complete depiction of sustainability impact, risk or opportunity. The sustainability information is neutral if it lacks bias in its selection or disclosure. It is accurate if it does not contain a material error or misstatement.

Sustainability information needs to be also comparable, and it is such if the primary users can compare it with the information disclosed from the entity in previous periods, from other entity or between entities, which operate in the same industry. Comparability of the sustainability information is related to the consistency, but both are not equal. Consistency means that similar concepts, principles and approaches have been applied in disclosing the information from one reporting period to another or between two or more reporting entities.

Sustainability information is verifiable if various knowledgeable and independent observers could reach consensus over it.

Compared to the qualitative characteristics of financial information in compliance with International Financial Reporting Standards (IFRS) and to these of sustainability – related financial information in accordance with IFRS S1 General Requirements for Disclosure of Sustainability – related Financial Information, it could be deemed they are with similar meaning.

In compliance with ESRS, the assessment of the sustainability impacts, risks and opportunities should be done under the due dilligence process. It is the process where the reporting entity

identifies, prevents, mitigates and accounts for how the entity addresses the actual or potential negative impacts on the environment and people, which are connected to its business (ESRS 1, par. 59, p. 12). Also the information in the sustainability statement should present the entity's business relationships in the upstream and downstream value chain. That means how the entity creates value upsteam and downtream through to the value chain.

The structure of the sustainability statement has four parts, which should be presented as follows:

- General information;
- Environmental information;
- Social information;
- Governance information.

The ESRS supports the information needs of the primary users of general – purpose financial reports regarding disclosure of information for ESG matters. The standards are well structured and comprehensive, also are conventional within the European Union. The information for sustainability matters disclosed in compliance with them is comparable and consistent.

3. Research Methodology

The research applied a qualitative review of the amendments in the EU's accounting legislation regarding disclosing of sustainability – related information and its transposition in the Bulgarian one. The study used a library method to present the author's findings. The research also adopted a comparability analysis over the amendments in the EU's and Bulgarian accounting legislation regards disclosing of information on ESG matters. The authors made difference between the Non – Financial Reporting directive and Corporate Sustainability Reporting Directive, also their transposition in the Bulgarian Law for Accounting, at point 2.1.

The study applied descriptive approach in presenting the European Sustainability Reporting Standards' requirements at point 2.2.

4. Conclusion

The concept of sustainability accounting requires disclosure of sustainability – related information by companies. Companies should report not only for their impact, risks and opportunities to the environment and to the society, but also for the sustainability impacts on their financial performance, financial position, cash flows, their access to finance and cost of capital. The implementation of the sustainability accounting concept by entities gives rise to the need of developing of conventional sustainability reporting standards. Such standards are the European Sustainability Reporting Standards. It is deemed that information served by the traditional accounting is not enough to the current needs of primary users of general – purpose financial reports and that information should be enhanced by information for ESG matters. The new EU's regulations will improve the reporting process for material financial and sustainability matters. Implementation of conventional sustainability reporting framework will increase the comparability and consistency of the disclosed sustainability information. The new requirements for disclosure of sustainability information are challenging to the accountants and auditors due to the fact that both of them need to be well qualified in the field of ESG reporting. Accountants should assess which information is material to the entity and disclose it in a precise and understandable manner, while auditors should express an assurance about the disclosed information on ESG matters.

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Natural Resources Rents and Economic Growth: A Causality Analysis for Saudi Arabia

Yilmaz Bayar[1]

Abstract

This study investigates the causal interplay between natural resources rents and economic growth in Saudi Arabia for the 1970-2021 period through causality test. The findings of the causality test demonstrate an insignificant interplay between natural resources rents and real GDP per capita. In other words, both natural resources rents and economic growth do not impact each other.

Keywords: Natural resources rents, economic growth, causality test, Saudi Arabia.

1. Introduction

Natural resources including non-renewable and renewable natural sources are the significant determinant of economic growth. However, depletin of natural resources is a significant obstacle for economic growth and development. Therefore, use of natural resources in a sustainable way for the long-run economic development (World Bank, 2011).

There have been two hypotheses about the interaction between natural resources and welfare. The first one is resource curse which suggests that rich countries have scarce sources while emerging countries are rich in natural resources (Harvey et al., 2014). On the other hand, Dutch disease effect suggests that high share of primary commodities export negatively impacts economic grwoth by crowding-out the manufacturing sector ((Sachs and Warner, 1997). However, some countries such as Norway and South Africa, which are rich in resources, managed the natural resources well and exhibited good economic performance (Kronenber, 2004). In conclusion, the net effect of natural resources on economic growth has remained in conclusive at theoretical terms.

This paper studies the interaction between natural resources rents and economic growth in Saudi Arabia, one of the largest oil exporters in the world, to empirically check the above theoretical considerations. The next part of the study overviews the empirical literature about the relationship between natural resources rents and economic growth, and then dataset and methodology are described. Section 4 performs the empirical analysis and the paper is finished with the Conclusion.

2. Literature Review

Natural resources are significant inputs for economic growth and development. Therefore, the nexus between natural resources and economic growth has been extensively extensive. However, the associated literature has remained inconclusive in compatible with the findings of Havranek et al. (2016). In this study, a causality analysis is conducted to uncover the interaction between natural resources rents and economic growth in Saudi Arabia.

Hamdi and Sbia (2013) explored the interaction among oil revenues and economic growth in Bahrain for the 1960-2010 duration through cointegration approach and found a positive effect of oil revenues on economic growth. Havranek et al. (2016) conducted a meta-analysis on the empirical literature about the nexus between natural resources and economic growth and found that nearly 40% of research papers disclosed a negative relationship between natural resources

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and economic growth while 20% of empirical studies revealed a positive relationship between natural resources and economic growth and 40% of the papers uncovered an insignificant interaction between natural resources and economic growth.

Mehar at al. (2018) studied the interaction between natural resource rents and economic growth in India and Pakistan between 1970 and 2017 through cointegration analysis and found a positive influence of total natural resources on economic growth in both countries. On the other hand, Shabbir et al. (2020) investigated the relationship between natural resources and economic growth in Pakistan for the 1972-2016 period and revealed that natural resources had a negative impact on economic growth

Arslan (2023) analtzed the effect of natural resource returns on economic growth in Qatar for the 1985-2017 duration through ARDL approach and discovered a negative long-term effect of natural resource returns on economic growth. Last, Singh et al. (2024) examined the effect of natural resources on economic growth in the S, UK, France, China, Russia, and Germany for the period of 1988-2019 by means of CS-ARDL and quantile-on-quantile regression approachers. Their results demonstrated a negative effect of natural resources rent on economic growth for the whole panel. The findings of a causality test indicate a unilateral causal relationship from natural resources to economic growth only in the U.S. and China and the panel, but the causality between natural resources and economic growth was insignificant for the other countries.

3. Data and Methodology

In this study, the interaction between natural resources rents and economic growth in Saudi Arabia for the 1970-2021 period is analyzed. Economic growth (EGRW) is proxied by GDP per capita based on constant 2015 US$ and natural resources rents (NATREN) are represented by total natural resources rents as a percent of GDP and both economic growth and natural resources are acquired from World Bank (2024a&b). The study term is determined as 1970-2021 because data of natural resources rents is available between 1970-2021. The statistical programme of Eviews 12.0 is employed to perform the econometric tests.

In the empirical analysis section, first the stationarity of the variables is examined by means of Phillips and Perron (PP) (1988) unit root test and then the causal nexus between natural resources rents and economic growth is analyzed through Toda and Yamamoto (1995) causality test.

3. Empirical Analysis

The presence of unit root at the series of EGRW and NATREN is examined by Phillips-Perron (PP) (1988) unit root test and the test results are introduced in Table 1. The findings of the PP unit root test demonstrate that EGRW is I(1) and NATREN is I (0).

Table 1. Results of PP unit root test.

Variables	Constant	Constant + Trend
EGRW	-1.160352	-1.983243
D(EGRW)	-4.563847***	-4.489156***
NATREN	-2.955169**	-3.370889*
D(NATREN)	-8.383958***	-8.457094***

Toda and Yamamoto (1995) causality test is an improved version of Granger (1969) traditional causality test and performs the causal interaction between two variables without pretest of cointegration. In this context, optimal lag length p is specified in the established VAR model

and it is added to the highest integration degree (d_{max}) of the variables under consideration. Then, VAR model is predicted with level values of the variables for the $p + d_{max}$ lag as following:

$$Y_t = \alpha_0 + \sum_{i=1}^{p+d_{max}} \alpha_{1i} Y_{t-i} + \sum_{i=1}^{p+d_{max}} \alpha_{2i} X_{t-i} + u_t \qquad (1)$$

$$X_t = \beta_0 + \sum_{i=1}^{p+d_{max}} \beta_{1i} X_{t-i} + \sum_{i=1}^{p+d_{max}} \beta_{2i} Y_{t-i} + v_t \qquad (2)$$

Last, the constraints are imposed on the coefficients obtained from the d_{max} and the significance of these constraints are tested by modified Wald test. The null hypothesis of the (1) equation is that there is no causality from X to Y and the null hypothesis of the (2) equation is that there is no causality from Y to X.

Within this scope, VAR model with the level values of EGRW and NATREN is estimated to determine the optimal lag length. The results are reported in Table 2 and the optimal lag length is specified as 1 regarding the SC and HQ information criteria.

Table 2. Determination of optimal lag length

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-703.7818	NA	2.03e+10	29.40758	29.48554	29.43704
1	-612.5132	171.1286*	5.34e+08	25.77139	**26.00529***	**25.85978***
2	-609.7140	5.015364	5.62e+08	25.82142	26.21125	25.96873
3	-604.5707	8.786352	5.37e+08	25.77378	26.31955	25.98003
4	-599.0767	8.927896	**5.07e+08***	**25.71153***	26.41323	25.97670

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The autocorrelation and heteroscedasticity problems are checked with LM tests and White heteroscedasticity tests and no problems of autocorrelation and heteroscedasticity are unveiled. Therefore, the causal interaction between natural resources rents and economic growth is investigated by Toda and Yamamoto (1995) causality test by $d_{max} = 1$ and $p = 1$ and the findings of Toda and Yamamoto causality test are reported in Table 3. The results indicate an insignificant interaction between natural resources rents and economic growth. On the one hand, natural resources do not have a significant influence on economic growth. On the other hand, economic growth does not have a significant effect on natural resources rents.

Table 3. Results of Toda and Yamamoto (1995) causality test

Null Hypotheses	**Chi-sq**	**P value**
NATREN is not Granger cause of EGROWTH	0.840372	0.3593
EGROWTH is not Granger cause of NATREN	1.082891	0.2981

5. Conclusion

Natural resources are significant drivers of economic growth and development. However, the empirical studies about the relationship been natural resources and economic growth has remained inconclusive. Therefore, this study investigates the causal interplay between natural resources rents and economic growth in the Saudi Arabia. The results of causality test indicate that there is an insignificant relationship between natural resources rents and economic growth in Saudia Arabia. Our results are compatible with nearly 40% of empirical studies' results. Furthermore, the results indicate that natural resources rents do not have significant influence on economic growth in Saudi Arabia. Future studies can be conducted on the nexus between natural resources and economic growth in different countries with rich natural resources by including different institutional and legal variables to understand the factors affecting the nexus between natural resources and economic growth.

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The Role of the Accounting Profession in the Sustainable Development of the Business Environment in the Republic of Moldova

Inga Cotoros[1]

Abstract

In recent years, increased importance has been given to environmental issues and social responsibility, which have led to changes at the level of the accounting profession, as the actions of accounting professionals relocated to the trends current.

Sustainable development involves a series of changes at the accounting level to meet the needs of users of financial and accounting information. Accounting professionals have an essential role to play in the business environment, because they measure, communicate, and control all information related to organizations, this thing causing them to embrace the notion of sustainable development.

At the proposal by the United Nations of the 17 objectives regarding sustainable development, with the role of stimulating activities and actions in critical areas for mankind, accountants have enthusiastically embraced this measure. Moreover, the International Federation of Accountants highlighted the contribution of accounting and the profession of accounting for the fulfillment of at least eight of the 17 objectives proposed by the UN, among which are quality education, gender equality, working conditions and economic growth, industry, innovation and infrastructure, responsible consumption of resources.

The field of sustainable development offers unlimited research opportunities, but insufficiently exploited until now, and the accounting practices and the actors in the accounting sphere are found on the border of many of these, raising the issue of an analysis of their role and impact.

In this context, the objective of this article is to determine to what extent it influences the profession and accounts for the current trend regarding the efforts made to ensure economic sustainability.

Keywords: Digitization, sustainability, accounting, profession, business environment.

