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THE INVERTED N-SHAPED RELATIONSHIP BETWEEN ECONOMIC GROWTH AND CO_2 EMISSIONS: EVIDENCE FROM OECD COUNTRIES

ABSTRACT: *Modern economic growth has led to increased levels of international trade, large-scale industrialisation, and major technological advancements, resulting in substantial negative externalities on a global scale. Among these, environmental degradation has emerged as a significant global public bad. Balancing economic growth objectives while addressing environmental challenges remains a critical issue for modern society. This study examines the relationship between economic growth and environmental degradation across 33 OECD countries during the period 1996-2015, employing a fixed effects model with the Driscoll-Kraay standard error estimation approach. The analysis reveals an inverted N-shaped relationship between economic growth and CO_2 emissions, contradicting the conventional environmental Kuznets curve theory. The results also show that renewable energy consumption and stronger institutional quality help reduce CO_2 emissions, while non-renewable energy consumption and higher levels of industrial activity have the opposite effect.*

KEY WORDS: *environmental quality, global public bad, EKC hypothesis, renewable energy, institutional quality*

JEL CLASSIFICATION: Q56, D62, H41, Q20

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1. INTRODUCTION

Environmental degradation has emerged as one of the most pressing global public harms, a concept that has gained increasing acceptance in public finance since Kaul et al. (1999) introduced the global public goods doctrine within the United Nations Development Programme. Unlike other challenges, the negative externalities of environmental damages such as climate change, deforestation and pollution transcend national borders and extend across borders and generations. The widespread and long-lasting effects of environmental degradation require interventions at the national and international levels and make the study of its relationship with economic growth vital for developing effective policies aimed at ensuring sustainable development.

Since the Industrial Revolution, human-caused releases of carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) have become major drivers of global warming, making them central targets in international efforts to combat climate change (Jones et al., 2023). This has led to a strong focus on tracking each country's role in climate change as well as setting fair reduction goals (de-carbonisation commitments) for all nations. Global warming, as predicted by most climate models, is expected to persist in the near future (2021–2040), reaching 1.5°C even under the lowest greenhouse gases (GHG) emission scenario and this persistence is primarily driven by heightened cumulative CO_2 emissions (Intergovernmental Panel on Climate Change (IPCC) (2023). The urgency of the situation is underscored by recent data. The latest IPCC report (2023) reveals that atmospheric CO_2 concentrations reached record highs (410 parts per million) in 2019, the highest level in at least 2 million years. This highlights the necessity for more decisive actions to reduce fossil fuel consumption.

While certain international efforts focus on reducing emissions, a key challenge remains achieving sustainable economic development without compromising environmental well-being. Achieving this equilibrium requires a comprehensive understanding of the complex relationship between economic development and environmental destruction.

The environmental Kuznets curve (EKC) hypothesis, building on the inverted U-shaped relationship between income inequality and economic growth identified by Simon Kuznets (1955), is one of the main conceptualisations dealing with the

relationship between the environment and the economy. It suggests that as economies grow, environmental destruction initially worsens, but this trend reverses at higher development levels. Grossman and Krueger (1991)[1], pioneers in studying the relationship between environmental pollution and economic growth, suggest that while various pollutants such as sulphur dioxide, dark matter and suspended particles increase with GDP per capita at lower national income levels, environmental pollution decreases at higher income levels. Since Grossman and Krueger's seminal work, numerous studies have focused on validating the EKC hypothesis, primarily investigating its applicability to the relationship between carbon emissions and income[2].

As previously noted, most EKC studies aim to confirm the inverted U-shape pattern. However, a subset of studies, inspired by works such as those by Grossman and Krueger (1995), Panayotou (1997), Dinda (2004), Galeotti et al. (2006), and Akbostancı et al. (2009), have incorporated a cubic term into their models. This term allows researchers to investigate the possibility of a reversal in the trend, where environmental degradation might increase again at very high-income levels, (Özokcu & Özdemir, 2017). The research on (inverse) N-shaped EKC hypothesis remains limited, especially for OECD countries (Özokcu & Özdemir 2017; Ullah et al., 2024).

The present study investigates the EKC hypothesis for 33 OECD countries from 1996 to 2015, analysing the impact of economic growth on CO_2 emissions while considering the role of renewable and non-renewable energy consumption. Notably, it departs from prior studies by incorporating a cubic term in the analysis to examine the potential for an (inverted) N-shaped relationship. Intriguingly, our findings challenge the conventional EKC theory by revealing an inverted N-shaped relationship between economic growth and air pollution levels. The implications of this inverted N-shaped relationship are profound, signalling that unchecked economic growth might not lead to automatic environmental improvement, even though growth may ultimately appear to

[1] It is important to note that Grossman and Krueger (1991) did not analyse CO_2 emissions in their study due to data limitations at the time. However, many studies mistakenly assume that the authors include CO_2 as a measure of environmental degradation in their analyses.

[2] For a thorough examination, refer to the research paper "What have we learned from Environmental Kuznets Curve hypothesis? A citation-based systematic literature review and content analysis." by Naveed et al. (2022).

improve the environment. Therefore, this study highlights the need for targeted and effective environmental policies to mitigate the adverse environmental impacts of economic development. Policymakers must recognise the complexities in addressing the challenges posed by varying levels of environmental degradation across different income brackets. Furthermore, testing this hypothesis and modelling the relationship between the environment and economic growth with OECD countries will be very instructive considering the distribution of economic power in the world economy. As a matter of fact, OECD countries, in addition to their economic power, may play a leading role in reaching effective solutions on a global scale with their advantages of international cooperation.

OECD countries prioritise transitioning to renewable energy sources as a key strategy to combat global environmental issues such as climate change, air and water pollution, and biodiversity loss. To assess the significance of this transition, this study utilises renewable and non-renewable energy consumption as control variables. We further included the "Rule of Law" (RL) indicator from the World Governance Indicators (WGI) as a proxy for institutional strength in environmental regulation. This addition is grounded in the understanding that institutions play a critical role in enforcing environmental laws, developing regulatory frameworks, and ensuring compliance, which can significantly affect environmental outcomes at different stages of economic growth (Dinda, 2004; Karim et al., 2022; Panayotou, 1997). Industrialisation is also controlled for, given that structural economic changes can significantly impact environmental outcomes, with higher industrial activity generally associated with increased environmental pressures (Li & Lin, 2015). Lastly, we conducted estimations for two distinct dependent variables, namely total GHG emissions and CO_2 emissions, to validate the robustness of the study's findings.

The remainder of the paper proceeds as follows. Section 2 highlights the relevant literature on the EKC for OECD countries. Section 3 details the data utilised, outlining sources and variables. Section 4 explains the chosen model and methodology, including the rationale and analytical techniques. Section 5 presents the key findings from the data analysis. Finally, Section 6 addresses the conclusions drawn from the study and explores potential policy implications.

2. SELECTED EMPIRICAL LITERATURE

The EKC hypothesis is a popular concept tested by researchers. It suggests an inverted U-shaped relationship between economic growth and environmental degradation. Economic growth is first thought to increase pollution, but after reaching a certain income level, societies prioritise environment at higher income levels, leading to a decline in pollution. In other words, once the economy has accumulated sufficient capital stock, it is possible to restore environmental quality. In essence, the EKC hypothesis argues that economic growth may eventually become a solution, not just a cause, of environmental pollution; therefore, policies that promote economic growth should not be sacrificed in the quest to reduce pollution (Dinda, 2004). However, critics argue that the EKC hypothesis is highly optimistic. They argue that there is no guarantee economic growth will give rise to environmental improvement, and it might even exacerbate ecological issues (Arrow et al., 1995; Beckerman, 1995).

Building on Grossman and Krueger's (1991) work, researchers have estimated the EKC using different methodologies across various contexts (Ahmed & Long, 2012; Aldy, 2005; Apergis & Payne, 2010; Bölük & Mert, 2015; Cole et al., 1997; Doğan & Şeker, 2016; Galeotti & Lanza, 1999; Galeotti et al., 2006; Gill et al., 2018; Hill & Magnani, 2002; Holtz-Eakin & Selden, 1995; Jalil & Mahmud, 2009; Magnani, 2001; Nasreen et al., 2017; Öztürk & Acaravcı, 2013; Panayotou, 1993; Shahbaz et al,. 2013; Sinha & Sen, 2016; Tamazian & Rao, 2010; Vollebergh et al., 2005; Yavuz, 2014). However, these studies lack consensus on the EKC's shape due to differences in model definitions, the choice of explanatory variables, timeframes, and geographical scope. The outcomes of these investigations indicate a linearly increasing or decreasing relationship, as well as a U-shaped or inverted U-shaped pattern supporting the EKC hypothesis.

Extending the work of Grossman and Krueger (1995), some studies challenge the EKC by analysing economic growth in a cubic form, suggesting an N-shaped or inverted N-shaped relationship. The N-shaped relationship indicates that the decrease in environmental degradation with economic growth is a temporary phenomenon (Akbostancı et al., 2009; Day & Grafton, 2003; Fodha & Zaghdoud, 2010; Fosten et al., 2012; He & Richard, 2010; Hill & Magnani, 2002; Lorente & Álvarez-Herranz, 2016; Moomaw & Unruh, 1997). Meanwhile, the inverted N-shape suggests that pollution initially falls but rises again with further income

growth, eventually declining after a high-income threshold (Abbasi et al., 2023; Abdallah et al., 2013; Dijkgraaf & Vollebergh, 2005; Dong et al., 2016; Fakher et al., 2023; Farooq et al., 2024; Huang et al., 2023; Nasr et al., 2015; Vollebergh et al., 2005; Yaduma et al., 2015).

In this study, we examine the (inverted) N-shaped EKC hypothesis within the context of OECD countries. We, therefore, present the findings from several selected studies focusing on OECD nations in the literature. Georgiev and Mihaylov (2015) investigated the validity of the EKC hypothesis across 30 OECD countries using four local air pollutants, sulphur oxides (SOx), nitrogen oxides (NOx), carbon monoxide (CO), and volatile organic compounds (VOC), with two global pollutants (CO_2, GHG) as dependent variables. The findings varied depending on the dependent variables. Specifically, the curve for the CO_2 and GHG emissions exhibited a linear increase. In contrast, the SOx emissions yielded a U-shaped curve, while employing the CO, VOC, and NOx variables resulted in an inverted U-shape.

Jebli et al. (2016) utilised both the FMOLS and DOLS methods across 25 OECD countries spanning the years 1980 to 2010. They confirmed the presence of an inverted U-shaped EKC within the data from the sample. In contrast, Özokcu and Özdemir (2017) analysed 26 high-income OECD countries for the years between 1980 and 2010 and found evidence against the EKC hypothesis. Their results suggest an inverted N-shaped curve, implying economic growth may not inherently decrease environmental damage.