1. The Role of the Accounting Profession Regarding Sustainability

Currently, the social significance of the activity of a professional accountant has evolved to another stage, a process determined by the current challenges taking place in the economic sphere, namely: digitalization, globalization, and integrated business solutions.
Under the inertia of these processes, the need to unite people in this profession in professional communities (international, regional, and national accounting bodies and/or organizations) has arisen to develop, analyze, and establish common rules of professional behavior. Accounting profession bodies are organizations that establish the general framework that underlies the activity of accountants, influencing their roles and behavior in the long term. Moreover, the way the profession is organized and the strategies of these bodies dictate the direction of development within the profession [https://www.ifac.org/knowledge-gateway/contributing-global-economy/discussion/doing-different-things-approaching-sustainability-confidence-and-your-existing-skillset]. At the same time, professional organizations of accountants aim to promote the development of the science of accounting, the principles of organizing audit and financial analysis.

Companies have realized that if they want to maintain their long-term financial stability and health, it is more beneficial to be very careful about their intentions before looking only at profit. That is why they have started to worry about their businesses being sustainable, requesting the help of sustainability consultants – experts specialized in sustainability solutions

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in various fields who help to define and implement sustainability elements for a company, regardless of its size. This profession is still in its infancy in our country, but it will soon become one of the most sought-after jobs, given the general interest in businesses aligned with the desires of consumers concerned with product traceability and a quality lifestyle, but also with the sustainability needs of the economy, accelerated by the effects of the pandemic [www.businesslease.ro].
The three pillars that define and underpin sustainability are environmental protection, social development, and economic development.

Protecting the environment involves reducing the carbon footprint, using friendly, recyclable packaging in as little as possible, reducing water consumption, and proper waste management. All these are included as efficient financial processes and as an essential part of the production chain. Moreover, environmental issues represent the principle most frequently discussed by businesses and corporate social responsibility (CSR) plans.

Social development is the element that measures responsibility towards employees, stakeholders, and the community in a company, consisting of fair, ethical, and fair behavior towards them. Work means fair payments and employees (adults) working in a protected and safe environment, but also care for benefits such as flexible hours, professional and personal development of employees, and various benefits, such as maternity or paternity.

Economic development. A sustainable economic business produces a sufficient income or profit to have continuity in the future, its challenge consists in achieving a balance - that of generating profit taking into account the other two sustainability principles above. This means focusing on more complex goals, not just making money by any means.

Sustainable development has been influenced by the main accounting bodies: the International Federation of Accountants (IFAC), the International Accounting Standards Board (IASB), and the Sustainability Accounting Standards Board – SASB) [Venter, E.R., Gordon, E.A., Street, D.L.,2018]. In 2019, the IASB identified two directions in support of the development of sustainability: reporting in the field of corporate social responsibility, oriented towards the common good, which regards society as representing the general public of this type of reporting, and reporting in the area of sustainability, which is based on the impact of aspects related to sustainable development on the company itself rather than on the public good. SASB has developed a set of 77 standards specific for each industry, which were published in November 2018, identifying and providing the minimum set of financial material sustainability characteristics and accounting indicators used in the evaluation of these elements, necessary to be calculated by entities operating in a certain sector. Thus, the use of accounting techniques to build performance evaluation indicators in the field of sustainability signals the role of accounting as a tool for measuring sustainable development and the achievement of sustainable development objectives. IFAC also supports companies in understanding their role in the global agenda on sustainable development [https://www.ifac.org/knowledge-gateway/contributing-global-economy/discussion/doing-different- things-approaching-sustainability-confidence-and-your-existing-skillset]. Professional accountants, have a desire to accumulate knowledge when faced with a new transaction or event, providing the confidence to extend processes, transactions, and reporting that can be applied in other areas. This willingness to learn is necessary to develop processes for producing information and presentations related to sustainability, which are becoming increasingly relevant and useful for organizations. Many of the skills and competencies required to effectively use standards and frameworks of sustainability are already present in the toolkit of today's accounting professionals, including:

- understanding and reporting information to users in a transparent, relevant, and meaningful way;
- understanding and applying appropriate guidance to transactions and reporting;

- determining and using appropriate measures of significance;
- evaluating the impact of guidance on transactions, trends, and strategy;
- understanding, developing, and executing processes to extract, synthesize, and interpret complete and accurate data;
- developing, implementing, executing, or evaluating an internal control system necessary for the preparation or assurance of an organization's information;
- collaborating with other departments.

2. Study on Sustainability in Business Recovery

The skills and competencies of a professional accountant are also supported by ethics and integrity, including having an appropriate role and mindset, and are applied to all activities carried out. With these acquired skills, accounting professionals can be trusted by businesses to provide sustainability reports. However, this does not mean that they are fully prepared to provide services related to sustainability. But optimism and knowledge will lead to filling the gaps. To support the accounting profession, IFAC has established a modular conceptual approach to reporting sustainability information.

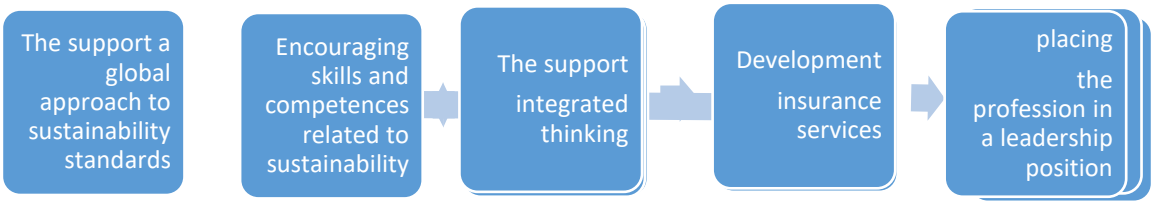

Figure 1: Conceptual approach to reporting sustainability information.

Source: Author processing after IFAC [https://www.ifac.org/knowledge-gateway/contributing-global-economy/discussion/doing-different- things-approaching-sustainability-confidence-and-your-existing-skillset].

Once the accounting profession identifies its role, accounting academia has the opportunity to contribute to ensuring that accounting's SDG interventions advance the achievement of SDG objectives [Godemann, J., Bebbington, J., Herzig, C., Moon, J, 2014, p.218-233].
Table nr. 1 includes the centralization of the main SDG objectives and those adjacent to them, to the achievement of which IFAC believes that the accounting profession can contribute, as well as highlighting the essential aspects targeted for their fulfillment, but also the number of actions or initiatives undertaken internationally by the various interested parties in the field of accounting.

Table 1. Analysis goals SDG on which profession accounting may exercise an influence right

Objective main SDG	Objection adjacent
SDG 4: Quality Education	SDG 4.3: Ensure access for all women and all men equally in technical education, vocational and tertiary, inclusive in education superior, of quality and TO affordable to prices; SDG 4.6: Ensure that all young people, as well as a substantial share of adults (both men, How, and women), TOUCH a level suitable for literacy.
SDG 5: Gender equality	SDG 5.5: Ensuring full participation and effective A women in leadership positions, such as and of equal opportunities for all levels of decision-making in political, economic life and public.

Objective main SDG	Objection adjacent
SDG 8: Decent work and economic growth	SDG 8.1: Supporting growth per capita economic output per national standards and, in private, an INCREASE with THE little 7% of GDP on year in creep THE less developed; SDG 8.3: Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity, and innovation, as well as encourage training and the growth of microenterprises, small enterprises, and medium, including through access to services financial.
SDG 9: Industry, innovation and infrastructure	SDG 9.4: Infrastructure modernization and industrial modernization to increase their sustainability, with increased efficiency of resource use and through widespread adoption A technology and A PROCESS industrially trustee and ecological; SDG 9.5a: Facilitate sustainable development and adaptability to infrastructure in developing countries development, through financial, technological, and technical support granted to African countries, the most less developed, landlocked countries, such as small island countries in the course of development.
SDG 12: Consumption and production responsive	SDG 12.6: encouraging companies, in special increase and transnational, saddle ADOPT sustainable practices and integrate sustainability information into their life cycle reporting of them.
SDG 13: Climate action	SDG 13.1: Increase resilience and adaptive capacity to natural disasters in all countries; SDG 13.2: Integrate measures for assessing the effects of climate change into the content policies, strategy, and planning national; SDG 13.3: Growth quality education, A level of awareness, AS and of human capacities and institutional mechanisms to reduce the effects of climate change, adaptation, but and of Report early A them.
SDG 16: Peace, justice and efficient institutions	SDG 16.5: Substantial reduction of corruption and giving/taking bribes in all their forms; SDG 16.6: Develop effective, accountable, and transparent institutions at all levels.
SDG 17: Partnerships to achieve goals	SDG 17.1: Increased mobilization resources locally, including through international support offered to developing countries, to increase collection capacities A CHARGES and OTHER income; SDG 17.3: Mobilize additional financial resources for developing countries from diverse sources;

Source: Author processing after IFAC [https://www.ifac.org/knowledge-gateway/contributing-global-economy/discussion/doing-different- things-approaching-sustainability-confidence-and-your-existing-skillset].

Analyzing the information presented in Table 1, it is found that the representatives of the accounting profession are actively involved and undertake significant steps to achieve at least 8 SDG objectives, especially by focusing on the 17 adjacent objectives. The actions carried out up to the present moment are especially aimed at ensuring quality education.

3. Conclusion

The field of sustainable development is characterized by a high complexity of implications and aspects that need to be addressed for an exhaustive understanding of the phenomenon, all the more so as sustainability is targeted and arouses interest regardless of the area of activity or industry. Thus, capturing all the ramifications and influences that come from the sphere of

sustainable development, especially those that intersect with the field of accounting, is a challenge for researchers, but also for all interested parties in general.

The results of the study indicate that taking steps to ensure sustainability for future generations is a necessity and a concern of bodies and organizations that exert influence at the international level, and accounting, through all the actors involved - the academic environment, researchers, accounting professionals, standardizes - can significantly support the achievement of this objective. In this sense, the work contributes to the specialized literature in the field of accounting for sustainable development, signaling the important role of accounting, as well as the initiatives started by the parties involved in this field.

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PISA Performance and Alignment with Sustainable Development Goals

Maja Mihaljević Kosor[1]

Abstract

The Sustainable Development Goals (SDGs) were adopted by all UN member countries in 2015 as part of the 2030 Agenda for Sustainable Development. Although EU countries have relatively high overall SDG and SDG 4 (Quality Education) indices, it is unlikely that they will succeed in fully achieving these goals by 2030. Focusing on education, one of the key indicators of the quality of education at lower levels are the PISA results. Over the past two decades, PISA has established itself as the leading global benchmark for comparing the quality, equity, and efficiency of learning outcomes across countries. However, the last PISA assessment saw an unprecedented drop in performance across the OECD with a decline of ten score points in reading and nearly 15 points in mathematics compared to 2018, equivalent to about three-quarters of a year's learning. Some of the decline in the results for the EU countries can be attributed to the pandemic, yet the negative trends were apparent even before 2018. Investigating the efficiency of secondary education in the EU countries in achieving SDGs highlights the policies and practices of efficient countries and identifies less efficient ones.

Keywords: SDGs, PISA, Secondary education, Efficiency

1. Introduction

Although EU countries have relatively high overall Sustainable Development Goals (SDG) index and SDG 4 (Quality Education) index, it is unlikely that they will succeed in fully achieving these goals by 2030. One of the key indicators of the quality of education at lower levels are the PISA results. Over the past two decades, PISA has established itself as the leading global benchmark for comparing the quality, equity, and efficiency of learning outcomes across countries. PISA 2023 results marked an unprecedented drop in performance across the OECD decline of ten score points in reading and nearly 15 points in mathematics compared to 2018, equivalent to about three-quarters of a year's learning.

It may be stated that the successful completion of education is becoming a norm in most countries of the world and it can also serve as a proxy of the rate at which the country is producing advanced knowledge. In order to improve educational outcomes, educational policy is of vital importance. More specifically, efficiency at which the countries are transferring inputs into (educational) outcomes. If various resources are not efficiently used, they will fail to maximize outcomes. Therefore, it is important to examine the efficiency of education sector in transforming inputs into outputs.

At upper secondary education young people acquire skills and competences necessary for their personal development in preparation for tertiary education or the labour market or both. This affects not only their development, but also their place in society, level of educational attainment, and employment opportunities. Upper secondary education is classified as ISCED level 3.This level follows ISCED level 2 (lower secondary education) where students have full implementation of basic skills.

Students typically begin their upper secondary education (ISCED level 3) after the completion of compulsory education at the age of 14 to 16. More specialization occurs at this level and teachers are generally more qualified and specialized than at ISCED level 2. ISCED level 3

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may provide programs for direct access to first stage of tertiary education (ISCED 5) (UNESCO, 2012). Some of these are programs that are intended to provide qualifications to gain entry into advanced research programs and profession with high requirements or programs that develop practical skills or are occupationally specific at ISCED level 5.