Churchill et al. (2018) examined the EKC hypothesis for 20 OECD countries from 1870 to 2014. Their country-level analyses revealed diverse outcomes. While five countries (Finland, France, Spain, the UK, and the USA) exhibit an inverted U-shaped relationship, consistent with the EKC hypothesis, three countries (Australia, Canada, and Japan) show an N-shaped curve, and one (Denmark) reveals an inverted N-shaped curve. Notably, in 11 countries, no significant relationship was found between economic growth and environmental pollution.

Lau et al. (2019), using panel GMM and FMOLS methods for 18 OECD countries, questioned the validity of the EKC hypothesis on the basis of nuclear energy data for the period 1996–2015. That is, in their study, the effects of electricity generation from nuclear sources, electricity generation from non-renewable

sources and trade openness on CO_2 emissions were investigated. Their results point to an inverted U curve and support the idea that electricity generated from nuclear sources leads to lower CO_2 emissions without delaying long-term growth in these countries. Ng et al. (2019) used the PMG, panel FMOLS, and panel DOLS approaches for 25 OECD countries. Their results support an inverted U-shaped relationship.

Leal and Marques (2020) examined the EKC hypothesis for the 20 highest CO_2-emitting OECD countries (1990–2016) by analysing different dimensions of globalisation. They divided the countries into low- and high-globalisation groups based on rankings. Their findings supported the EKC hypothesis only in highly globalised countries, suggesting that economic growth might improve environmental quality in more integrated economies. Conversely, the EKC did not hold for low-globalisation OECD countries. This study highlights the importance of considering different aspects of globalisation when examining its link to environmental pollution.

The study by Isik et al. (2021) investigated the EKC hypothesis for 8 OECD countries utilising Driscoll-Kraay standard errors and the CCEMG estimator for robust analysis. They tested the EKC hypothesis using a different method. This method involved decomposing the per capita GDP series into periods of increase and decrease, focusing only on the economic growth phases in the model. They argued that this approach better reflects the core idea of the EKC hypothesis. The standard model, using undecomposed GDP data, supported the EKC hypothesis for four countries (Türkiye, Australia, Canada, and France). However, when they applied their method with decomposed GDP data, the EKC hypothesis was not supported in any country.

Our study addresses a critical gap by investigating the validity of the inverted N-shaped EKC in OECD countries. While prior research has extensively examined the EKC hypothesis, limited studies have focused on OECD nations, particularly regarding the differential impacts of renewable and non-renewable energy consumption. Additionally, we employ two distinct environmental degradation measures to strengthen the robustness of our analysis. This study aims to contribute to a deeper understanding of the complex relationship between the

environment and economic development in OECD nations, offering valuable insights for policymakers navigating the energy transition.

3. DATA

This study applies a set of panel data for the 33 OECD countries covering the period spanning from 1996 to 2015[3]. All the data in this study were extracted from the World Development Indicators (WDI)[4]. Detailed information about the data used in the study is given in Table 1.

Table 1: Variable descriptions

Acronyms	Variables	Measurement Units	Source
Dependent variables			
$LNCO_2$	CO_2 emissions	Metric tons per capita	The World Bank, 2024
LNGH	Total greenhouse gas emissions	kt of CO_2 equivalent	The World Bank, 2024
Explanatory variable			
LNGDP	GDP per capita	Constant 2017 international $	The World Bank, 2024
Control variables			
REN	Renewable energy consumption	% of total final energy consumption	The World Bank, 2024
NREN	Fossil fuel energy consumption	% of total	The World Bank, 2024
LNRL	Rule of Law	Percentile ranks	The WGI, 2024
IND	Industry	Industry (including construction), value added (% of GDP)	The World Bank, 2024

[3] Advanced Economies: Australia, Austria, Belgium, Canada, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, the Republic of Korea, the Netherlands, New Zealand, Norway, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the United Kingdom, United States.
Emerging Economies: Chile, Hungary, Mexico, Poland, Türkiye.

[4] https://datatopics.worldbank.org/world-development-indicators/

$LNCO_2$ is the logarithm of per capita carbon dioxide emissions. Carbon dioxide emissions include carbon dioxide produced during the consumption of solid, liquid, and gaseous fuels and during gas flaring. LNGH shows the logarithm of total GHG emissions. Total GHG emissions refer to a sum in carbon dioxide equivalent, including anthropogenic sources of methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (HFCs, PFCs, and SF_6), which exclude short-cycle biomass burning activities but include other sources of biomass combustion (e.g., forest fires, post-combustion decay, peat fires, and the decay of drained peatlands). LNGDP refers to the logarithmic transformation of GDP per capita, serving as a measure of income level. REN is the share of renewable energy obtained from natural resources such as solar, wind, hydroelectric, biomass, and geothermal in the total final energy consumption. NREN denotes fossil fuel energy consumption as a non-renewable energy source. It is the total energy consumption of a country as a percentage of the amount of energy obtained from fossil fuels such as coal, oil, and natural gas. To incorporate the role of institutional capacity in shaping environmental outcomes, we include the LNRL variable which is the logarithm of "Rule of Law" from the WGI. This measure reflects the extent to which individuals and institutions in a country adhere to established societal rules, encompassing elements such as the effectiveness of contract enforcement, protection of property rights, reliability of law enforcement agencies, and the functioning of judicial systems. The LNRL is measured as percentile ranks, with values ranging from 0 to 100, with higher ranks indicating stronger institutional quality. We include the variable Industry (IND), value added (% of GDP) from the World Bank, to account for the impact of structural economic changes on environmental outcomes. This variable captures the extent to which a country's GDP is derived from industrial activities, including manufacturing and construction.

4. MODEL AND METHODOLOGY

Our baseline model is specified as follow:

$$E=f(Y, Y^2, Y^3, Z) \quad (1)$$

where E represents each of the environmental damage indicators, Y denotes income, Y^2 denotes income squared, Y^3 denotes income cubed, and Z includes

other explanatory variables that may influence environmental degradation. The empirical model assumes the following structure:

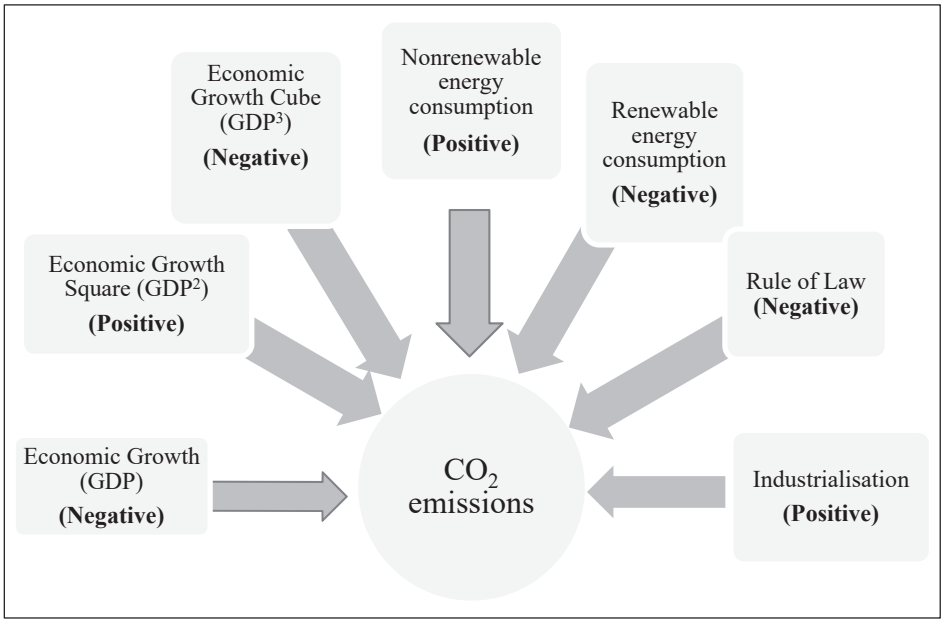
$$LNCO_{2_{it}} = \beta_0 + \beta_1 LNGDP_{it} + \beta_2 LNGDP_{it}^2 + \beta_3 LNGDP_{it}^3 + \beta_4 REN_{it} + \beta_5 NREN_{it} + \beta_6 LNRL_{it} + \beta_7 IND_{it} + \mu_{it} + \eta_t + \varepsilon_{it}\,, \quad (2)$$

where i is the cross-sectional country index and t is the time index. *LNGDP*, *LNGDP*^{2}, and *LNGDP*^{3} represent the log transformed per capita real GDP in linear, quadratic, and cubic form, respectively. *REN* is renewable energy consumption (% of total) and *NREN* is non-renewable energy consumption (% of total), $LNRL$ is the logarithm of "Rule of Law" measured as percentile ranks, and IND is industry (% of GDP). Finally, μ captures state-specific effects, η represents time-specific effects, and ε is the error term. The sign of coefficient β related to income, determines the specific shape of the EKC:

- $\beta_1 = \beta_2 = \beta_3 = 0$: There is no association between income growth and pollution levels. Changes in income have no impact on pollution in this scenario.
- $\beta_1 > 0$, $\beta_2 = \beta_3 = 0$: Pollution increases linearly with income growth. As income rises, pollution is expected to proportionally increase.
- $\beta_1 < 0$, $\beta_2 = \beta_3 = 0$: Pollution decreases linearly with income level. This suggests that stricter environmental regulations or technological advancements might be offsetting the negative impact of income growth on pollution.
- $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 = 0$: This represents the inverted U-shaped EKC. Initially, pollution increases with income growth ($\beta_1 > 0$). However, as income continues to rise ($\beta_2 < 0$), pollution starts to decrease.
- $\beta_1 < 0$, $\beta_2 > 0$, $\beta_3 = 0$: This represents a U-shaped EKC. Initially, pollution might decrease with income growth ($\beta_1 < 0$) due to initial environmental improvements. However, as income continues to rise ($\beta_2 > 0$), pollution might begin to rise again, potentially due to the unsustainable practices or limitations of initial improvements.
- $\beta_1 > 0$, $\beta_2 < 0$, $\beta_3 > 0$: This describes an N-shaped EKC. Similar to the inverted U-shape, pollution rises with income initially ($\beta_1 > 0$). However, the decline in pollution ($\beta_2 < 0$) is followed by another increase ($\beta_3 > 0$) at even higher income levels. This could stem from factors like increased consumption patterns or limitations of previous pollution control strategies.

- $\beta_1 < 0, \beta_2 > 0, \beta_3 < 0$: This represents an inverted N-shaped EKC. Here, this indicates an initial increase in pollution ($\beta_1 < 0$) with economic growth, followed by a decline ($\beta_2 > 0$) as income reaches a certain level, eventually leading to lower pollution at higher income levels ($\beta_3 < 0$). This pattern is a less common scenario, but it may potentially reflect specific policy changes or technological advancements at various development stages. The study summarises the theoretical framework of the inverted-N shaped relationship among the variables in Figure 1.

Figure 1. Theoretical framework of the study



5. EMPIRICAL RESULTS AND DISCUSSION

Table 2 presents the summary statistics for the chosen variables, while Table 3 depicts the correlation between the independent and dependent variables. Notably, $LNCO_2$ is positively and significantly correlated with LNGDP and NREN, suggesting a link between economic growth, non-renewable energy use, and emissions. In contrast, REN and LNRL are significantly negatively correlated with CO_2 emissions, indicating potential environmental benefits from renewable energy and stronger institutional frameworks. IND does not show a significant

correlation with CO_2 emissions, highlighting potential structural variability in emission patterns.

Table 2: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
$LNCO_2$	660	2.083	0.406	1.112	3.019
LNGH	660	11.945	1.452	8.017	15.734
LNGDP	660	10.473	0.378	9.484	11.18
REN	660	0.168	0.155	0.006	0.778
NREN	660	0.739	0.199	0.103	0.985
LNRL	660	4.421	0.214	3.301	4.605
IND	658	0.26	0.049	0.141	0.408

Table 2: Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) $LNCO_2$	1.000						
(2) LNGH	0.282	1.000					
	(0.000)						
(3) LNGDP	0.424	0.036	1.000				
	(0.000)	(0.352)					
(4) REN	-0.242	-0.603	0.220	1.000			
	(0.000)	(0.000)	(0.000)				
(5) NREN	0.138	0.595	-0.189	-0.736	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)			
(6) LNRL	0.446	-0.142	0.722	0.272	-0.287	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)		
(7) IND	-0.043	-0.003	-0.304	0.046	0.055	-0.259	1.000
	(0.268)	(0.931)	(0.000)	(0.237)	(0.161)	(0.000)	

To assess the presence of cross-sectional dependence (CSD) in our data, we employ the Pesaran (2004) test. Table 4 reports the results, where the null hypothesis of no CSD is rejected for all variables at a 1% significance level, except LNRL. This confirms the existence of cross-sectional dependence within the data

series for the variables. The stationarity properties of the variables are examined using Pesaran's Cross-sectionally Augmented Dickey-Fuller (CADF) test due to the presence of cross-sectional dependence. Table 5 reveals that all variables achieve stationarity only in their first-differenced form (i.e., they are integrated of order one I(1)).

Table 4: Pesaran (2004) cross-section dependence test

Variable	CD-test	p-value
$LNCO_2$	32.607*	0.000
LNGH	14.830*	0.000
LNGDP	86.719*	0.000
REN	42.164*	0.000
NREN	39.403*	0.000
LNRL	-1.034	0.301
IND	42.099*	0.000

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

Table 5: Cross-sectionally dependent panel unit root test

Variable	Level		First difference	
	t-bar	p-value	t-bar	p-value
$LNCO_2$	-1.579	0.803	-3.323*	0.000
LNGH	-1.234	0.997	-3.310*	0.000
LNGDP	-1.884	0.193	-2.295*	0.001
REN	-1.457	0.938	-2.997*	0.000
NREN	-1.585	0.794	-3.234*	0.000
LNRL	-2.823	0.509	-2.823*	0.000
IND	-0.322	0.374	-4.901*	0.000

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

Additionally, the study conducted post-fixed effects estimations, including Wooldridge tests for assessing serial correlation among the estimated parameters, and a modified Wald statistic to detect group-wise heteroscedasticity within the residuals of fixed effect regressions. The outcomes of these tests, displayed in

Table 6, reveal the presence of both heteroscedasticity and autocorrelation within the dataset under examination in this study.

Table 6: Heteroscedasticity and autocorrelation tests

Modified Wald test for groupwise heteroscedasticity	Chi-square	p-value
	3262.73	0.0000
Wooldridge test for autocorrelation	F-test	p-value
	96.478	0.0000

Given the identified issues of cross-sectional dependence, heteroscedasticity, and autocorrelation within the dataset, it is imperative to use appropriate statistical techniques to address these challenges and ensure the validity of the study's findings. In this regard, the utilisation of Driscoll-Kraay standard errors presents a compelling solution (Hoechle, 2007).

Table 7 illustrates the regression results of Driscoll-Kraay standard errors with the fixed effects (FE) and random effects (RE) model. We employed the Hausman test before calculating Driscoll and Kraay standard errors and reported Chi-square probability at the bottom of the table. The Hausman test with a probability value of 0.0001 suggests significant bias in the random effects model. Therefore, we prefer the fixed effects model for more consistent estimates.

Regarding Driscoll-Kraay standard errors with the FE model result, all variables show statistical significance at the 1% level. The estimated coefficients for LNGDP, $LNGDP^2$, and $LNGDP^3$ are -114.399, 11.220, and -0.365, respectively, providing empirical support for the hypothesis of an inverted N-shaped EKC in the OECD sample of 33 countries. More specifically, pollution falls with economic development at the early stages. However, beyond a certain threshold of economic development, further increases in GDP per capita results in increased CO_2 emissions, reflecting the environmental costs associated with industrialisation and rising energy demands (the scale effect). Eventually, at even more advanced stages of development, further economic growth correlates with a subsequent decline in pollution. This may be due to factors such as technological advancements, shifts towards cleaner energy sources (the

technology effect), heightened environmental awareness and the implementation of environmental policies and regulations. Our findings support the earlier results of Özokcu and Özdemir (2017) but contradict the findings of Ullah et al. (2024), who reported an N-shaped curve for 17 OECD countries, and other studies finding an inverted U-shape for OECD countries (Churchill et al., 2018; Jebli et al., 2016; Lau et al., 2019).

Sinha et al. (2018) argue that simply looking at the signs of the coefficients without verifying the first and second order conditions of the mathematical model employed is not sufficient to confirm an (inverted) N-shaped EKC. Instead, two conditions must be met: (i) $\beta_1, \beta_3 < 0$, $\beta_2 > 0$, and (ii) $\beta_2^2 - 3\,\beta_1\,\beta_3 > 0$ (Sinha et al., 2018). The first condition ensures the downward and upward slopes of the curve, while the second condition guarantees the existence of real turning points. By applying these conditions and testing our model mathematically, we verify the validity of the inverted N-shaped EKC finding in the dataset of 33 OECD countries[5].

The results reveal a negative and significant correlation between REN and carbon emissions. Specifically, a 1% increase in REN usage corresponds to a reduction in environmental degradation of 1.773% in OECD countries. This suggests that incorporating renewable energy sources helps mitigate emission levels, offering a valuable means to alleviate the ecological impact of human activities. This finding is further supported by the study of Destek and Sinha (2020) on OECD nations. Given these findings, it is advisable for OECD governments to actively promote greater adoption of renewable energy. Strategies may include increasing investment in the renewable energy sector and implementing measures to lower the cost of renewable energy, thereby stimulating demand. By undertaking such initiatives, governments can foster a more sustainable energy landscape while concurrently addressing environmental concerns. A 1% increase in NREN consumption is associated with a statistically significant 0.47% rise in CO_2 emissions, supporting findings in the existing literature that identify NREN use as a major contributor to emissions.

[5] $ß_2^2 - 3ß_1ß_3 = (11.220)^2 - 3(-114.399)(-0.365) = 0.621$
Since 0.621> 0, the second condition is also satisfied.

Furthermore, our analysis emphasises the importance of strong institutions in addressing environmental challenges. The findings reveal that the RL variable has a significant negative effect on environmental outcomes. Our findings are in line with recent studies emphasising the impact of institutional quality on the environment (Apergis & Ozturk, 2015; Leal & Marques, 2022; Salman et al., 2019; Wang et al., 2024). Therefore, countries with higher institutional effectiveness are generally better positioned to manage the environmental impacts of economic growth, leading to a pattern where pollution levels eventually decrease. Finally, the results show that higher levels of industrial activity are associated with increased CO_2 emissions, highlighting the environmental impact of industrialisation. This finding is also consistent with studies such as Lin et al. (2015), Zafar et al. (2020) and Nasir et al. (2021), which point to the correlation between industrialisation and carbon emissions.

Table 7: Estimation results of FE and RE with the Driscoll-Kraay standard error approach

DV: $LNCO_2$	DK-FE				DK-RE		
	Coef.	Std.Err.	Prob.		Coef.	Std.Err.	Prob.
LNGDP	-114.399*	20.233	0.000		-112.729*	17.153	0.000
LNGDP2	11.220*	1.964	0.000		11.051*	1.675	0.000
LNGDP3	-0.365*	0.064	0.000		-0.359*	0.055	0.000
REN	-1.773*	0.102	0.000		-1.714*	0.195	0.000
NREN	0.474*	0.072	0.000		0.419*	0.084	0.000
LNRL	-0.158**	0.055	0.010		-0.121**	0.060	0.058
IND	0.500**	0.230	0.042		0.476	0.300	0.128
_cons	389.514*	69.422	0.000		383.831*	58.725	0.000
Observations	658				658		
N	33				33		
Prob> Chi2	0.0001						

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

To verify the reliability of our results, we used total GHG emissions as the dependent variable. The analysis details are presented in Table 8.

Table 3: Robustness check

DV: LNGH	DK-FE				DK-RE		
	Coef.	Std.Err.	Prob.		Coef.	Std.Err.	Prob.
LNGDP	-80.881*	24.617	0.004		-82.352*	21.661	0.001
LNGDP2	7.866*	2.394	0.004		8.008*	2.099	0.001
LNGDP3	-0.254*	0.078	0.004		-0.258*	0.067	0.001
REN	-2.043*	0.144	0.000		-2.050*	0.099	0.000
NREN	0.228*	0.056	0.001		0.255**	0.112	0.034
LNRL	-0.193**	0.076	0.021		-0.199**	0.072	0.013
IND	0.354	0.209	0.107		0.351	0.224	0.134
_cons	288.412*	84.205	0.003		293.473*	74.274	0.001
Observations	658				658		
N	33				33		
Prob> Chi2	0.0011						

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

Conducting the Hausman test prior to estimations, we find a *p*-value of 0.001, indicating preference for the fixed effects model. Notably, all coefficients remain significant at the 1% level and reinforce the presence of the inverted N-shaped pattern that characterises the relationship between economic development and emissions in OECD countries. Additionally, the signs of the coefficients for the control variables remain consistent with the main analysis. Reinforcing the robustness of our findings, the mathematical conditions for an inverted N-shaped EKC ($ß_1 < 0, ß_3 < 0, ß_2 > 0$, and $ß_2^2 - 3ß_1ß_3 > 0$) are again satisfied in the robustness check using total GHG emissions as the dependent variable.