According to Eurostat (2024), in the EU there were 18.2 million pupils and 1.6 million teachers in upper secondary education in 2022. The number of pupils in upper secondary education outnumbered the pupils in lower secondary education (ISCED level 2) in most EU countries. A large majority (81.5%) of pupils in upper secondary education in the EU were taught in public institutions in 2022 (Belgium being the only exception). Given the demographic challenges in the EU related to declining birth rate and smaller number of pupils, the EU Council in 2021 adopted the Resolution on a strategic framework for European cooperation in education and training towards the European Education Area and beyond (2021-2030) (European Commission, 2021). The goal of the resolution is trifold - to improve the quality, inclusion and success in education and training, to support green and digital transitions and to improve competencies and motivation in occupations related to education and training. To monitor the progress, several targets have been introduced. The one target related to the research in this paper is that the share of low-achieving 15-year-olds in reading, mathematics and science should be less than 15 percent by 2030. One of the key indicators of the quality of education at lower levels are the Programme for International Student Assessment (PISA) results.

Over the past two decades, PISA has established itself as the leading global benchmark for comparing the quality, equity, and efficiency of learning outcomes across countries. PISA measures 15-year-olds' ability in reading, mathematics and science knowledge and skills to meet real-life challenges. With one year delay, in 2022, as countries were still faced with the impact of the COVID-19 pandemic, nearly 700 thousand students from 81 OECD Member and partner economies, took the PISA test (OECD, 2023a). This makes 2022 PISA the first large-scale study to collect data on educational performance, well-being, and equity before and after the COVID-19 disruption. However, the last PISA assessment saw an unprecedented drop in performance across the OECD with a decline of ten score points in reading and nearly 15 points in mathematics compared to 2018, equivalent to about three-quarters of a year's learning. Some of the trends in PISA scores are presented in Figure 1. These include average scores in mathematics, reading and science from 2003 until 2022.

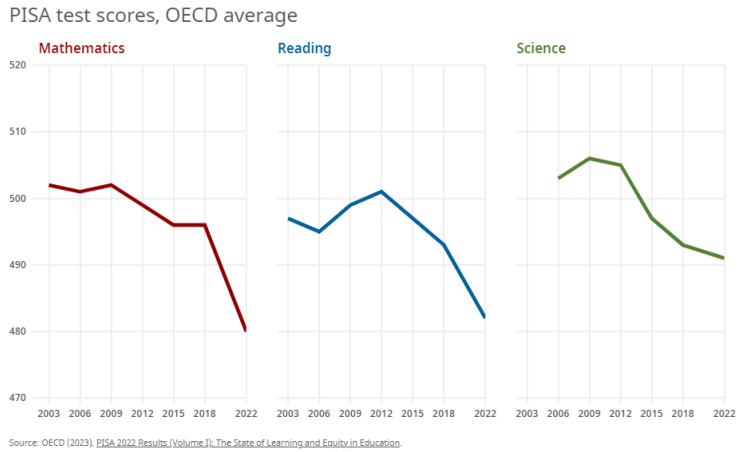


Figure 1: Trends in mathematics, reading and science performance (PISA test scores, OECD average)

Source: OECD (2023), PISA 2022 results (Volume I) – The State of Learning and Equity in Education

Some of the decline in the results for the EU countries can be attributed to the pandemic, yet the negative trends were apparent even before 2018 (OECD, 2023a) and in Figure 1. It may be argued that this decline in PISA scores may affect the achievement of SDGs. In the next sections, a model to investigate this relationship is developed.

2. Efficiency in Education

The positive relationship between education and economic growth has long been established. Some of the benefits of education are related to society as a whole - see studies by Hanushek and Woessmann (2012) or Hanushek and Kimko (2000). For instance, Hanushek and Woessmann (2008) find there is around one percentage point gain in GDP growth for every country’s one standard deviation higher (standard international) test performance. Private benefits of education have also been investigated, e.g. Psacharopoulos and Patrinos (2004) emphasize the lifetime returns to individuals from investment in additional year of schooling. Given the positive social and private effects of education, a large number of empirical studies to date have attempted to define and measure efficiency in education at various levels.

These studies used different techniques to identify ‘efficient’ decision-making units (students, schools, departments, universities, countries) and compare them with ‘inefficient’ ones. Three most widely used approaches in efficiency estimation are statistical or econometric approach (mostly regression analysis), Stochastic Frontier Analysis and Data Envelopment Analysis (DEA). For this research, the focus is on DEA. More details on DEA are presented in Section 4.

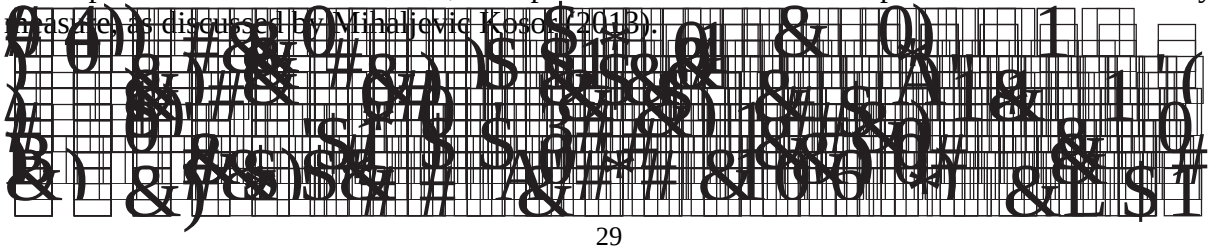
3. Literature Review

DEA is a widely used technique in calculating the efficiency of secondary education. Some of its more relevant applications are detailed in this section with the discussion of variables and main results.

Koçak et al. (2019) use DEA to calculate the efficiency of primary, secondary and tertiary education in OECD countries. The inputs are public expenditures at each level of education; while the outputs are the indicators used to measure SDG4 (Quality Education).Their results suggest that Latvia, Poland, Slovenia and South Korea are highly efficiency at all three levels of education and that the countries with high efficiency scores are clustered around them.

A recent application of DEA can be found in Gavurova et al. (2017). They examine the efficiency of government expenditure on secondary education in European countries through an output-oriented DEA method with variable returns to scale. PISA score in 2015 is the output variable, while government expenditure on education is the input variable. Their results suggest that the average technical efficiency is high and equal to 0.955 with the most efficient countries being Estonia, Finland, Ireland, Slovakia, Sweden, Norway and Switzerland.

Scippacercola and D'Ambra (2014) use Stochastic Frontier Analysis (SFA) to analyze the relative efficiency of secondary schools in Campania region in Italy. On a sample of 35 secondary schools in the academic year 2012/2013, they find that efficiency increases with the increase in the number of teachers per 100 pupils and number of pupils per class. The SFA the authors use, is developed along statistical lines and pioneered by Aigner, Lovell and Schmidt (1977). The researcher establishes a functional form between a set of explanatory variables and the dependent variable. However, misspecifications can be incorporated in the efficiency measures, as discussed by Mihaljevic Kosor (2013).



Aristovnik and Obadić (2014) analyze the technical efficiency of secondary education in 31 EU and OECD member countries for the period from 1999 to 2007. In four models, they combine various variables as inputs and outputs. These are public expenditure on secondary education (percent of GDP per capita), secondary school enrolment (percent of all primary school graduates), secondary school student/teacher ratio (a proxy for the quality or efficiency of education), tertiary education enrolment (percent of all secondary school graduates), and the average PISA score for 2006. Their results suggest that the technical efficiency of secondary education is relatively low. This is especially the case for new EU member countries and less developed OECD economies. They also find low technical efficiency for Slovenia and Croatia in all models and suggest educational reforms for secondary education in these countries.

Finally, Afonso and Aubyn (2006) examine the efficiency of secondary education in 25 OECD countries using a two-stage DEA approach and the Tobit method. In the first stage, the input variables are total time spend in school for pupils of age 12 to14, and total staff per pupil in schools. The output variable is PISA score for 2003. Their results suggest that the selected countries could increase their PISA score by 11.6% while holding inputs constant.

From the above, it may be argued that DEA is a widely used, versatile technique. It allows for comparisons of school efficiency within a certain education system or across different regions, countries and time periods.

4. Data and Method

Production function can be used to express the relationships between decision making unit (DMU)'s inputs and outputs. In a mathematical form it shows how a DMU generates a vector of outputs using a flow of inputs and some available technology. In education, these outputs are not easily quantifiable and there are many stakeholders, many objectives and many outputs (Dixit 2002). The method can handle multiple inputs and multiple outputs and this makes it an appealing choice for measuring the efficiency in education.

DEA is a non-parametric method and its efficiency estimates are not conditional on the specific functional form. It was originally developed for efficiency evaluation of 'not-for-profit entities participating in public programs' where prices are not clearly observed (Charnes et al., 1978).

Efficiency estimates are then obtained as the maximum of a ratio of weighted outputs to weighted inputs (output orientation). Linear programming methods are used to assign an observation-specific set of weights to outputs and inputs in such a way that the ratio of weighted output to weighted input is maximized for each observation, subject to certain constraints. This methodology amounts to constructing a linear surface over the data so that the actual input/output quantities are either on or in the interior of this frontier.

For an early review of this literature see Worthington (2001), followed by Johnes et al. (2017) or De Witte and López-Torres (2017) for more recent discussions.

Using DEA for the empirical part of the research, we calculate the technical efficiency of the upper secondary education of 26 EU countries in achieving Sustainable Development Goals. The efficiency analysis is calculated using the Banker, Charnes and Cooper (1984) i.e. BCC output-oriented model with two input and one output variable. Similar to other empirical work using DEA, the model in this research is output oriented i.e. focused on maximizing output production while not exceeding the actual input level. Variable returns to scale are used in the estimation. A more detailed discussion of the variables is in the next section.

4.1 Data

The variables used in this research are in Table 1. There are two input variables (PISA score in mathematics and the total number of students enrolled in upper secondary education in 2018 and 2022) and one output variable – the country's overall SDG index. The overall SDG index captures the total progress of a country in achieving all 17 SDGs. The goal is to compare the efficiency in achieving SDGs in two periods - 2018 and 2022.

Table 1: Dataset.

Variable	Category	Description	Year	Source
PISA score mathematics	Input	Country's average score in mathematics	2018 and 2022	OECD, PISA database
Enrolled students	Input	Total number of students enrolled to ISCED 3 level progammes, per country in thousands	2018 and 2022	Eurostat, Education and training database
Overall SDG index	Output	Total progress of a country towards achieving all 17 SDGs	2018 and 2022	Eurostat, Education and training database

Source: (Author).

Table 2 presents summary statistics for the variables used in the dataset. In 2018 and 2022 there were 26 EU countries considered for the estimation.

Table 2: Summary statistics.

Variable	Obs.	Mean	Std.dev.	Min	Max.
PISA score mathematics 2018	26	488.34	24.75	429.92	523.41
PISA score mathematics 2022	26	471.94	23.5	417.3	509.95
Enrolled students 2018	26	677.88	833.66	18.14	2854.6
Enrolled students 2022	26	661.67	841.33.	17.7	2909.4
Overall SDG index 2018	26	79.21	3.14	73.34	85.89
Overall SDG index 2022	26	79.89	2.99	74.2	86.5

Source: (Author, summary statistics calculated in Stata).

In Table 2, there is an expected decline in the mean PISA score in mathematics in 2022, and a decline in the number of students enrolled in upper secondary education (ISCED 3). The overall SDG index increased from 79.21 to a 79.89 mean value.

The next section presents the results of efficiency estimation performed in Stata.

5. Results

Results in Table 3 present the technical efficiency score of EU countries in achieving SDGs. The model is output oriented and focused on maximizing output production while not exceeding the actual input level. Variable returns to scale are used in the estimation. Technical efficiency score can have values from 0 to 1. Fully efficient countries have the score equal to 1, worst performing countries would be close or equal to zero.

Table 3: Technical efficiency scores in 2018 and 2022.

Country	Efficiency score, 2018	Efficiency score, 2022
Austria	0.967014	0.951445
Belgium	0.920829	0.921387
Bulgaria	1	1
Croatia	1	0.969189

Country	Efficiency score, 2018	Efficiency score, 2022
Cyprus	1	1
Czechia	0.940387	0.930636
Denmark	1	1
Estonia	1	0.998354
Finland	1	1
France	0.95509	0.95633
Germany	0.962384	0.966544
Greece	0.983165	0.996717
Hungary	0.949684	0.932408
Ireland	0.961775	0.957807
Italy	0.934401	0.926741
Latvia	1	0.993424
Lithuania	0.954538	0.932614
Malta	1	1
Netherlands	0.927698	0.923699
Poland	0.933752	0.930636
Portugal	0.932755	0.937054
Romania	1	1
Slovakia	0.962101	0.961343
Slovenia	0.986897	0.982427
Spain	0.951262	0.942405
Sweden	0.996772	0.989201
Average	**0.9698881**	**0.9653985**

The average technical efficiency of EU countries is high in 2018 and 2022 and equal to 0.97. Nine countries stand out as fully efficient in 2018. These are Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, Latvia, Malta and Romania. Six countries are fully efficient in 2022 (Bulgaria, Cypres, Denmark, Finland, Malta and Romania). Four best performing countries in 2018 and 2022 are Bulgaria, Finland, Malta and Romania.