We further divided the sample into advanced (28 countries) and emerging economies (5 countries), given the diverse nature of OECD countries in terms of income levels based on the IMF classification (Appendix Table A1, A2, A3, and A4). This division addresses the heterogeneity among OECD nations, as countries with higher income levels and more developed infrastructure may exhibit different environmental patterns than emerging economies. Our findings indicate that the inverted N-shaped EKC pattern holds for advanced economies, whereas this pattern does not emerge for emerging countries. Additional analyses using LNGH as the dependent variable yielded consistent results, further supporting the robustness of the inverted N-shaped EKC pattern for advanced

economies. This suggests that our original findings primarily reflect the advanced OECD nations. However, we acknowledge that the smaller sample size of emerging economies (only five nations) may limit the statistical power and generalisability of the results for this subgroup.

6. CONCLUSION

Environmental destruction has been of great interest to researchers and policymakers and has taken a central place on their agendas. Decades of research have studied the complex interplay of factors underlying global environmental problems. However, the quests for comprehensive solutions are still on-going. Especially with the continuous increase in industrial production, increasing gas emissions have led to a cross-border externality, leading to such critical problems as ozone depletion and climate change.

Escalating environmental concerns highlight the need for a deeper understanding of economic growth patterns in advanced economies, particularly OECD countries, whose dominance in the international arena grants them significant influence over environmental outcomes. This paper investigates the impact of economic growth on the environment within the framework of the EKC hypothesis, considering the role of both renewable and non-renewable energy consumption. Specifically, we aim to empirically validate the (inverted) N-shaped EKC hypothesis in 33 OECD economies using panel data analysis from 1996 to 2015.

The analysis yielded surprising findings that challenge the conventional EKC theory. According to the regression results, the income (GDP), the income squared (GDP^2), and the income cubed (GDP^3) have a negative, positive, and negative impact on environmental destruction, respectively. In other words, the findings reveal an inverted N-shaped EKC curve, signalling that unchecked economic growth might not lead to automatic environmental improvement, even though growth may appear to improve the environment in the long run. We also find that incorporating renewable energy sources plays a vital role in mitigating emissions, offering a valuable means to alleviate the environmental pressures of human activities.

Overall, environmental problems represent a critical global threat that transcends national borders, generating negative externalities impacting both current and future generations. These multifaceted issues demand a comprehensive approach. Yet, global environmental challenges are the result of contributions from numerous countries, and no single nation acting alone can effectively resolve them. Therefore, combating environmental problems necessitates international cooperation and coordination, alongside strong institutions and well-designed national public policies. Furthermore, a shift towards cleaner energy alternatives, for example renewable sources such as solar and wind power, is crucial to achieve sustainable economic development. Further studies could investigate the effectiveness of specific environmental policies in different contexts to provide evidence-based guidance for policymakers.

While this study offers insights into the relationship between economic growth and environmental degradation in OECD countries, it has some limitations. First, focusing solely on OECD countries may limit the generalisability to non-OECD nations with different economic structures and policies. Future research could be expanded to include a more diverse set of countries to better capture global EKC dynamics. Second, the 1996–2015 timeframe, although capturing important changes, may not reflect recent policies and technologies. Extending this period as well as examining additional environmental indicators such as the ecological footprint or load capacity factor could test the persistence of the inverted N-shaped EKC across varied forms of degradation. Third, while our model controls for energy consumption, industrialisation, and institutional quality, such factors as trade openness, urbanisation, and innovation may also play roles. Including these could provide a more complete view of EKC influences. Lastly, although we address cross-sectional dependence and autocorrelation with DK standard errors, future studies might consider dynamic panel data models or instrumental variable approaches to further account for endogeneity. In summary, expanding the sample, updating the period, broadening environmental indicators and controls, and exploring advanced methods are valuable next steps to enhance our understanding of the EKC.

REFERENCES

Abbasi, K. R., Awan, A., Bandyopadhyay, A., Rej, S., & Banday, T. P. (2023). Investigating the inverted N-shape EKC in the presence of renewable and nuclear energy in a global sample. *Clean Technologies and Environmental Policy*, *25*(4), 1179–1194.

Abdallah, K. B., Belloumi, M., & De Wolf, D. (2013). Indicators for sustainable energy development: A multivariate cointegration and causality analysis from Tunisian road transport sector. *Renewable and Sustainable Energy Reviews*, *25*, 34–43.

Ahmed, K., & Long, W. (2012). Environmental Kuznets curve and Pakistan: An empirical analysis. *Procedia Economics and Finance*, *1*, 4–13.

Akbostancı, E., Türüt-Aşık, S., & Tunç, G. İ. (2009). The relationship between income and environment in Turkey: Is there an environmental Kuznets curve?. *Energy Policy*, *37*(3), 861–867.

Aldy, J. E. (2005). An environmental Kuznets curve analysis of US state-level carbon dioxide emissions. *The Journal of Environment & Development*, *14*(1), 48–72.

Apergis N, & Ozturk, I. (2015). Testing environmental Kuznets curve hypothesis in Asian countries. *Ecological Indicators, 52*, 16–22.

Apergis, N., & Payne, J. E. (2010). The emissions, energy consumption, and growth nexus: Evidence from the Commonwealth of Independent States. *Energy Policy*, *38*(1), 650–655.

Arrow, K., Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C. S., & Pimentel, D. (1995). Economic growth, carrying capacity, and the environment. *Ecological Economics*, *15*(2), 91–95.

Beckerman, W. (1995). Economic growth and the environment: Whose growth? Whose environment?. In *Growth, the Environment and the Distribution of Incomes* (pp. 275–290). Cheltenham: Edward Elgar Publishing.

Bölük, G., & Mert, M. (2015). The renewable energy, growth and environmental Kuznets curve in Turkey: An ARDL approach. *Renewable and Sustainable Energy Reviews*, *52*, 587–595.

Churchill, S. A., Inekwe, J., Ivanovski, K., & Smyth, R. (2018). The environmental Kuznets curve in the OECD: 1870–2014. *Energy Economics*, *75*, 389–399.

Cole, M. A., Rayner, A. J., & Bates, J. M. (1997). The environmental Kuznets curve: An empirical analysis. *Environment and Development Economics*, *2*(4), 401–416.

Day, K. M., & Grafton, R. Q. (2003). Growth and the environment in Canada: An empirical analysis. *Canadian Journal of Agricultural Economics/Revue Canadienne D'agroeconomie*, *51*(2), 197–216.

Destek, M. A., & Sinha, A. (2020). Renewable, non-renewable energy consumption, economic growth, trade openness and ecological footprint: Evidence from Organisation for Economic Co-operation and Development countries. *Journal of Cleaner Production*, *242*, 118537.

Dijkgraaf, E., & Vollebergh, H. R. (2005). A test for parameter homogeneity in CO_2 panel EKC estimations. *Environmental and Resource Economics*, *32*, 229–239.

Dinda, S. (2004). Environmental Kuznets curve hypothesis: A survey. *Ecological Economics*, *49*(4), 431–455.

Dogan, E., & Seker, F. (2016). The influence of real output, renewable and non-renewable energy, trade and financial development on carbon emissions in the top renewable energy countries. *Renewable and Sustainable Energy Reviews*, *60*, 1074–1085.

Dong, B., Wang, F., & Guo, Y. (2016). The global EKCs. *International Review of Economics & Finance*, *43*, 210–221.

Fakher, H. A., Ahmed, Z., Acheampong, A. O., & Nathaniel, S. P. (2023). Renewable energy, nonrenewable energy, and environmental quality nexus: An investigation of the N-shaped environmental Kuznets curve based on six environmental indicators. *Energy*, *263*, 125660.

Farooq, U., Bhanja, N., Rather, S. R., & Dar, A. B. (2024). From pollution to prosperity: Using inverted N-shaped environmental Kuznets curve to predict India's environmental improvement milestones. *Journal of Cleaner Production*, *434*, 140175.

Fodha, M., & Zaghdoud, O. (2010). Economic growth and pollutant emissions in Tunisia: An empirical analysis of the environmental Kuznets curve. *Energy Policy*, *38*(2), 1150–1156.

Fosten, J., Morley, B., & Taylor, T. (2012). Dynamic misspecification in the environmental Kuznets curve: Evidence from CO_2 and SO_2 emissions in the United Kingdom. *Ecological Economics*, *76*, 25–33.

Galeotti, M., & Lanza, A. (1999). Richer and cleaner? A study on carbon dioxide emissions in developing countries. *Energy Policy*, *27*(10), 565–573.

Galeotti, M., Lanza, A., & Pauli, F. (2006). Reassessing the environmental Kuznets curve for CO2 emissions: A robustness exercise. *Ecological Economics*, *57*(1), 152–163.

Georgiev, E., & Mihaylov, E. (2015). Economic growth and the environment: Reassessing the environmental Kuznets curve for air pollution emissions in OECD countries. *Letters in Spatial and Resource Sciences*, *8*(1), 29–47.

Gill, A. R., Viswanathan, K. K., & Hassan, S. (2018). A test of environmental Kuznets curve (EKC) for carbon emission and potential of renewable energy to reduce greenhouse gases (GHG) in Malaysia. *Environment, Development and Sustainability*, *20*, 1103–1114.

Grossman, G. M., & Krueger, A. B. (1991). Environmental impacts of a North American Free Trade Agreement (Working Paper No. 3914). National Bureau of Economic Research.

Grossman, G. M., & Krueger, A. B. (1995). Economic growth and the environment. The quarterly journal of economics, 110(2), 353-377.

He, J., & Richard, P. (2010). Environmental Kuznets curve for CO_2 in Canada. *Ecological Economics*, *69*(5), 1083–1093.

Hill, R. J., & Magnani, E. (2002). An exploration of the conceptual and empirical basis of the environmental Kuznets curve. *Australian Economic Papers*, *41*(2), 239–254.

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, *7*(3), 281–312.

Holtz-Eakin, D., & Selden, T. M. (1995). Stoking the fires? CO_2 emissions and economic growth. *Journal of Public Economics*, *57*(1), 85–101.

Huang, J., Zhang, D., Zhang, Z., Kong, W., Yan, J., & Xia, F. (2023). Trapped in dilemma: Inverted N-shaped EKC evidence of economic growth and ecological land in a spatial spillover perspective. *Applied Geography*, *161*, 103145.

Intergovernmental Panel on Climate Change. (2023). *Climate change 2023: Synthesis report, summary for policymakers: Contribution of Working Groups I, II, and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (Core Writing Team, H. Lee & J. Romero, Eds.). IPCC.

Isik, C., Ongan, S., Ozdemir, D., Ahmad, M., Irfan, M., Alvarado, R., & Ongan, A. (2021). The increases and decreases of the environment Kuznets curve (EKC) for 8 OECD countries. *Environmental Science and Pollution Research*, *28*, 28535–28543.

Jalil, A., & Mahmud, S. F. (2009). Environment Kuznets curve for CO_2 emissions: A cointegration analysis for China. *Energy Policy*, *37*(12), 5167–5172.

Jebli, M. B., Youssef, S. B., & Ozturk, I. (2016). Testing environmental Kuznets curve hypothesis: The role of renewable and non-renewable energy consumption and trade in OECD countries. *Ecological Indicators*, *60*, 824–831.

Jones, M. W., Peters, G. P., Gasser, T., Andrew, R. M., Schwingshackl, C., Gütschow, J., ... & Le Quéré, C. (2023). National contributions to climate change due to historical emissions of carbon dioxide, methane, and nitrous oxide since 1850. Scientific Data, 10(1), 155.

Karim, S., Appiah, M., Naeem, M. A., Lucey, B. M., & Li, M. (2022). Modelling the role of institutional quality on carbon emissions in Sub-Saharan African countries. *Renewable Energy*, *198*, 213–221.

Kaul, I., Grunberg, I., & Stern, M. (1999). *Global Public Goods.* New York: Oxford.

Kuznets, S. (1955). Economic growth and income inequality. *American Economic Review, 45*(1), 1–28.

Lau, L. S., Choong, C. K., Ng, C. F., Liew, F. M., & Ching, S. L. (2019). Is nuclear energy clean? Revisit of environmental Kuznets curve hypothesis in OECD countries. *Economic Modelling*, *77*, 12–20.

Leal, P. H., & Marques, A. C. (2020). Rediscovering the EKC hypothesis for the 20 highest CO_2 emitters among OECD countries by level of globalization. *International Economics*, *164*, 36-47.

Leal, P. H., & Marques, A. C. (2022). The evolution of the environmental Kuznets curve hypothesis assessment: A literature review under a critical analysis perspective. *Heliyon*, *8*(11).

Li, K., & Lin, B. (2015). Impacts of urbanization and industrialization on energy consumption/ CO_2 emissions: Does the level of development matter?. *Renewable and Sustainable Energy Reviews*, 52, 1107–1122.

Lin, B., Omoju, O. E., & Okonkwo, J. U. (2015). Impact of industrialisation on CO_2 emissions in Nigeria. *Renewable and Sustainable Energy Reviews*, *52*, 1228–1239.

Lorente, D. B., & Álvarez-Herranz, A. (2016). Economic growth and energy regulation in the environmental Kuznets curve. *Environmental Science and Pollution Research*, *23*, 16478–16494.

Magnani, E. (2001). The environmental Kuznets curve: Development path or policy result?. *Environmental Modelling & Software*, *16*(2), 157–165.

Moomaw, W. R., & Unruh, G. C. (1997). Are environmental Kuznets curves misleading us? The case of CO_2 emissions. *Environment and Development Economics*, *2*(4), 451–463.

Nasir, M. A., Canh, N. P., & Le, T. N. L. (2021). Environmental degradation & role of financialisation, economic development, industrialisation and trade liberalisation. *Journal of Environmental Management*, *277*, 111471.

Nasr, A. B., Gupta, R., & Sato, J. R. (2015). Is there an environmental Kuznets curve for South Africa? A co-summability approach using a century of data. *Energy Economics*, *52*, 136–141.

Nasreen, S., Anwar, S., & Ozturk, I. (2017). Financial stability, energy consumption and environmental quality: Evidence from South Asian economies. *Renewable and Sustainable Energy Reviews*, *67*, 1105–1122.

Naveed, A., Ahmad, N., Aghdam, R. F., & Menegaki, A. N. (2022). What have we learned from environmental Kuznets curve hypothesis? A citation-based systematic literature review and content analysis. *Energy Strategy Reviews*, *44*, 100946.

Ng, C. F., Choong, C. K., Ching, S. L., & Lau, L. S. (2019). The Impact of electricity production from renewable and non-renewable sources on CO_2 emissions: Evidence from OECD countries. *International Journal of Business & Society, 20*(1).

Özokcu, S., & Özdemir, Ö. (2017). Economic growth, energy, and environmental Kuznets curve. *Renewable and Sustainable Energy Reviews*, *72*, 639–647.

Ozturk, I., & Acaravci, A. (2013). The long-run and causal analysis of energy, growth, openness and financial development on carbon emissions in Turkey. *Energy Economics*, *36*, 262–267.

Panayotou, T. (1993). *Empirical tests and policy analysis of environmental degradation at different stages of economic development* (ILO Working Paper WP 238). Technology and Employment Programme, International Labour Organization.

Panayotou, T. (1997). Demystifying the environmental Kuznets curve: Turning a black box into a policy tool. *Environment and Development Economics*, *2*(4), 465–484.

Pesaran, M. H. (2004). *General diagnostic tests for cross section dependence in panels* (Cambridge Working Papers in Economics No. 0435). Faculty of Economics, University of Cambridge.

Salman, M., Long, X., Dauda, L., & Mensah, C. N. (2019). The impact of institutional quality on economic growth and carbon emissions: Evidence from Indonesia, South Korea and Thailand. *Journal of Cleaner Production*, *241*, 118331.

Shahbaz, M., Mutascu, M., & Azim, P. (2013). Environmental Kuznets curve in Romania and the role of energy consumption. *Renewable and Sustainable Energy Reviews*, *18*, 165–173.

Sinha, A., & Sen, S. (2016). Atmospheric consequences of trade and human development: A case of BRIC countries. *Atmospheric Pollution Research*, *7*(6), 980–989.

Sinha, A., Shahbaz, M., & Balsalobre, D. (2018). *N-shaped environmental Kuznets curve: a note on validation and falsification* (MPRA Paper No. 99313).

Tamazian, A., & Rao, B. B. (2010). Do economic, financial and institutional developments matter for environmental degradation? Evidence from transitional economies. *Energy Economics*, *32*(1), 137–145.

Ullah, A., Dogan, M., Pervaiz, A., Bukhari, A. A. A., Akkus, H. T., & Dogan, H. (2024). The impact of digitalization, technological and financial innovation on environmental quality in OECD countries: Investigation of N-shaped EKC hypothesis. *Technology in Society*, *77*, 102484.

Vollebergh, H. R., Dijkgraaf, E., & Melenberg, B. (2005). *Environmental Kuznets curves for CO_2: Heterogeneity versus homogeneity* (CentER Discussion Paper Series No. 2005-25). http://dx.doi.org/10.2139/ssrn.683109

Wang, Q., Li, Y., & Li, R. (2024). Rethinking the environmental Kuznets curve hypothesis across 214 countries: The impacts of 12 economic, institutional, technological, resource, and social factors. *Humanities and Social Sciences Communications*, *11*(1), 1–19.

World Bank. (2024). The Worldwide Governance Indicators. https://info.worldbank.org/governance/wgi/

World Bank. (2024). World Development Indicators. https://databank.worldbank.org/source/worlddevelopment-indicators.

Yaduma, N., Kortelainen, M., & Wossink, A. (2015). The environmental Kuznets curve at different levels of economic development: A counterfactual quantile regression analysis for CO_2 emissions. *Journal of Environmental Economics and Policy*, *4*(3), 278–303.

Yavuz, N. Ç. (2014). CO_2 emission, energy consumption, and economic growth for Turkey: Evidence from a cointegration test with a structural break. *Energy Sources, Part B: Economics, Planning, and Policy*, *9*(3), 229–235.

Zafar, A., Ullah, S., Majeed, M. T., & Yasmeen, R. (2020). Environmental pollution in Asian economies: Does the industrialisation matter?. *OPEC Energy Review*, *44*(3), 227–248.

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APPENDIX

Table A1. Estimation results of FE and RE with DK standard error approach – dependent variable CO_2 (advanced economies)

DV: $LNCO_2$	DK-FE				DK-RE		
	Coef.	Std.Err.	Prob.		Coef.	Std.Err.	Prob.
LNGDP	-173.404*	18.506	0.000		-178.536*	15.767	0.000
LNGDP2	16.863*	1.789	0.000		17.355*	1.535	0.000
LNGDP3	-0.545*	0.058	0.000		-0.560*	0.050	0.000
REN	-1.277*	0.151	0.000		-1.207*	0.189	0.000
NREN	0.523*	0.107	0.000		0.484*	0.117	0.001
LRL	-0.280***	0.137	0.055		-0.248	0.148	0.109
IND	0.569***	0.314	0.085		0.639	0.401	0.128
_cons	595.217*	63.302	0.000		612.956*	53.605	0.000
Observations	558				558		
N	28				28		
(Prob> Chi2)	0.0058						

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

Table A2. Estimation results of FE and RE with DK standard error approach – dependent variable GH (advanced economies)

DV: GH	DK-FE				DK-RE		
	Coef.	Std.Err.	Prob.		Coef.	Std.Err.	Prob.
LNGDP	-164.206*	16.799	0.000		-164.043*	20.019	0.000
LNGDP2	15.824*	1.623	0.000		15.809*	1.919	0.000
LNGDP3	-0.506*	0.052	0.000		-0.506*	0.061	0.000
REN	-1.430*	0.164	0.000		-1.450*	0.113	0.000
NREN	0.194**	0.077	0.020		0.211	0.136	0.137
LRL	-0.470*	0.124	0.001		-0.473*	0.121	0.001
IND	0.316	0.250	0.222		0.302	0.268	0.274
_cons	579.386*	57.719	0.000		578.790*	69.308	0.000
Observations	558				558		
N	28				28		
Prob> Chi2	0.0011						

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

Table A3. Estimation results of FE and RE with DK standard error approach – dependent variable CO_2 (emerging economies)

DV: $LNCO_2$	DK-FE				DK-RE		
	Coef.	Std.Err.	Prob.		Coef.	Std.Err.	Prob.
LNGDP	1.518	1.468	0.314		6.518	3.988	0.119
LNGDP2	-0.228	0.301	0.459		-1.481***	0.796	0.078
LNGDP3	0.011	0.015	0.492		0.079***	0.040	0.064
REN	-4.654*	0.561	0.000		-2.110*	0.250	0.000
NREN	-1.784*	0.597	0.008		2.168*	0.589	0.002
LRL	0.079***	0.043	0.081		0.810*	0.056	0.000
IND	0.941**	0.337	0.012		2.736*	0.343	0.000
_cons	-	-	-		-	-	-
Observations	100				100		
N	5				5		
Prob> Chi2	0.000						

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

Table A4. Estimation results of FE and RE with DK standard error approach – dependent variable GH (emerging economies)

DV: GH	DK-FE				DK-RE		
	Coef.	Std.Err.	Prob.		Coef.	Std.Err.	Prob.
LNGDP	3.354***	1.745	0.070		13.058**	5.156	0.020
LNGDP2	-0.263	0.358	0.472		-2.399**	1.009	0.028
LNGDP3	0.006	0.018	0.745		0.118**	0.049	0.028
REN	-4.855*	0.666	0.000		2.822*	0.622	0.000
NREN	-1.377**	0.713	0.068		9.302*	0.362	0.000
LRL	0.093	0.057	0.121		-1.314*	0.143	0.000
IND	1.29*	0.385	0.003		2.246**	0.835	0.015
_cons	-	-	-		-	-	-
Observations	100				100		
N	5				5		
Prob> Chi2	0.000						

*, **, and *** denote significance at the 1%, 5%, and 10% levels, respectively.