Results provided a form of ranking for countries, from best to worst. However, overall sample of 26 EU countries demonstrates high levels of efficiency in turning inputs into output.

For future research, including more variables related to upper secondary education and extending the time periods under consideration, could provide more detailed information on efficiency. It may encourage transparency and promote accountability within countries' educational systems and lead to promoting effective practices while improving student outcomes.

6. Conclusion

DEA remains a valuable tool for assessing the performance of educational systems. It is widely used in calculating relative efficiency of decision-making units using multiple inputs and

outputs. Measuring efficiency in education is crucial for ensuring that education systems operate efficiently, achieve desirable outcomes while using limited resources. It is a non-parametric method so no functional form is imposed. Using DEA, this research presented new information on the efficiency of EU countries in achieving SDGs in the recent years. It adds to the literature on efficiency at upper secondary level; a level that has been underrepresented in efficiency evaluations.

Calculating efficiency helps to identify best (and worst) performing countries. Finding the most productive benchmarks and eliminating waste in resources dedicated to secondary education represents a good starting point. To gain insight, a more detailed analysis is necessary in examining the success of four best performing countries in 2018 and 2022 (Bulgaria, Finland, Malta and Romania).

However, caution should be used in applying DEA. It is a non-parametric technique and only relative efficiencies are calculated. This makes the selection of inputs and outputs quite important.

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The Relationship between Democratization and Economic Growth: The Case of Selected EU Countries

Ahmet Ozen[1] Mahmut Unsal Sasmaz[2]

Abstract

Democracy is a form of government based on the sovereignty of the people. and is a system that protects the fundamental rights and freedoms of individuals and is based on the principles of equality and participation. Also economic growth is an indicator of the increase in an economy's capacity to produce goods and services in a certain period. It is usually evaluated by measures such as Gross Domestic Product (GDP) and expresses the potential of a country to increase its economic prosperity, production power and living standards. Therefore, this paper examines the causal relation between democratization and economic growth in selected EU countries by way of causality test over the period of 2010-2023. According to Emirmahmutoğlu and Köse (2011) causality test results, it was determined that there is a bidirectional causality relationship between the level of democratization and economic growth.

Keywords: Democratization, economic growth, panel causality analysis, selected EU countries

1.Introduction

The relationship between democracy and economic growth has been a long-debated issue in the field of political science and economics. Democracy, as a form of government that ensures public participation in government and protects fundamental rights and freedoms, contains many elements that can affect economic growth. Economic growth is a critical indicator that expresses the welfare level and development of a country. The link between these two phenomena is shaped in both direct and indirect ways.

It supports the functioning of the market economy with its principles such as democracy, rule of law and accountability. Protection of freedoms and a transparent management approach can increase individuals' creativity and entrepreneurial capacities. On the other hand, the fact that decisions taken in democratic systems are open to long discussions may slow down the pace of economic reforms. Therefore, democracy may not always lead to rapid economic growth, but it can offer a sustainable development environment in the long run.

Consequently, the relationship between democracy and economic growth is affected by various socioeconomic and political dynamics. Understanding this relationship is an important guide to both strengthening a country's democratic values and increasing its economic prosperity.

2.Literature Review

The issue of democracy and its impact on economic growth dates back to Plato and Aristotle in ancient Greece, and the basis of the debate is the debate about which type of government will bring the most political and economic gain to society. As a matter of fact, although it has been discussed for more than two thousand years, there is still no consensus on whether it provides better economic growth than other types of autocratic governments, which are alternatives to democracy (Ghardallou and Sridi, 2020). When starting a literature search on this subject, it can be detected even in a quick scan that there are hundreds of articles addressing these two topics. However, the existence of a definitive relationship between democracy and economic growth is not generally accepted in studies. For example, Doocouliagos and Ulubasoglu (2008)

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stated in their study that the direct effect of democracy on growth is neutral, whereas economic freedom has a direct positive effect. Another study supporting this was conducted by De Haan and Siermann (1995) and it was concluded that there is no significant relationship between democracy and growth. Additionally, Heo and Tan (2001) conducted a Granger analysis of thirty-two developing countries in the period from 1948 to 1982 and found that the causal direction between democracy and economic development could not be generalized either way.

When the literature is examined comprehensively, studies that evaluate the impact positively or make contrary findings in the context of democracy and economic growth also stand out. In order to clarify the subject, Table 1 was prepared by us and a number of studies were categorized. Of course, since these two issues are addressed dynamically, the number of studies may increase. As a matter of fact, studies that we consider noteworthy are grouped in Table 1.

Table 1: Relationship between Democracy and Economic Growth

Democracy positively affects economic growth.	Protection of property rights positively affects economic growth.	North (1990); Dixon (1993); Acemoğlu & Johnson (2005)
	Political stability increases investment appetite and growth is positively affected	Pastor ve Hilt (1993); Tavares ve Wacziarg (2001) ; Aggarwal ve Goodell (2009) ; Apergis (2017)
	Democracy positively affects growth through education and investment.	Helliwell (1994)
	Increasing human capital positively affects growth	Tavares ve Wacziarg 2001 ; Baum ve Lake 2003
	Increasing technology positively supports growth	Romer (1990); Halperin etc. (2005); Aghion ve Howitt (2009)
	Reduction in bureaucratic procedures positively supports growth by reducing the pressure on companies.	Rabiul 2018; Ho etc. (2018)
Democracy negatively affects economic growth.	Autocratic governments can focus on long-term goals and implement policies that are much more consistent with optimal economic choices	Wade (1990); Zakaria (1997)
	Inefficiencies resulting from the pressure of lobbies lead to a decrease in national income in democracies	Olson (1982); Przeworski ve Limongi (1993)
	Increased government intervention in the name of democracy may reduce economic growth	Weede (1983)
	Democracy can negatively affect investments and growth by revealing the distribution of capitalists' income to the poor.	Sah (1991)

A new dimension to such studies, which examine the relationship between democracy and economic growth from different aspects, was brought by Knutsen (2012). As a matter of fact, Knutsen (2012) emphasized in his study that there is still a disagreement about whether democracy increases economic growth. However, he argued that in light of more recent studies, using better methodological approaches and more data than previous studies, two trends have emerged. According to the first of these, the hypothesis that democracy reduces economic

growth has been refuted by recent studies. Second, the hypothesis that democracy has no effect on growth seems less plausible today than it did 10 or 20 years ago. In fact, he claimed that some recent studies have revealed that democracy has positive effects on growth and stated that democracy indirectly affects growth through ways such as increasing human capital or strengthening the protection of property rights.

The literature we discussed in the study proves that there is currently no general acceptance of a concrete relationship between democracy and economic growth. One of the reasons for this may, of course, be the differences in the country groups and time series subject to analysis. Nevertheless, each new analysis will mean taking another step in terms of concretizing the relationship and will be important in this respect. The analysis we will include in our study is important in terms of contributing to the concretization of this relationship.

3. Data and Method

The study investigated the relationship between democratization and economic growth in 10 EU countries (Germany, France, Italy, Spain, the Netherlands, Poland, Belgium, Sweden, Ireland and Austria) between 2010 and 2023. Theoretical and empirical literature were taken into account in determining the variables in the study. The democratization index used in the study was obtained from EIU (The Economist Intelligence Unit) (2024), and the economic growth data was obtained from the World Bank (2024). Table 2 includes the variables and definitions used in the study;

Table 2: Variables and Definitions

Variables	**Sembol**	**Source**
Democracy Index	DE	EIU (2024)
GDP growth (annual %)	GRWT	World Bank (2024)

In the study, Emirmahmutoğlu and Köse (2011) causality test method was chosen as the method. First, it was tested whether there was a cross-sectional dependency relationship between the series, then the homogeneity of the series was examined. Finally, the causality relationship between the variables was examined with Emirmahmutoğlu and Köse (2011) causality analysis. The causality relationship between democratization and economic growth was examined in the study. The equation of the model is given below;

Model: $GRWT_{it} = \alpha_{it} + \beta_1 DE_{it} + u_{it}$ (1)

4. Econometric Analysis

In the econometric analysis, cross-sectional dependency between democratization and economic growth is examined with tests of LM, $LM_{adj.}$, and LM CD, and the test results are reported in Table 3. The null hypothesis of cross-sectional independency is abnegated given the probability values of three tests and the subsistence of cross-sectional dependency is disclosed between two variables.

Table 3: Cross-sectional dependence tests' results

Test	**Test statistic**	**Prob.**
LM (Breusch and Pagan, 1980)	43.36	0.000
LM adj* (Pesaran et al., 2008)	22.15	0.000
LM CD* (Pesaran, 2004)	-2.704	0.005

The homogeneity is examined with delta tilde tests of Pesaran and Yamagata (2008) and their results are reported in Table 4. The homogeneity is abnegated given the probability values of two tests and subsistence of heterogeneity is disclosed.

Table 4. Homogeneity tests' results.

Test	Test statistic	Prob.
$\tilde{\Delta}$	4.262	0.000
$\tilde{\Delta}_{adj.}$	4.185	0.000

The stationarity of DE and GRWT is examined by Pesaran (2007) CIPS unit root test because of the cross-sectional dependency between two series and its results are shown in Table 5. The test results identify that DE and GRWT are integrated to I(1).

Table 5: Unit root test's results

Variables	Constant	Constant +Trend
DE	2.505	2.202
D(DE)	-2.358***	-2.182**
GRWT	0.241	-2.775***
D(GRWT)	-5.820***	-4.858***

*** and ** are respectively significant at 1% and 5% level.

Table 6 shows the panel causality results between DE and GRWT. According to Emirmahmutoğlu and Köse (2011) causality test results, it was determined that there is a bidirectional causality relationship between the level of democratization and economic growth.

Table 6: Emirmahmutoğlu and Köse (2011) causality test results

Variables	Fisher stat.	Probability Values
DE ↛ GRWT	1688.163***	0.0000
GRWT ↛ DE	111.640***	0.0000

Note: *** indicates the significance at 1% level, ** indicates the significance at 5%,* indicates the significance at 10% level.

5. Conclusion

The reciprocal causality relationship between the level of democratization and economic growth is an important finding in understanding the interaction between economic development and political systems. This relationship shows that both phenomena affect each other and form a cycle. The democratization process allows the public to have a greater say in governance, which encourages a more transparent, accountable and participatory approach to governance. This type of management contributes to the sustainable growth of the economy by ensuring that economic decisions are taken and implemented more effectively. In addition, the freedoms provided by democracy and the assurance of the rule of law encourage entrepreneurship and the investment environment.

On the other hand, economic growth can also support the democratization process. Economic prosperity can enable individuals to demand more freedom and participate more. Economic growth allows for greater investment in education, infrastructure and technology in society, which can help accelerate the democratization process. Therefore, this interrelationship

between economic growth and democratization allows both areas to feed each other, creating a more stable development process. As a result, there is a strong interaction between democratization and economic growth, and this interaction plays a critical role for sustainable development in the long term.

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The Relationship between Democratization and CO_2 Emissions: The Case of Selected EU Countries

Mahmut Unsal Sasmaz[1] Ahmet Ozen[2]

Abstract

Democracy is a form of government that enables people to participate in government. Carbon emissions are carbon dioxide and other greenhouse gases released into the atmosphere from human-induced processes such as fossil fuel use, industrial activities and agriculture. These two concepts have an important interaction in the formation and implementation of environmental policies. Therefore, this paper examines the causal relation between democratization and CO_2 emissions in selected EU countries by way of causality test over the period of 2010-2020. Emirmahmutoğlu and Köse (2011) causality test results, a one-way causality relationship from democratization to carbon dioxide emissions was determined.

Keywords: Democratization, CO_2 Emissions, panel causality analysis, selected EU countries

1.Introduction

Global warming and climate change have become one of the most critical problems facing humanity. This problem directly affects not only environmental impacts but also the sustainability of social, economic and political structures. Government styles and policies of states play an important role in combating the climate crisis. In this context, the relationship between democracy and carbon emissions is an important issue discussed in both the academic world and policy circles. So, are democratic forms of government more effective in reducing carbon emissions? Or can authoritarian systems that prioritize economic development take faster and more decisive steps in this regard?

Democracy is defined as a system that enables the public to participate directly or indirectly in government. In democratic countries, citizens have the right to criticize and change government policies and raise awareness for sustainability. This feature can provide a significant advantage in the formulation and implementation of environmental policies. For example, non-governmental organizations and individuals can push governments to be more transparent and accountable on environmental issues. Moreover, democratic governments generally tend to develop more inclusive policies; This could open up more room for long-term strategies aimed at reducing carbon emissions.