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HARNESSING RESOURCE RENTS FOR DEBT REDUCTION: A STUDY OF OIL-RICH SUB-SAHARAN AFRICAN COUNTRIES

ABSTRACT: *This paper examines the effect of oil resource rents and economic complexity on the debt burden of five oil-rich Sub-Saharan African countries between 1995 and 2019. A panel autoregressive distributed lag estimation technique was used to estimate the models; the results reveal a negative and significant impact of economic complexity and natural resources rents on debt services of the selected oil-rich African countries. The paper also shows that using natural resources rents to enhance the complexity of the economy reduces public debt burdens. The implication is that greater economic complexity and natural resources rents may reduce the tendency of oil-rich countries to experience debt crises in the long run. The paper recommends that a greater deployment of natural resources rents for productive purposes may create a conducive investment climate, reducing the incidence of debt. Finally, policy makers in these economies should take advantage of natural resources rents to diversify their economies in order to deepen economic complexity and reduce the burden of public debt.*

KEY WORDS: *Oil resource rent, economic complexity, public debt burden*

JEL CLASSIFICATION: O13, F34, Q43, Q55

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1. INTRODUCTION

The assertion that a nation's resource endowment is both a curse and a blessing remain inconclusive. Some countries have improved their citizens' welfare by making the most of their natural resources. The availability of natural resources has been identified as a pre-condition for take off in Rostow's theory of stages of economic development (Arora, 2022; Muda et al., 2020; Rostow, 1959). While this affirms the case for resource endowment-led growth, there is an abundance of literature to the contrary that refutes it, as many resource-rich economies are ensnared in a cycle of poverty characterised by high capital flights and low living standards (Badeeb et al., 2017; Ndikumana & Sarr, 2019; Tabash et al., 2022). According to the literature, resource-rich countries are more likely to use their natural resources as collateral for debt in international markets, which can lead to debt crises and economic volatility (Frynas & Buur, 2020; Melina et al., 2016; Sarr et al., 2011).

Moreover, there have been concerns about the possibility of a new sovereign debt crises in sub-Saharan African (SSA) countries (Odior & Iwegbu, 2021). The effects of the 1990s' debt crises are still evident in most countries in SSA. The Multilateral Debt Relief Initiative (MDRI) for the complete forgiveness of debts owed by a group of 36 low-income poor countries was adopted by representatives from major creditor countries (a group known as the Paris Club) and multilateral organisations. The majority of these countries (precisely, 29 countries) were in Africa. Large-scale debt relief was contingent on prudent economic management and anti-poverty initiatives. Resource-intensive nations continue to experience deficits, and their economies were accompanied by debt rising more rapidly. The International Monetary Fund (IMF) in its Regional Economic Outlook for SSA classified eight countries in the region as oil exporters (IMF, 2022).

Through the Economic Complexity Index (ECI), the Growth Lab at Harvard University (2019) evaluate the current level of a nation's productive knowledge. It measures the variety and complexity of the goods countries successfully export. The ECI is determined by the level of knowledge as shown by the products a country produces. The variety of exports a nation produces and their pervasiveness, or the number of nations able to produce them (and the complexity of those nations), are used to determine a nation's economic complexity. A more diversified economy with complex exports implies a higher

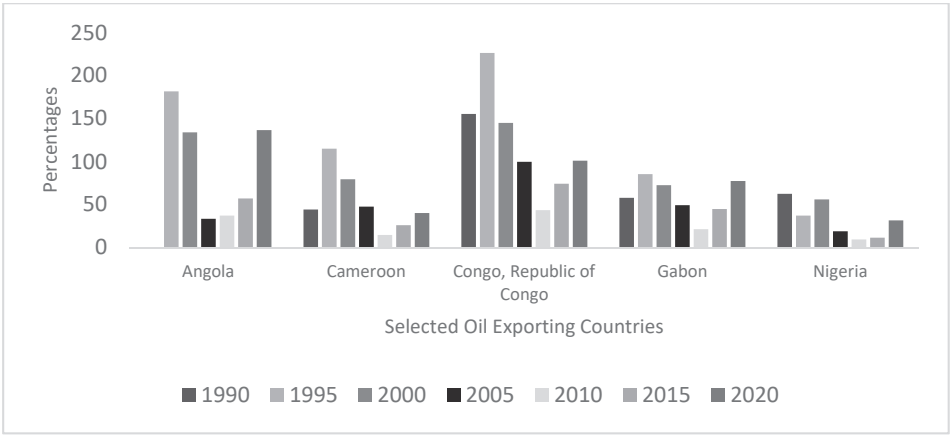
ECI and economic development. Three Asian countries (Japan, South Korea and Singapore) are ranked among the five countries with the highest ECI. These countries are, however, not endowed with natural resources. The ECI of African countries are particularly low with South Africa (60th position) as the most complex country in Africa. Oil-exporting countries in SSA are ranked between the 125th and 133rd positions, where Nigeria is ranked as the lowest ECI country.

The high ECI for Asian countries therefore demonstrates the complexity of exports in these countries in contrast to the dependence on primary exports in SSA countries. The linkage between oil rents, debt crises and economic complexity has not been exhaustively explored in the literature. This present study attempts to examine whether oil resources and economic complexity have a significant effect on debt in SSA. The study also explores the impact of economic complexity on debt crises and the effect of oil resources on debt crises in SSA. We employ five countries (Angola, Republic of Congo, Gabon, Nigeria and Cameroon) from the IMF's classification of eight oil-exporting countries; South Sudan, Equatorial Guinea and Chad were omitted due to lack of data on the ECI (IMF, 2022). The data span from 1995 to 2019 to measure the effect of economic complexity. The remainder of the paper is organised as follows: Section 2 describes stylised facts while Section 3 provides the literature review. Section 4 presents the methodology and dataset and Section 5 the empirical results. Lastly, Section 6 concludes and offers policy recommendations.

2. STYLISED FACTS

The Heavily Indebted Poor Countries (HIPC) and MDRI debt reduction programmes helped SSA countries in the late 1990s. As a result, the average level of government debt as a percentage of GDP dropped significantly for all these countries, as seen in Figure 1. Debt as a percentage of gross domestic product peaked in 1995 at 226.3% for Republic of Congo and has since dropped to 145% in 2000 and 101% in 2020. There is clear evidence of the link between the resource boom and indebtedness in the selected countries. The country's external debt stocks have increased very sharply since the large gas discovery in 2010 (Fig. 1) when it became known that the massive quantities of natural gas could serve as collateral for further contraction of loans overseas.

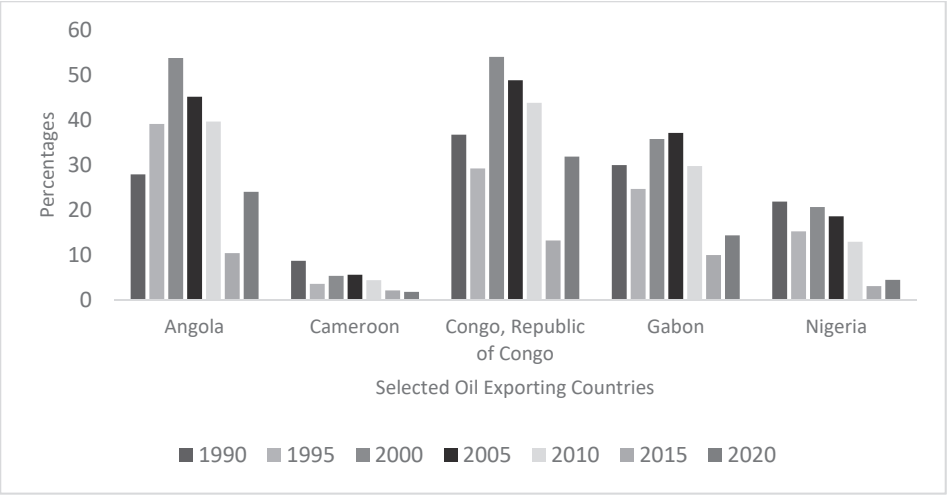
Figure 1: Government debt for the selected oil-exporting countries (% of GDP)



Source: World Bank – World Development Indicators online database

Figure 2 presents oil rents for the selected countries from 1990 to 2020. Oil rents gradually increased between 1990 and 2010 but declined sharply in 2015 and then mostly increased significantly in 2020. Comparing Figures 1 and 2, we can infer that there is an inverse pattern between both. As oil rents increase, public debt decreases, while when oil rents start declining, public debt begins to rise. This relationship demonstrates how increased natural resource revenues may initially support debt reduction by providing surplus funds that reduce reliance on borrowing. However, as oil rents decrease, the governments turn to debt financing to offset the revenue shortfalls, leading to an upward trend in public debt. This cyclical pattern underscores the fiscal challenges of managing public debt in natural resource-dependent economies, where fluctuations in natural resources rents directly impact debt sustainability and the need for strategic financial planning during revenue downturns.