However, the effects of democracy on the environment may not always be positive. Democratic systems can move slowly at times because decision-making processes are often longer and more complex. Short-term economic interests can override long-term environmental policies, especially when economic development conflicts with environmental sustainability. Additionally, in some democratic countries, individual lifestyles and consumption habits may stand out as factors that increase high carbon emissions.

On the other hand, authoritarian regimes generally stand out with their ability to make and implement rapid decisions. For example, some authoritarian regimes have been able to take faster and more effective steps towards transitioning to renewable energy or limiting carbon

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emissions. However, in such systems, the sustainability and long-term effects of policies are questionable since the participation of the public and civil society in the process is limited. Moreover, in authoritarian regimes, environmental policies are generally shaped according to economic development goals and environmental concerns can be put in the background.

This dynamic relationship between democracy and carbon emissions is also shaped by factors such as the level of economic development, energy consumption habits and technological development. Democratic countries may have an advantage when it comes to investing in clean energy and reducing their carbon footprint, as they generally have higher income levels and advanced technologies. However, these advantages can only be transformed into sustainable results with effective political will and public support.

2.Literature Review

The relationship between democracy and carbon emissions has been an important topic of discussion in recent years in terms of environmental sustainability and understanding the effects of political structures. The impact of various factors such as the level of democracy, use of renewable energy and environmental policies on carbon emissions has been demonstrated by numerous studies. These studies show that the impact of democracy on the environment is not one-dimensional and that complex interactions exist.

In their study for 46 Sub-Saharan African countries in the period 1980-2015, Adams and Acheampong (2019) concluded that democracy and the use of renewable energy reduced carbon emissions. This finding revealed that democratic governments that support renewable energy policies play an active role in reducing environmental impacts. Similarly, Joshi and Beck (2018) compared OECD countries with politically unfree countries in terms of carbon emissions and found that carbon emissions were higher in non-free countries. This shows that non-democratic regimes tend to attach less importance to environmental policies.

Hartwell and Coursey (2015) pointed out the positive effects of the level of economic freedom on the environment and public health. It has been emphasized that environmental protection policies can be implemented more effectively when economic freedoms are combined with democratic structures. In contrast, Aubourg et al (2008) argued that authoritarian regimes rarely invest in environmental protection policies because they are immune from popular pressure. This situation reveals the insensitivity of authoritarian regimes to environmental problems and the advantages of democratic structures in environmental protection.

Povitkina (2018) analyzed the impact of democracies on carbon emissions by combining it with the corruption factor and emphasized that democracies with low corruption can reduce carbon emissions. This finding shows that the positive effects of democracy on the environment should be supported not only by democratic structures but also by good governance practices. Similarly, Muttakin et al. (2022) stated that companies operating in countries with strong democratic institutions emit less carbon compared to companies in other countries. These findings suggest that democratic institutions positively influence company behavior and environmental impacts.

Lv (2017) argued in his study that the reducing effect of democracy on carbon emissions can only be seen if the country reaches a certain income level. This finding shows that the relationship between democracy and carbon emissions is an important determinant of economic development. Li and Reuveny (2006) stated that non-governmental organizations in democratic countries can intensify their actions to reduce carbon emissions by obtaining a freer environment in environmental protection. This is an important finding that emphasizes the positive impact of democracy on civil society.

Eren (2022) presented a more complex perspective on the relationship between democracy and carbon emissions and argued that a high level of democracy positively affects environmental quality in countries with low and medium emission intensity, but this may have the opposite effect in countries struggling with high carbon emissions. This finding shows that the effects of democracy on the environment depend on the subjective conditions of the countries.

Midlarsky (1998) examined the relationship between democracy and environmental pollution in three sub-dimensions and found a positive effect of democracy only in the protected land area, while stating that it did not have a significant effect on issues such as freshwater availability and soil erosion by chemicals. This study emphasizes that the effects of democracy on the environment are complex and multidimensional.

Clulow (2019) stated that democracies generally have lower carbon emissions than non-democratic countries, but a similar difference is not observed in a country's own democracy development. He also stated that democratic developments in the country could have positive effects on carbon emissions. You et al. (2015) found that democracy has a positive effect in countries with low emissions and a negative effect in countries with high emissions. These findings show that the environmental impacts of democracy may vary depending on countries' emission levels and structural conditions.

In general, the literature reveals that the factors affecting the relationship between democracy and carbon emissions are multidimensional. In this relationship, the potential advantages of democratic structures in environmental protection are shaped by factors such as our economic development, the level of corruption and renewable energy policies. Therefore, it is important that both theoretical and applied approaches are developed to address these complex dynamics.

3. Data and Method

The study investigated the relationship between democratization and CO_2 Emissions in 10 EU countries (Germany, France, Italy, Spain, the Netherlands, Poland, Belgium, Sweden, Ireland and Austria) between 2010 and 2023. Theoretical and empirical literature were taken into account in determining the variables in the study. The democratization index used in the study was obtained from EIU (The Economist Intelligence Unit) (2024), and the CO_2 emissions data was obtained from the World Bank (2024). Table 1 includes the variables and definitions used in the study;

Table 1: Variables and Definitions

Variables	**Sembol**	**Source**
Democracy Index	DE	EIU (2024)
CO_2 emissions (metric tons per capita)	CO	World Bank (2024)

In the study, Emirmahmutoğlu and Köse (2011) causality test method was chosen as the method. First, it was tested whether there was a cross-sectional dependency relationship between the series, then the homogeneity of the series was examined. Finally, the causality relationship between the variables was examined with Emirmahmutoğlu and Köse (2011) causality analysis. The causality relationship between democratization and CO_2 emissions was examined in the study. The equation of the model is given below;

Model: $CO_{it} = \alpha_{it} + \beta_1 DE_{it} + u_{it}$ (1)

4. Econometric Analysis

In the econometric analysis, cross-sectional dependency between democratization and CO_2 emissions is examined with tests of LM, $LM_{adj.}$, and LM CD, and the test results are reported in Table 2. The null hypothesis of cross-sectional independency is abnegated given the probability values of three tests and the subsistence of cross-sectional dependency is disclosed between two variables.

Table 2: Cross-sectional dependence tests' results

Test	Test statistic	Prob.
LM (Breusch and Pagan, 1980)	39.27	0.000
LM adj* (Pesaran et al., 2008)	21.44	0.000
LM CD* (Pesaran, 2004)	-2.609	0.000

The homogeneity is examined with delta tilde tests of Pesaran and Yamagata (2008) and their results are reported in Table 3. The homogeneity is abnegated given the probability values of two tests and subsistence of heterogeneity is disclosed.

Table 3. Homogeneity tests' results.

Test	Test statistic	Prob.
$\tilde{\Delta}$	3.877	0.000
$\tilde{\Delta}_{adj.}$	3.653	0.000

The stationarity of DE and CO is examined by Pesaran (2007) CIPS unit root test because of the cross-sectional dependency between two series and its results are shown in Table 4. The test results identify that DE and CO are integrated to I(1).

Table 4: Unit root test's results

Variables	Constant	Constant +Trend
DE	2.408	2.300
D(DE)	-2.150***	-2.182**
CO	0.222	-2.555***
d(CO)	-5.715***	-4.759***

*** and ** are respectively significant at 1% and 5% level.

Table 5 shows the panel causality results between the level of democratization and carbon dioxide emissions. According to Emirmahmutoğlu and Köse (2011) causality test results, a one-way causality relationship from democratization to carbon dioxide emissions was determined.

Table 5: Emirmahmutoğlu and Köse (2011) causality test results

Variables	Fisher stat.	Probability Values
DE $\nrightarrow$ CO	77.664***	0.0000
CO $\nrightarrow$ DE	30.744	0.559

Note: *** indicates the significance at 1% level, ** indicates the significance at 5%,* indicates the significance at 10% level.

5. Conclusion

This study aimed to examine the causal relationships between democratization and carbon dioxide (CO_2) emissions and detected a unidirectional causality instead of bidirectional causality. The findings showed that increasing the level of democratization had a significant effect on CO_2 emissions, but changes in CO_2 emissions did not have a similar effect on democratization. This result allows us to make various theoretical and practical inferences.

First, the impact of democratization on carbon emissions can be explained by contributing to making environmental policies more transparent and accountable. In democratic societies, the public has greater access to information about environmental issues, which can lead to increased environmental awareness. At the same time, democratic mechanisms can increase the influence of public demands on politics, directing decision-makers to implement more sustainable environmental policies. This may contribute to the reduction of greenhouse gas emissions.

However, the lack of reverse causality, that is, the lack of an impact of CO_2 emissions on democratization, can be explained by the fact that environmental concerns are often seen as a secondary priority. It is observed that, especially in authoritarian regimes, priorities such as economic development and industrialization take precedence over democratic reforms. However, the fact that the effect of increasing awareness of environmental pollution and public pressure on democratization is relatively more indirect also supports this result.

The study's findings highlight the potential positive effects of democratization processes on environmental recovery. Increased levels of democracy may enable public policies to evolve in an environmentally friendly direction. However, this does not mean that democratic countries will automatically achieve low emissions levels. The relationship between democracy and carbon emissions is affected by many factors such as the economic structures of countries, industrial compositions, the effectiveness of environmental policies and the environmental awareness of the public. For example, in industrialized democratic countries, energy-intensive industrial activities can keep CO_2 emissions high, while renewable energy policies can reduce this impact.

As a result, the findings of the study provide important clues for policy makers. Strengthening democratic values and institutional structures can be used as a tool for environmental sustainability in the long term. However, it is important to design democratization processes in line with environmental goals. The public should be made aware of environmental problems and these problems should have a priority place in public policies. In addition, international efforts need to be integrated with environmental issues in order to minimize the impact of environmental pressures of authoritarian regimes on democratization processes.

This study also suggests that the interactions between democracy and the environment need to be examined more deeply. Future studies may provide more comprehensive analyzes by including factors such as countries' economic development levels, energy policies, and participation in international environmental agreements. In addition, potential indirect effects between environmental degradation and democratization should also be examined. For example, the effects of climate change on conflict and social unrest should be evaluated together with the possible effects of these conflictual environments on the process of democratic institutionalization.

Finally, testing the study's methodological approach and findings across different countries and time periods may increase the generalizability of the findings. In this way, the impact of democratization on carbon emissions can be evaluated more accurately and a more effective road map can be presented to guide policy designs.

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Tourism Tax Revenue Trends in Bulgarian Municipalities Bordering Turkey: A 10-Year Analysis

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Abstract

This study examines tourism tax revenue trends over a ten-year period in Bulgarian municipalities along the Turkish border, focusing on patterns, fluctuations, and factors influencing revenue dynamics from 2013 to 2022. Using municipal revenue data, this research analyzes the impact of significant events, particularly the COVID-19 pandemic, on tourism tax income in these border regions. The findings reveal marked shifts in revenue during the pandemic years, as well as a gradual recovery following this period. The study highlights the economic resilience and challenges faced by border municipalities in sustaining tourism-related income streams, while also assessing the implications for future regional development policies. The results provide insights for policymakers seeking to strengthen local economies and improve revenue stability in border regions.

Keywords: Tourism tax; border municipalities Bulgaria-Turkey; revenue trends; local self-government; COVID-19.

1. Introduction

Tourism is one of the fastest growing economic sectors, which plays a key role in the economy of many regions and municipalities. Not only those directly employed in this industry benefit from tourism, but also local authorities, which must finance new and better services, develop infrastructure and improve the living conditions of local communities.

Tourism occupies an important place and is one of the structurally determining sectors of the Bulgarian economy, which generates between 13-15% of GDP (Ministry of Tourism of Bulgaria, 2023). Despite having a significant impact on social development, economic growth, employment and migration, it faces many objective and subjective challenges. The development and principles of operation of the tourism industry are subject to the Tourism Act (Tourism Act of Bulgaria, 2024), the Regulations on the Determination of the Amount of Local Taxes and Fees, in the specific case of this study - the tourist tax. (Ministry of Finance of Bulgaria, 2024)

The aim of this study is to track trends in tourism tax revenues in seven Bulgarian municipalities bordering Turkey over a 10-year period (2013-2022). The economic impact of tourism on these municipalities is analyzed, identifying the potential for stimulating local economies through targeted tourism strategies.

2. Literature Review

Tourist taxes and fees play a key role in financing tourism in European countries. Accommodation taxes are levied on paid short-term stays and are usually calculated on a per-tourist, per-night basis or sometimes as a percentage of the room rate. These taxes are often paid individually and cannot be included in the prepaid accommodation price. This is usually because each municipality decides the amount of the tax itself, it often changes every year, it differs significantly between tourist and non-tourist regions within the country, and children are exempt from this type of tax.

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From 2024 Non-EU citizens, including Americans, Australians, Britons and other travelers from outside the Schengen area, fill out an entry application for €7. This fee is not charged to persons under 18 and over 70. (European Comission, 2024)

A comparative review of most EU member states shows some diversity in the way tourist taxes and fees are calculated and collected. For example, in the Czech Republic, the tourist tax is collected only in Prague (Ministry of Regional Development Czech Republic, 2024). This is less than 1 euro per person per night for up to 60 nights. The Taxe de Séjour is the French tourist tax, which varies depending on the municipality (Articles L2333-26 to L2333-47 of the (French General Code of Territorial Communities, 2024). It is set aside for the development of tourism, and local authorities can decide to apply the tax base based on the actual nights spent by visitors or to calculate the tax based on the total amount, according to the capacity of the accommodation.

The Greek Ministry of Tourism announced that from 2024 Greece is collecting a climate tax from tourists, which replaces the current hotel tax and is valid during the active season - from March to October. The amount varies depending on the category of the hotel and is from 1 to 4 euros per night, and is paid upon check-in.

In Spain, the Cyprus tax is applied in Barcelona, Catalonia, the Balearic Islands, and from 2024. and in Valencia. The tourist tax in Barcelona consists of a regional tax, which goes to the budget of Catalonia and depends on the chosen hotel (2.25 euros). And passengers on cruise ships pay a tourist tax of 1.5 euros per day.

In Italy, the size of the tourist tax depends on the region. In Rome, it is from 3 to 7 euros per day per person, depending on the chosen place of accommodation. In Milan, the rules are the same, but the fee does not exceed 5 euros per person per night during high season, and during low season it is 50% less. From spring 2024, the authorities in Venice will charge tourists a fee of 5 euros per person for a one-day visit to the city on weekends and other public holidays from April to Wednesday in July - a total of 29 days. Travelers over 14 years old also have to pay to enter the city. To do this, the passenger registers in a special application (the number of places is limited) and pays for the ticket. In return, he receives a QR code, which must be shown in case of inspection. The fine for failure to comply with the new rule is from 50 to 300 euros. The funds from the tourist tax are used to support the city, help residents, and improve their quality of life.

In the Netherlands, tourists are charged a tax on their accommodation (night). The amount depends on the class of the hotel and the type of accommodation, as well as on the municipality in which the traveler is staying (European Committee of the Regions, 2024). Amsterdam has the highest tourist tax in Europe. In 2024, it will increase from 7% to 12.5% of the price of a tourist hotel room. A tax is also paid by passengers on cruise ships. In addition, the Amsterdam authorities have introduced a €1 camping tax. The tax on apartment rentals has been increased to 10%, including on the private accommodation booking service Airbnb. Amsterdam also requires a €8 tax on people arriving in the city by boat.

Operating under the auspices of the Ministry of Economy, Turismo de Portugal - Portugal's National Tourism Authority (Turismp de Portugal, n.d.) - reports that a tourist tax in Portugal is collected in 13 of the 308 municipalities, including Porto (1.5 euros per night), Lisbon (2 euros per night). The popular fishing town of Olhão in the Algarve province will impose a tourist tax from 2023. According to local authorities, the revenues from the tourism tax are used to minimize the impact of tourism on the Algarve province, especially to improve cleanliness and safety. At the same time, according to Gróf Katalin (Gróf, 2019), the tourist tax on overnight stays is one of the most controversial taxes in Hungary, because it should serve as a

basis for the development of tourism, but in reality it is only a part of the entire revenue budget of local authorities.

According to the (Ministry of Culture and Tourism, 2024), a 2% residence tax has been introduced in the country as of January 1, 2023. The tax is charged for accommodation in hotels, tourist villages, motels, guesthouses. It can be included in tourist tours by travel agencies. Exempt from paying the tax are students and pupils living in dormitories, guesthouses and campsites, as well as representatives of diplomatic missions and international organizations with diplomatic status.

In summary, most European countries and two-thirds of the European Union member states collect a tourist tax at the local level.

According to (Weidenfeld, 2013). cross-border tourism consists of two main factors: borders as the main objects of tourists' attention and tourism related to the proximity to the border. The first includes tourist attractions and regions whose main appeal stems from various cross-border elements (or images), including flags, welcome signs on highways and customs buildings. The second refers to emerging cross-border activities in response to foreign demand created by differences in socio-political systems, prices, regulations, etc. between neighboring regions, including shopping, gambling, prostitution, alcohol, international parks and international enclaves (Timothy, Tourism and political boundaries, 2002). While the first approach suggests that the border can stimulate more original and new tourism product innovations related to border themes, the second suggests more imitative innovation processes, drawing ideas from other cross-border regions. The term cross-border tourists refers to all types of human mobility for any purpose involving the crossing of international borders (Hampton, 2010), (Timothy & Butler, Cross-boder shopping: A North American perspective, 1995) and, like the definition of 'tourist', ignores the problematic aspects of the temporality of the visit (day trip or overnight stay), the purpose of the trip and the distance (Hall & Page, 2014).

The three main factors for the attractiveness of regions for cross-border tourism include the border as an object (e.g. geopolitical, historical, heritage), the location of the border region (natural and cultural) and the type of tourism development that attracts tourism. These factors determine the nature of tourism innovation and the degree of knowledge transfer between cross-border actors. Weidenfeld, A. (2013).

Cross-border economic relations, including labour mobility, student exchanges, joint patenting and joint publications, trade relations, formal and informal networks in technology and innovation, etc., are recognised as facilitating knowledge linkages (Trippl, 2010), while the contribution of tourism to cross-border mobility, including tourists and labour, remains largely ignored in this context. The emergence of cross-border destinations stems from substantial cross-border interdependencies, regional alliances (especially in the field of marketing and staff training) and human mobility, which represent a great potential for cross-border knowledge transfer, especially considering that the exchange of training and knowledge is a determining factor in tourism networks (Morrison, Lynch, & Johns, 2004). Tourism is influenced by political borders and the government policies associated with them, the administrative management on both sides of them, and the physical and psychological barriers created by borders against human mobility and interactions, including the movement of people, goods, and services between countries (Gelbman & Timothy, 2010), (Prokkola, 2010).

3. Data and Method

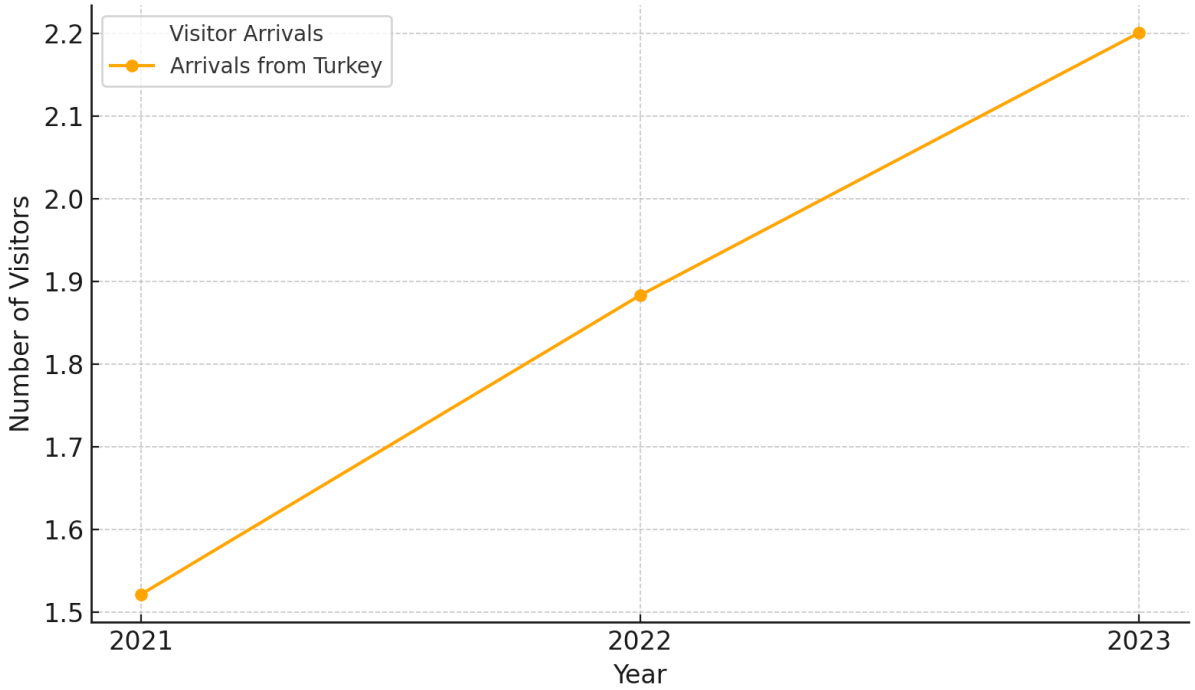
This study examines the trends in tourism tax revenues over a ten-year period in 7 Bulgarian municipalities from 3 districts located along the border with the Republic of Turkey. It analyzes the fluctuations and factors influencing the dynamics of revenues in the period from 2013 to

2022. It compares the impact of the tourism tax between border municipalities and those located in the interior of the country, which have approximately the same population. It also analyzes the specifics and factors for the development of cross-border tourism.

4. Bulgarian Municipalities Bordering the Republic of Turkey

The issue of tourism tax revenues is extremely important, especially for municipalities with limited sources of income. In many municipalities, tourism tax represents a small part of total revenues. For example, in 2022, the municipality of Svilengrad generated 3.10% of its revenues from tourism taxes, while for smaller municipalities such as Sredets, this percentage is only 0.08%. Despite its small share, tourism tax revenues have significant potential for growth. This is especially true for smaller and less economically developed municipalities. By improving tourism services, infrastructure and promoting the region, these municipalities can generate additional revenues that are essential for local development, especially when facing financial challenges.

Figure 1: Tourists from Turkey who visited Bulgaria in the period 2021-2023



Source: Republic of Bulgaria National Statistical Institute

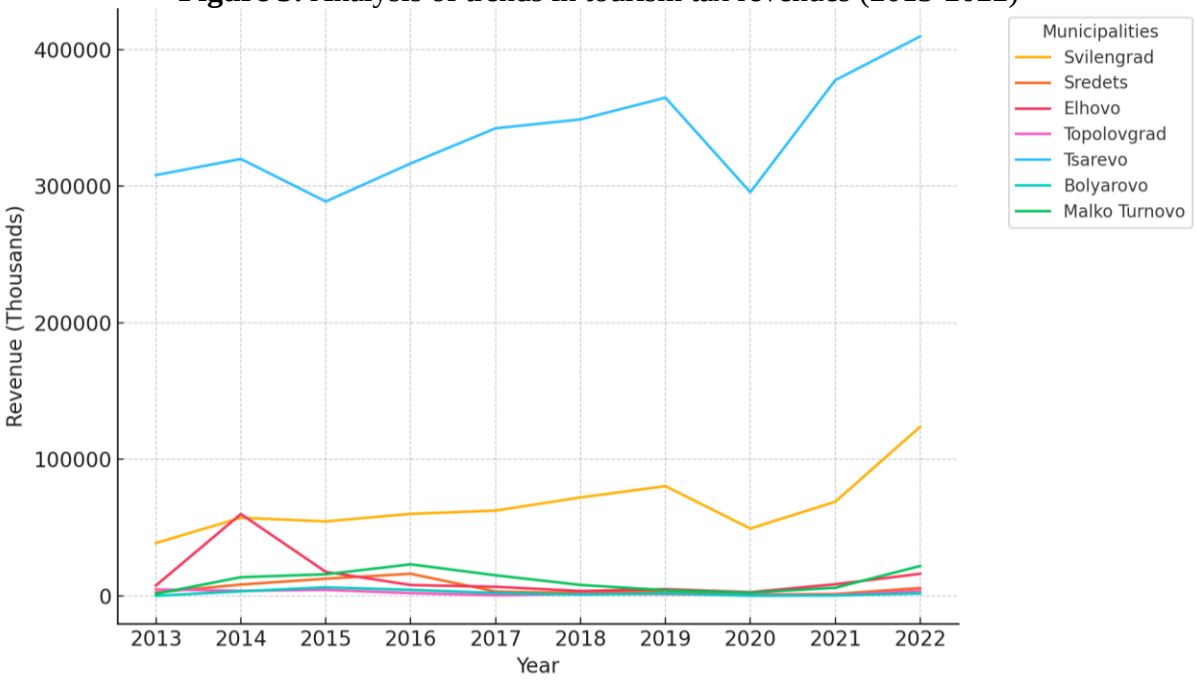
Over the past few years, we have seen a steady increase in the number of Turkish tourists visiting Bulgaria. According to the National Statistical Institute, from 2021 to 2023, the number of Turkish tourists increased by about 30% from 2021 to 2022 and by 17% from 2022 to 2023, reaching over 2.2 million visitors by 2023. This growth in the number of tourists is of great importance for municipalities bordering Turkey, such as Svilengrad, Tsarevo and others, as it represents an opportunity for these municipalities to benefit from this source of revenue through the tourist tax. Although the tourist tax is still a relatively small part of the total revenues of municipalities, the growing flow of tourists offers an opportunity for further development of the tourism infrastructure and an increase in the revenues of municipalities from this sector. Municipalities located close to the border have the potential for a larger share of these tourism revenues, especially if they succeed in attracting and managing the increasing number of visitors coming from Turkey.