Figure 2: Oil Rents for the selected oil-exporting countries (% of GDP)



Source: World Bank – World Development Indicators online database

3. LITERATURE REVIEW

Theoretically, the existing literature provides a relationship between natural resource ownership and growth of the economy, with a strand explaining why certain oil-rich countries enjoy sustainable economic growth, while others that are developing experience stunted growth. The theories explain the transmission mechanism through which these economies experience such growth (Brunnschweiler & Bulte, 2008). The resource curse hypothesis validates the proposition that resource-rich countries experience slower economic growth, poor governance and increased public debt compared to resource-poor countries and this causes volatility in foreign exchange earnings because of the volatility in prices of natural resources. During the period of high prices of natural resources with consequential currency appreciation, the government of such an economy borrows more in the belief that the increase in prices will be sufficient to offset the borrowings. However, debt unsustainability sets in when the prices fall and this results in fiscal crises (Poelhekke, 2009; Sachs & Warner, 1995; van der Ploeg, 2011). Challenges in the governance structure of the economies also contribute to debt crises and too much accumulation of debt. Most of the governments of oil-rich economies encourage corruption and wastage of resources through their rent-seeking behaviour because the institutional framework that would normally

provide checks and balances on their actions is weak (Mehlum et al., 2006). These governance issues limit a country's ability to generate long-term economic growth from resource wealth and increase its dependence on external debt. Empirical studies show that resource-rich countries with poor institutional quality are more likely to experience debt distress due to poor policy choices and a lack of accountability in fiscal management (Collier & Hoeffler, 2009).

Furthermore, the resource curse hypothesis suggests that resource booms reduce competitiveness in other sectors, particularly manufacturing, which limits economic diversification, and this exposes them more to economic shocks, making them significantly rely on debt as a financial buffer against revenue volatility (Auty & Kiiski, 2001; van der Ploeg, 2011). The neglect of these other critical sectors leads to abandonment and lean sources of revenue to achieve sustainable economic growth and development (Corden & Neary, 1982). During natural resource booms, there is a huge neglect of human capital development, which is necessary for sustainable growth, as suggested by endogenous growth theory. This leaves these economies vulnerable when resource revenues decline (Romer, 1986).

In other related literature, international trade theory suggests that natural resource dependent countries concentrate on exporting their natural resources, resulting in reduced export diversification, fiscal unpredictability and an increased likelihood of borrowing to stabilise public finances during downturns (Ricardo, 1817; Deaton, 1999). However, Arezki et al. (2017) posited that effective management of the natural resources can help these rich natural resource countries to enjoy fiscal stability, thereby avoiding debt overhang. Some of the countries that have adopted these strategies include Norway, who implemented sovereign wealth funds and prudent fiscal policies to save surplus resource revenues, allowing for economic stability and debt management during market downturns. In essence, the relationship between natural resources and public debt is significantly influenced by governance quality, fiscal policies and economic diversification efforts (Arezki et al., 2017; van der Ploeg, 2011).

Due to the varied empirical data, the relationship between oil resources and public debt has occupied much of the literature. However, this study departs from previous research by incorporating economic complexity into the debate on oil

resources and public debt. Consequently, the study examines the relevant literature in two distinct ways. First, the literature demonstrates that oil resource endowment is a source of revenue that might lower public debt stock, and second, evidence demonstrates that oil resource endowment is a curse that leads to larger debt stock and economic complexity as a link.

Table 1a: Summary of empirical literature

S/N	Author	Year covered	Country	Methods	Findings
1	Sadik-Zada and Gatto (2019)	2013	184 countries	Cross-country linear regression	The share of oil rents, share of mineral rents, and economic growth all have a negative impact on public debt growth, whereas interest rate payments have a positive impact on public debt.
2	Ghecham (2020)	1996–2018	6 OPEC oil-exporting countries	Stochastic frontier analysis (SFA)	The improper distribution of oil resources has a negative effect on public debt.
3	Chuku et al. (2021)	2000–2017	18 African economies	endogenous Binary-treatment regression models	Chinese loans have a positive impact on physical and economic oil abundance. However, a negative effect of public debt sustainability is found.
4	Ampofo et al. (2021)	1991–2017	17 mineral-rich countries	Pooled mean group-ARDL and VECM	In the long run, resource rent has a positive impact on public debt. Therefore, overdependence on natural resource rents affects public debt sustainability. Resource rents and public debt have an established bidirectional causal link.
5	Melina, Yang & Zanna (2016)		Developing countries	DSGE model called debt, investment, growth, and natural resou rces (DIGNAR)	Resource funds combined with acyclical government spending can reduce macroeconomic instability. However, high debt level and ambitious public investment may lead to debt sustainability risks especially when resource funds are lower than expected.

6	Canh et al. (2020)	2002–2017	90 countries divided into low and lower-middle income (LMEs), upper-middle income (UMEs) and high income economies (HIEs)	Generalised method of moments (GMM) model and sequential (two-stage) estimation of linear panel-data models (SELPDM)	In LMEs and HIEs, economic complexity has a minimal effect on total natural rents, whereas in UMEs it has no effect. Complexity has a diminished effect on mineral and natural gas rents, but is likely to boost coal rents.
7	Tabash et al. (2022)	1995–2017	24 African economies	GMM model	Natural resources rents have a negative impact on economic growth while economic complexity has a positive impact on economic growth. When economic complexity interacts with natural resources, however, the effect on economic growth is favourable.

Source: Authors' compilation from desk review

Table 1b: Continuation of summary of empirical literature

S/N	Author	Year covered	Country	Methods	Findings
8	Abdulahi et al. (2019)	1998–2016	14 resource-rich countries of SSA	OLS standard error and White-correlated standard error models and system (GMM)	Resource rent has a positive impact on economic growth when a country's institutional quality is above the threshold level
9	Dong et al. (2019)	2014–2015	China	Probit model regression	Coal output has a positive impact on corruption. Coal mining encourages graft at all levels of government in affected areas.
10	Ajide (2022)	1995–2018	32 African economies	pooled OLS, fixed effects, random effects and generalised method of moments (GMM)	The theory of the resource curse is supported by economic complexity.

11	Khan et al. (2020)	1985–2017	China	ARDL & VECM	In the long run, there is a bidirectional causal relationship between FDI and economic complexity. The rapid economic emergence of China is credited to its products and economic complexity.
12	Frynas & Buur (2020)	1995–2015	3 African countries (Sao Tome and Principe, Madagascar and Mozambique)	Exploratory	All the three countries experienced the negative effects of anticipation of future extractive revenues including low economic growth, high debt levels, and eroded governance and social conflicts.
13	Ndikumana and Sarr (2019)	1970–2015	30 African countries	Fixed-effects	Natural resources rents are associated with high capital flight and the quality of institution does not mitigate this link.
14	Adams et al. (2019)		Ghana	Stratified simple random sampling, descriptive and regression analyses	In order to avoid the resource curse, a government needs more than only Extractive Industries Transparency Initiative (EITI) participation and petroleum revenue management regulations.

Source: Authors' compilation from desk review

4. RESEARCH METHODOLOGY

To achieve the research objective, we adapt the model specified by Sadik-Zada and Gatto (2019) only to the extent that we introduce the economic complexity index into the model and vary other explanatory variables employed in the model. Thus, the implicit function of our model is specified as:

$$GDEBT = f\left(GDPC, OILR, ECI, LF, INV, TOP, CC, OILR * ECI\right). \quad (1)$$

Equation (1) suggests that debt service is a function of gross domestic product per capita, oil rent, the economic complexity index, the labour force, investment, trade openness and interactive variables between oil resource rent and the economic complexity index. Theoretically, economic complexity enables countries to reduce dependency on volatile resource rents by promoting diversified industries that can sustain revenue generation (Hidalgo & Hausmann,

2009). Countries with higher economic complexity tend to be more resilient to resource price fluctuations, as they can offset downturns in resource revenues with income from other sectors, mitigating the adverse effects on debt service (Hartmann et al., 2017). Furthermore, resource rents in complex economies are more likely to be allocated to infrastructure and institutional investments that support economic stability and debt sustainability (Mazzucato, 2013). This theory aligns with the resource curse literature, which argues that resource-rich countries with less economic diversification often experience weaker fiscal outcomes and higher debt burdens (Sachs & Warner, 1995).

Equation (1) can be further expanded explicitly in econometric form as an autoregressive distributed lagged model and is thus specified as:

$$\begin{aligned} GDEBT_{m,t} = {} & \varphi_0 + \varphi_1 GDPC_{m,t} + \varphi_2 OILR_{m,t} + \varphi_3 ECI_{m,t} + \varphi_4 LF_{m,t} + \varphi_5 INV_{m,t} + \varphi_6 TOP_{m,t} \\ & + \varphi_7 CC_{m,t} + \varphi_8 (OILR * ECI)_{m,t} + \lambda_1 \sum_{i=1}^{\rho} \Delta GDPC_{m,t-\rho} + \lambda_2 \sum_{i=1}^{\rho} \Delta OILR_{m,t-\rho} \\ & + \lambda_3 \sum_{i=1}^{\rho} \Delta ECI_{m,t-\rho} + \lambda_4 \sum_{i=1}^{\rho} \Delta LF_{m,t-\rho} + \lambda_5 \sum_{i=1}^{\rho} \Delta INV_{m,t-\rho} + \lambda_6 \sum_{i=1}^{\rho} \Delta TOP_{m,t-\rho} \\ & + \lambda_7 \sum_{i=1}^{\rho} \Delta CC_{m,t-\rho} + \lambda_8 \sum_{i=1}^{\rho} \Delta (OILR * ECI)_{m,t-\rho} + \mu_{it} \end{aligned} \tag{2}$$

Equation (2) shows that the long run coefficients are $\varphi_0 \longrightarrow \varphi_8$ while the short run coefficients are $\lambda_0 \longrightarrow \lambda_8$. The choice of the lags ρ for each variable in the short run is determined using the least Akaike Information Criterion (AIC), while each of the variables is for the respective oil-rich country *m* at time *t*. The definition, measurement and source of the variables employed are presented in Table 2. Three models are estimated: the first model is estimated without considering the economic complexity index (ECI) and the interaction between economic complexity and oil resource rent (OILR*ECI), while the second model includes the economic complexity index (ECI) amongst other variables specified in equation (2) but without the interaction term. The third model estimates the entire model while considering the interaction term. The separation of the model is to establish the effect of economic complexity and understand how its interaction with the oil resource affects the public debt of these selected oil-rich

nations. In order to estimate equation (2), the panel autoregressive distributed lag (PARDL) model is employed. The PARDL model is appropriate in estimating panel models that have mixed order of stationarity at level and at first difference. It is also appropriate in capturing the long-run model and the short-run model in a regression model. Prior to the estimation of the PARDL model, preliminary correlation analysis and unit root testing using the Levin et al. (2002) and Breitung (2001) statistics and panel cointegration test will be carried out.