5. Tourist Tax in Border Municipalities and Analysis of Trends in Tourist Tax Revenues (2013 - 2022)

The tourist tax is a tax collected for overnight stays in registered accommodation facilities. In Bulgaria, municipalities have the right to set the tax rate, and the revenues from it are a significant source of local income. The analysis focuses on seven municipalities from three districts (Burgas, Haskovo and Yambol) that border Turkey: Svilengrad, Sredets, Elhovo, Topolovgrad, Tsarevo, Bolyarovo and Malko Tarnovo. These municipalities were selected due to their strategic location along the border and their role in receiving cross-border tourism, especially from Turkey.

Figure 2. Municipalities bordering Turkey

Figure 3: Analysis of trends in tourism tax revenues (2013-2022)



Source: Ministry of Finance of the Republic of Bulgaria

Several key observations have been identified from this data:

• Pre-pandemic growth (2013-2019): Most municipalities reported a steady increase in tourism tax revenues, indicating that the tourism sector has been growing during this period. This trend is particularly strong in Svilengrad and Tsarevo, which can be explained by their strategic location close to major tourist routes and attractions.

• Impact of the pandemic (2020): A dramatic decline in revenues was reported in 2020 across the sector, with the largest decrease observed in the municipalities of Tsarevo and Svilengrad. This decline can be explained by the global COVID-19 pandemic, which led to widespread disruptions in tourism. According to (CEIC Data, 2020), tourism revenues in Bulgaria in 2020 decreased by 62.9% due to the pandemic. The municipalities surveyed follow a similar trend, with a decline in both the number of tourist visits and tax revenues.
• Post-pandemic recovery (2021-2022): From 2021 onwards, there has been a gradual recovery of tourism tax revenues, especially in the municipalities of Tsarevo and Svilengrad, which recovered more quickly. This recovery is a promising sign that tourism is returning to pre-pandemic levels, especially in regions with good infrastructure and well-established tourist attractions. Overall, revenue trends clearly demonstrate the vulnerability of tourism-dependent economies to external shocks, such as global pandemics. However, they also indicate the potential for recovery, especially in municipalities with better-established tourism infrastructure.

6. Factors that Influence Trends in Tourism Tax Revenues

Several key factors contribute to these fluctuations and understanding them is crucial for developing strategies to improve tourism revenues:

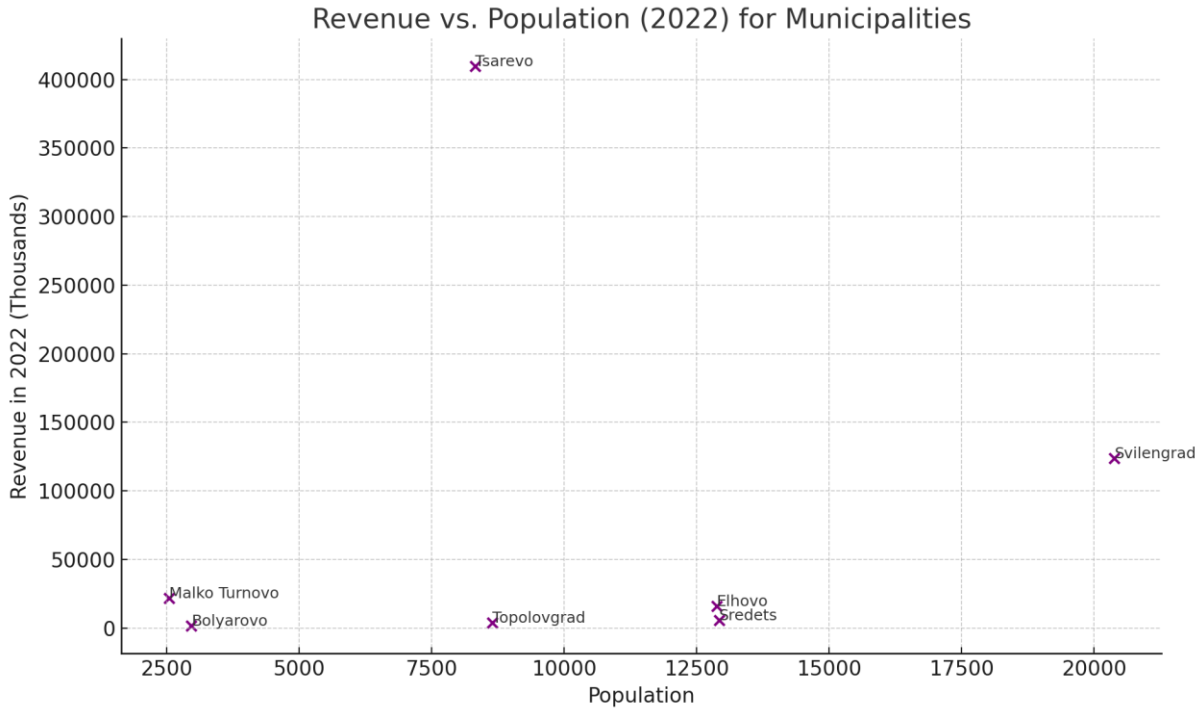
• Geographic location: Proximity to major tourist destinations and border crossings is one of the strongest factors influencing tourism tax revenues. For example, Svilengrad and Tsarevo, which are located close to the Bulgarian-Turkish border, attract a significant number of cross-border tourists, which increases revenues. On the other hand, municipalities located further from these border areas, such as Bolyarovo and Topolovgrad, tend to generate lower tourism tax revenues due to fewer visitors.

• Tourism infrastructure: Municipalities with well-developed tourism infrastructure – such as hotels, restaurants and transport services – are better equipped to welcome and attract more tourists. Tsarevo, with its coastal attractions, benefits from a well-established tourism sector, which directly leads to higher revenues. Meanwhile, areas such as Topolovgrad and Bolyarovo, which have fewer accommodation options and weak tourist infrastructure, have difficulty generating significant revenue from the tourism tax.

• Cultural and natural attractions: The presence of cultural and natural attractions plays an important role in stimulating tourism. Tsarevo and Svilengrad have remarkable cultural, historical and natural sites that attract visitors and contribute to higher revenues. In this context, municipalities such as Elhovo face challenges, as although they have natural resources, their ability to attract large numbers of tourists is limited by the lack of more prominent attractions.

• Global events: Global events, especially the COVID-19 pandemic, have had a serious impact on tourism. In 2020, tourism revenues in Bulgaria decreased by 62.9%, reflecting the global slowdown in tourism. The data shows a sharp decline in tourism tax revenues in these municipalities, highlighting the strong role of external factors that can disrupt local economies.

Figure 4: Revenue to population analysis (2022)



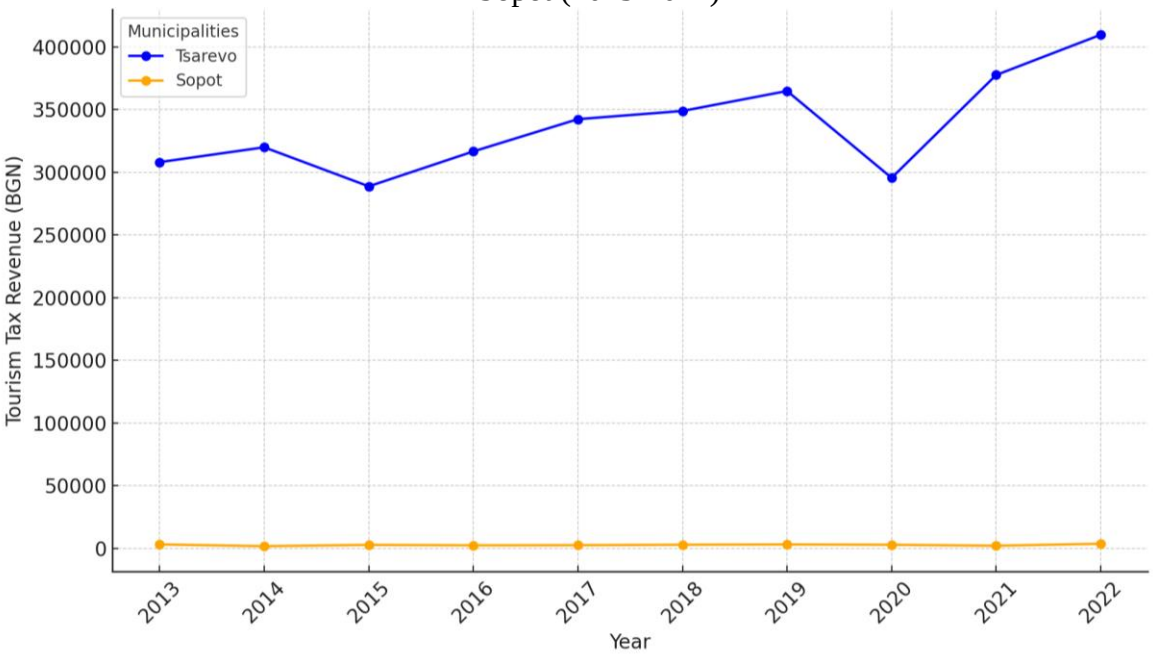
Source: Ministry of Finance of the Republic of Bulgaria and National Statistical Institute

Comparing tourism tax revenues to the size of the municipalities' population for 2022 shows that larger municipalities like Svilengrad generate higher revenues, and the data also helps identify inefficiencies in how smaller municipalities like Bolyarovo and Sredets use their tourism potential. Although Svilengrad has a larger population, Tsarevo generates more tourism tax revenues, showing that population size alone is not a major driver of tourism revenues. Factors such as tourism infrastructure, local attractions, and proximity to borders play a crucial role in how much revenue a municipality can generate.

7. Comparison between Border and Non-border Municipalities

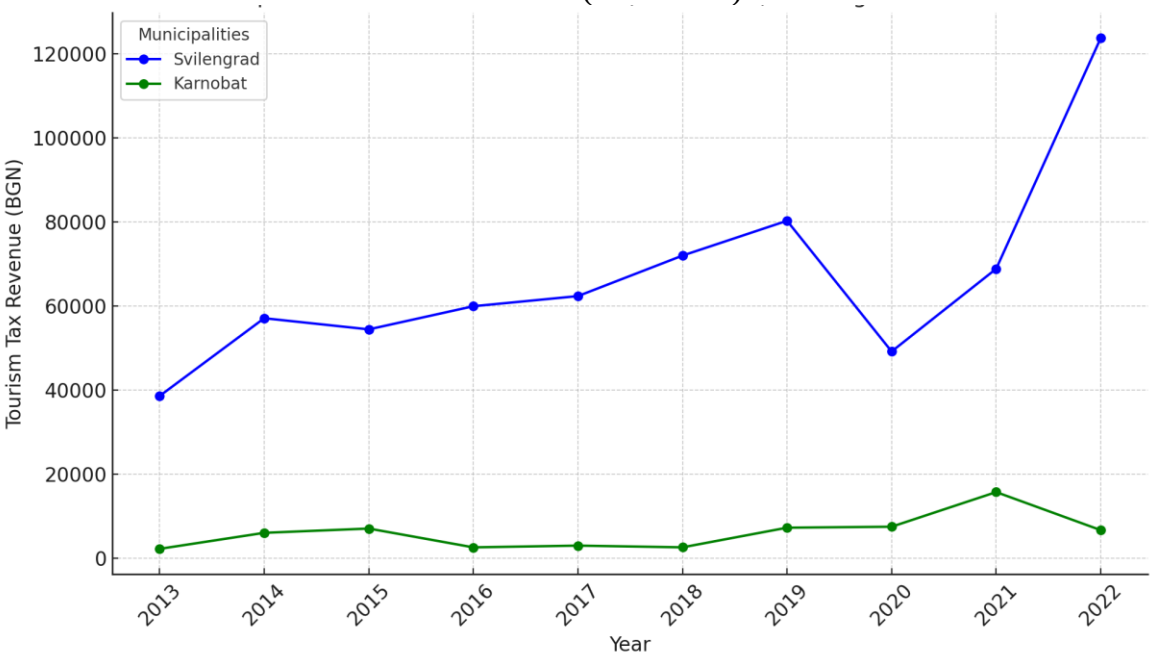
For the purpose of the study, a comparison was made between border municipalities and non-border municipalities that have a similar population size, such as the municipalities of Tsarevo and Sopot. Despite having a similar population, Tsarevo generates much higher tourism revenues due to its proximity to the Turkish border, which attracts more tourists. Similarly, when comparing the municipality of Svilengrad with the municipality of Karnobat, a similar discrepancy in tourism tax revenues is observed. Svilengrad's border location leads to significantly higher tourism revenues, while Karnobat, despite having a similar population size, does not benefit from the same flow of cross-border tourism.

Figure 5: Comparison of tourist tax revenues between the municipalities of Tsarevo and Sopot (2013-2022)



Source: Ministry of Finance of the Republic of Bulgaria, Municipal finances, Municipal financial indicators

Figure 6: Comparison of tourist tax revenues between the municipalities of Svilengrad and Karnobat (2013-2022)



Source: Ministry of Finance of the Republic of Bulgaria, Municipal finances, Municipal financial indicators

8. Conclusion

Tourism tax revenues have clear potential for growth in municipalities along the Bulgarian-Turkish border, especially if strategic investments are made in areas such as infrastructure, tourism products and marketing. Although the current share of tourism taxes in the total revenues of many municipalities remains small, with the right strategies they can significantly contribute to local economic growth. Municipalities such as Tsarevo and Svilengrad, which

have a well-developed tourism infrastructure and strategic location, show potential for expanding tourism revenues. A comparison with the municipality of Sopot and other municipalities with similar populations shows a significant difference in their ability to generate tourism revenues, and it is clear that geography and infrastructure are major factors determining these differences. Even if the tourism tax is properly invested in local economies, it shows that very often local authorities cannot develop tourism on their own with their own resources alone. It is necessary for central governments on the one hand and local authorities on the other to encourage the creation and improvement of quality tourism.

Furthermore, cross-border tourists facilitate the diffusion of tourism innovations that are visible and more easily imitated than those in most other sectors. Border themes represent potential knowledge and incentives for innovation of original tourism products compared to emerging activities in response to cross-border differences (e.g. shopping), which usually lead to more gradual innovations. Other factors, including the integration of cross-border tourism and the permeability in terms of levels of interaction and movement of actors between bordering countries, enhance knowledge transfer and innovation not only in tourism but also in other areas of public life. Weidenfeld, A. (2013).

In order to improve tourism tax revenues, municipalities should focus on the following:

Diversify tourism products, such as ecotourism, cultural tourism and adventure tourism, to attract a wider range of tourists.

Investing in infrastructure, especially in smaller municipalities such as Bolyarovo and Topolovgrad, where tourism potential is not fully exploited.

Regional cooperation between municipalities to promote joint marketing strategies and shared tourism offers.

Sustainability: Developing sustainable tourism practices to attract eco-conscious travelers and preserve local natural resources.

Opening new border checkpoints with the Republic of Turkey to stimulate bilateral tourism.

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The Interplay between ICT and Quality Education: Empirical Evidence from MINT Countries

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Abstract

Information and Communication Technologies (ICT) are widely regarded as a critical factor supporting development in various aspects. Specifically, it is believed that ICT enhances educational quality, which in turn positively affects economic growth in the medium term and economic development in the long term. However, the relationship between ICT and educational quality has been overlooked in many studies. Existing research has primarily focused on the impacts of ICT on educational quality in specific regions through experimental studies. This study aims to analyze the causal relationship between ICT and educational quality by using causality analysis for the period between 2000 and 2022 in MINT countries. The results demonstrate that there exists a two-way causal relationship between ICT and quality education in panel level. In addition, country specific causality analyses show that there is a unilateral causality from ICT to quality education in Türkiye, while this causality works the other way around in Indonesia. These findings suggest the importance of utilizing ICT in education from a broader perspective and highlight its significance across various educational contexts.

Keywords: Information and communication technologies, Quality education, panel causality analysis.

1. Introduction

The use of ICT is closely linked to development from social, cultural, and economic perspectives. Particularly, the use of technology in education is crucial both for advancing human capital and facilitating the faster and more effective dissemination of knowledge. In this context, the use of ICT in educational activities and its impact on improving educational quality emerges as a significant issue. However, the desired effects of ICT, such as enhancing quality in education, are only apparent when a certain level of physical infrastructure and human capital is present. In other words, while ICT is effectively utilized in educational processes in relatively developed countries, the same is still a matter of question in developing countries.

Although ICT access and effective use of technological tools seem to be less effective in developing countries (Nawaz, 2013), ICT holds significant potential to enhance access to education and improve its quality in these countries, as previously stated by Tinio (2002). Even though many studies in literature are inconclusive about the role of ICT in educational quality, ICT is expected to enhance the quality of education, develop students' skills, and integrate them into the continuously evolving global world (Wagner and Kozma, 2005). However, investments in ICT over the years have created undeniable effects, especially in the field of education (Cuban, 2001). This ambiguity between ICT and educational quality makes the topic intriguing. From this perspective, the association between ICT and educational quality seems to be an interesting puzzle to analyze from an empirical perspective.

Studies in literature are often country-specific and micro-level, and they are mostly using survey methods. The absence of research examining the causal relationship between ICT and educational quality is the primary motivation for this study. In this short paper, therefore, we aim to analyze the interplay between ICT and quality education in MINT countries for the period 2000-2022 by using a causality analysis. Our results show that there is a two-way causal relationship between ICT and quality education at panel level. It shows that changes in any of

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these variables explain changes in other variables in MINT countries, in general. However, country specific causality test results indicate that there is a one-way causality from ICT to quality education in Türkiye, while there is a causality from quality education to ICT in Indonesia. These results reveal that ICT is important in quality education but policies for increasing ICT use and the quality of education should be tailored considering country-specific characteristics.

Next section will present a brief section of literature review. Afterwards, the data and econometric methodology section will be specified, and the results will be presented. The last section concludes.

2. Literature Review

The impact of ICT usage on sustainable development goals has been analyzed from various perspectives. A significant portion of this literature focuses on how ICT affects the quality of education. It is believed that the use of ICT tools will yield positive outcomes for both educators and students and will create an environment where ICT tools would be useful for all in the learning and teaching process (Ahmadi et al., 2011).

From a theoretical point of view, ICT usage and its association with education is the subject of development, in general (Tas, 2011). It can be asserted that the use of ICT contributes positively to education by enhancing global communication, reducing the cost of accessing quality education, and by decreasing hardware costs (Shields, 2011). The use of ICT can also be considered a phenomenon closely linked to educational quality in a narrow sense and to economic growth and development in a broader sense, as it enhances educational opportunities in many underdeveloped regions and offers new possibilities to people in these areas.

On the other hand, the presence of certain social and cultural infrastructures is crucial for ICT to manifest its positive effects (Ferede, 2022). Without the necessary physical infrastructure for ICT and the human capital to utilize it, the use of these technologies may not achieve the desired impact. In the study by Ahmadi et al. (2011), it is noted that despite the rapid adoption of ICT, it is not widely used in classrooms, particularly by many educators. Such situations will diminish the effectiveness of ICT in enhancing the quality of education.

Some studies have attempted to measure the impact of ICT on education in various countries or regions using different tools. These studies are generally conducted in relatively less developed countries. Zhu (2011) discussed the importance of using ICT in educational and teaching processes in Chinese schools. Similarly, Ferede (2022) emphasized the need to evaluate the role of ICT in education in Ethiopia not only from the perspective of educators and students but from institutional, hardware, and multifaceted angles as well. In their study, Ginzburg and Barak (2023) examined the effects of technology-supported educational processes in the USA and Israel by involving seven experienced teachers and 109 sixth-grade students. They report that the impact of ICT on education depends on individual motivation and cultural differences. Kozma (2005) discussed the impacts of ICT-based education on economic and social development, using examples from Egypt, Finland, and Singapore. The author argues that the inclusion of ICT in national education programs plays a significant role in development.

From a different perspective, Fernández-Gutiérrez et al. (2020) analyzed whether ICT led to better student outcomes in 13 Spanish regions, and they concluded that the regions that have a higher use of ICT at schools show better outcomes in terms of students' performance. Banerjee et al. (2007) further analyzed whether ICT supported education program led to better outcomes in terms of students' scores in India and concluded that ICT-enhanced programs positively affect the performance of students. Zhao and Chen (2023) investigated how ICT may impact

the success of students in rural China by using Difference-in-Difference (DID) method. The authors substantiated that ICT significantly affects the achievements of students.

The studies conducted are generally limited to specific regions, particular schools, and a defined number of students. The causal direction between ICT and educational quality remains uncertain in the literature. Considering this, the next section will address the causal relationship between these two factors in MINT countries.

3. Data and Methodology

This study analyzes the causal relationship between ICT and quality education in the MINT countries between 2000 and 2022 by means of causality test. Quality education (QUALEDU) is proxied by quality education index which is calculated as a combination of participation rate in learning, net primary enrollment rate, lower secondary completion rate, literacy rate, tertiary educational attainment, PISA score, variation in mathematics performance, and underachievers in mathematics by Sachs et al. (2024). On the other hand, ICT is represented by ICT index which is calculated as a combination of fixed line and mobile phones users, internet accessibility and server security by UNCTASTAT (2024).

The period is restricted between 2000 and 2022 due to ICT data availability. MINT countries include Mexico, Indonesia, Nigeria, and Turkiye. The causal relationship between ICT and quality education is analyzed by using Emirmahmutoglu and Kose's (2011) causality test.

Summary statistics of each variable are displayed in Table 1. Quality education and ICT index have 76.995 and 33.043 mean values, respectively. However, both series show a remarkable variation among the MINT states.

Table 1: Summary statistics

Statistics	QUALEDU	ICT
Mean	76.995	33.043
Std. Dev.	23.277	15.046
Maximum	98.789	58.586
Minimum	32.787	5.133

4. Empirical Results

In this section, we first examined the cross-sectional dependence (CD) between QUALEDU and ICT with Breusch and Pagan's (1980) LM, Pesaran et al. (2008) $LM_{adj.}$, and Pesaran's (2004) LM CD tests. Results regarding these tests are reported in Table 2 below. As can be seen, test results reveal that there is a cross-sectional dependence among the variables.

Table 2: CD tests' results

Test	Test statistic	P value
LM	14.64	0.0003
LM adj*	2.171	0.0299
LM CD*	7.9281	0.003

We then examined homogeneity by deploying Pesaran and Yamagata (2008) tests, and the results of them are shown in Table 3 below. The presence of heterogeneity is concluded regarding the results of delta tilde tests.

Table 3. Homogeneity tests results.

Test	Test statistic	Prob.
$\tilde{\Delta}$	2.155	0.031
$\tilde{\Delta}_{adj.}$	2.311	0.021

We use Pesaran's (2007) CIPS unity root test to test the stationarity of the variables due to the presence of cross-sectional dependency between two series. The test results in Table 4 below show that ICT and QUALEDU are I(1).

Table 4: Unit root tests results

Variables	Constant	Constant +Trend
ICT	-0.897	-0.022
d(ICT)	-3.862***	-3.365***
QUALEDU	-0.430	-0.640
D(QUALEDU)	-5.404***	-4.281***

*** significant at 1%.

The causal relationship between ICT and quality education is analyzed through Emirmahmutoglu and Kose (2011) causality test and the test results are reported in Table 5. The results demonstrate a bidirectional causal relationship ICT and quality education. Furthermore, the results of the country level causality analysis uncover a unilateral causal relationship from ICT to quality education in Turkiye and from quality education to ICT in Indonesia.

The results of the causality analysis indicate a bidirectional causality between ICT and quality education at the panel level. Specifically, the analysis shows a unidirectional causality from ICT to quality education in Türkiye, and from quality education to ICT in Indonesia. This situation suggests that the interaction between ICT and educational quality can vary significantly across different national contexts, and this reflects the unique educational and technological landscapes of each country.

Table 5: Causality test results

Countries	ICT ↛ QUALEDU		QUALEDU↛ ICT	
	Test statistic	P value	Test statistic	P value
Indonesia	0.001	0.978	**4.708**	**0.030**
Mexico	4.188	0.242	5.736	0.125
Nigeria	0.789	0.374	1.878	0.171
Turkiye	**16.402**	**0.000**	0.000	0.988
Panel	**24.606**	**0.002**	**14.729**	**0.065**

4. Conclusion

Technological advancement significantly impacts various aspects of life. The ability to use technology effectively is closely linked to a country's development. In recent literature, ICT have been frequently discussed due to their association with numerous factors. Studies have also analyzed the impacts of ICT on education and demonstrated its potential to provide quality education to individuals in impoverished areas and reduce the costs of accessing education.

These aspects highlight the role of ICT in promoting human development and long-term economic growth.

Although the relationship between ICT and the quality education is not entirely clear in the literature, event studies focusing on specific schools or groups of educators and students in some regions suggest that ICT can enhance educational quality. However, to the best of our knowledge, the bidirectional causality between these two factors has not been previously analyzed. This study tests the causality between ICT and quality education in MINT countries from 2000 to 2022 using panel causality analysis and finds a bidirectional causal relationship among them at the panel level. Conversely, country-specific analyses reveal a unidirectional causality from ICT to quality education in Turkey, while in Indonesia, the direction is reversed. These findings highlight the significance of ICT and educational quality as mutually influential factors. This study also emphasizes the importance of tailoring policies to the unique characteristics of each country.

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