Table 2: Data description and source

Variable	Identification	Definition	Source
GDEBT	Debt Service	Debt service on external debt	WDI 2021
GDPC	Gross Domestic Product	GDP per capita (constant 2015 US$)	WDI 2021
OILR	Oil rent	Oil rents (% of GDP)	WDI 2021
LF	Labour force, total	Total labour force	WDI 2021
ECI	Economic complexity index	The economic complexity index is a ranking of countries based on the diversity and complexity of their export basket	Harvard Growth Lab, 2021
INV	Investment	Gross fixed capital formation as a % of GDP	WDI 2021
TOP	Trade Openness	This is captured with trade as a % of GDP	WDI 2021
OILR*ECI	Interactive Variable	Oil rent is interacted with the economic complexity index	Derived
CC	Corruption perception index	This scores countries on the perceived levels of government corruption by country.	WDI 2021

Source: Researcher's compilation and WDI = World Development Indicator

5. PRESENTATION AND ANALYSIS OF RESULTS

This section presents some descriptive statistics on the variables employed and other pre-estimation tests that are necessary in order to ensure that we do not estimate a spurious regression.

Table 3: Summary statistics of panel variables employed

	GDEBT	GDPC	OILR	ECI	LF	INV	CC
Mean	3.754	7.854	2.693	-1.500	15.360	3.207	-1.186
Median	3.759	7.731	2.939	-1.538	15.857	3.178	-1.186
Maximum	5.439	9.134	4.016	-0.511	17.947	4.395	-0.520
Minimum	1.985	6.927	0.419	-2.506	12.661	2.651	-1.648
Std. Dev.	0.821	0.638	0.976	0.376	1.689	0.337	0.245
Skewness	-0.110	0.675	-0.645	0.138	-0.035	1.003	0.613
Kurtosis	2.385	2.317	2.291	2.962	1.743	4.456	3.056
Jarque-Bera	2.130	11.446	10.826	0.390	7.930	30.734	7.537
Probability	0.345	0.003	0.004	0.823	0.019	0.000	0.023
Sum	450.537	942.431	323.178	-179.962	1843.143	384.805	-142.370
Observations	120	120	120	120	120	120	120

Source: Authors' computation using data from world development indicators

From Table 3, the average rate of change in debt service was 3.8 while its maximum value was 5.4. However, the rate of change in debt service for a particular country was as low as 1.99. Converting the value of debt service to rates of change reduced the extent of variation associated with the trend of the variable. Also, the rate of change in per capita GDP stood at an average of 7.9 over the period in consideration while it ranged between a minimum value of 6.9 and a maximum value of 9.1. The rate of change in oil revenue was minimal at an average of 2.7 but had a maximum rate of change of 4.02. The countries under consideration had an average negative ranking of their complexity and the range of the complexity was never favourable as a positive maximum value was not achieved. The rate of change in labour force was high with an average value of 15.36 and fluctuated between 12.66 and 17.95. Gross fixed capital formation, a measure of investment, experienced a low rate of change as an average value of 3.21 was recorded with a peak value of 4.4 and a minimum value of 2.65. The measure of institution and control of corruption never recorded a favourable rating. The perception index with respect to the control of corruption remained in the negative range between -1.65 and -0.520 on a ranking that spans between -2.5 and +2.5.

The skewness and kurtosis help us to understand the pattern of distribution of the series. Alternatively, using the Jarque–Bera probability value, it can be determined that the rate of change in debt service and the economic complexity

index is normally distributed as the probability values are greater than 0.05 and therefore the null hypothesis of normal distribution cannot be rejected. However, the rate of change in per capita GDP, oil revenue, labour force, investment and control of corruption index are not normally distributed as the probability values are less than 0.05, which therefore rejects the null hypothesis of normal distribution and accepts the alternative that the variables are not normally distributed.

Table 4: Panel correlation analysis

	GDEBT	GDPC	OILR	ECI	LF	INV	CC	TOP
GDEBT	1.000							
GDPC	0.091	1.000						
OILR	0.297	0.499	1.000					
ECI	0.079	0.026	-0.149	1.000				
LF	-0.550	-0.650	-0.469	-0.390	1.000			
INV	0.265	0.145	0.450	0.070	-0.281	1.000		
CC	-0.241	0.299	-0.015	-0.117	0.009	0.066	1.000	
TOP	0.582	0.378	0.787	0.225	-0.738	0.534	-0.202	1.000

Source: Authors' computation using data from world development indicators

Furthermore, we conducted a correlation analysis to understand the degree of relationship that exists between our variables of interest. Table 4 presents the results of the correlation analysis. Firstly, we observe that the highest degree of relationship is between labour force and trade openness at -0.7. Although this is very high, it does not suggest the possibility of perfect multicollinearity associated with the regression result. A close examination of our variables of interest shows that there is a weak positive relationship between the extent of economic complexity and debt service, while there is a weak negative correlation between economic complexity index and oil rent. There is also a weak positive correlation between oil rent and debt service for the group of economies examined.

Table 5: Panel unit root result

	Level		First difference	
Variables	**LLC**	**Breit**	**LLC**	**Breit**
GDEBT	1.856	1.177	-5.667***	-4.028***
GDPC	2.632	1.825	-1.261*	-2.952***
OILR	-4.269***	-5.375***	–	–
LF	-1.672**	4.339	–	-1.448*
ECI	-2.915***	-2.127**	–	–
INV	1.059	1.421	-4.929***	-3.456***
TOP	-1.587*	-2.985***	–	–
CC	-0.070	-0.479	-2.898***	-3.888***

Note: LLC represents Levin et al. (2002), Breit represents Breitung (2001) statistics; * means 10%, ** means 5%; *** means 1% significance levels

Source: Authors' computation using data from world development indicators

Table 5 shows the results of the panel unit root test, which indicate that debt service, gross domestic product per capita, investment and control of corruption are not stationary at levels as their LLC and Breitung statistics are not significant at the 10% level. Hence, the null hypothesis cannot be rejected, leading to the conclusion that these variables have unit root at level and are therefore not stationary. We then further examined these variables at first difference and the result shows that they are stationary at first difference as the LLC and Breitung statistics are at least significant at the 10% level, leading to the conclusion that these variables are stationary at first difference. The results show that oil resource rent, labour force, the economic complexity index and trade openness are stationary at levels as the LLC and Breitung statistics are significant at least the 10% level and we then reject the null hypothesis and conclude that oil resource rent, labour force, economic complexity index and trade openness are stationary at levels.

Table 6: Cointegration result

Method	**Statistic**	**Prob.**	**Weighted statistic**	**Prob.**
Alternative hypothesis: individual AR coefs. (within-dimension)				
Panel v-statistic	-0.304	0.620	-1.534	0.938
Panel rho-statistic	0.782	0.783	1.067	0.857
Panel PP-statistic	-3.702	0.000	-5.552	0.000
Panel ADF-statistic	-1.541	0.062	-4.873	0.000
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	Prob.		
Group rho-statistic	1.726	0.958		
Group PP-statistic	-7.513	0.000		
Group ADF-statistic	-4.006	0.000		

Source: Authors' computation using data from world development indicators

We also investigated the cointegration of the variables using the panel v, rho, Phillips–Perron and augmented Dickey Fuller statistics and the results in Table 6 show that there is a long-run relationship associated with the regression results using the Phillips–Perron and augmented Dickey Fuller statistics. This becomes evident given that the Phillips–Perron and augmented Dickey Fuller statistics are statistically significant at the 1% level, leading to rejection of the null hypothesis of no cointegration in the within- and between-dimensions associated with the regression result.

Table 7: Empirical result using panel autoregressive distributed lag model (PARDL)

Regressors	Dependent variable LOG(GDEBT)		
	I	II	III
Selected model	PARDL(1,1,1,1,1,1,1)	PARDL(1,1,1,1,1,1,1,1)	PARDL(1,1,1,1,1,1,1,1,1)
	A. Long-run estimates		
LOG(GDPC)	0.497 (0.497)	0.535 (2.480)	10.570 (3.470)***
OILR	0.001 (0.010)	-0.080 (0.018)***	-0.022 (0.006)***
LOG(LF)	1.659 (0.561)***	-1.737 (0.548)**	-1.714 (0.469)***
INV	-0.023 (0.014)*	-0.021 (0.017)	-0.088 (0.015)***
TOP	-0.013 (0.006)**	-0.004 (0.017)	-0.055 (0.014)***
CC	-0.861 (0.495)*	-6.912 (1.224)***	-8.833 (0.648)***
ECI	–	-7.418 (1.159)***	-10.845 (0.771)***
OILR*ECI	–	–	-0.089 (0.041)**
	B. Short-run estimates		
COINTEQ01	-0.725 (0.206)***	-0.334 (0.166)**	-0.268 (0.163)*
Δ	-2.585 (1.850)		
LOG(GDPC)		-1.986 (1.698)	-1.601 (0.068)***
Δ (OILR)	0.018 (0.009)**	0.022 (0.008)**	-0.127 (0.050)**
Δ LOG(LF)	8.494 (6.853)	0.462 (28.686)	38.784 (34.788)
Δ (INV)	0.083 (0.005)***	0.080 (0.014)***	0.090 (0.014)***
Δ (TOP)	-0.011 (0.011)	-0.016 (0.012)	0.001 (0.017)
Δ (CC)	1.690 (0.458)***	1.421 (0.788)*	2.374 (1.328)*
Δ (ECI)	–	1.275 (0.603)**	-1.939 (0.970)**
Δ (ECI*OILR)	–	–	-0.086 (0.009)***
Constant	-5.786 (1.452)***	8.725 (3.855)**	-17.149 (6.507)**

Note: *** specifies 1% level of significance, ** specifies 5% level of significance, * specifies 10% level of significance, ( ) specifies standard error.

Table 7 presents the results of the regression where debt is the dependent variable while there are other explanatory variables. To reduce the skewness of variables and make them normally distributed so as to have a better fit of the regression line, and also reduce scale differences with others, gross domestic product (GDPC), debt service (DEBT) and labour force (LF) were logged to base 10 and thus renamed as LOG(GDPC), LOG(DEBT) and LOG(LF), respectively. The coefficients of LOG(GDPC) and LOG(LF) are interpreted as growth rates. Recall that our objective is to understand the effect of economic complexity and natural resources on debt in five selected oil-exporting countries in SSA (Angola, Republic of Congo, Gabon, Nigeria and Cameroon). The results of the last two

models show that, in the long run, there is a negative and significant impact of oil resource rent on debt among the oil-rich countries, signifying the effect of economic complexity. The implication of this finding is that oil resource rent leads to a reduction in debt burden for these countries. In the second and third models, the results show that there is a negative and significant impact of the economic complexity index on the debt burden of these countries in the long run. The implication of this finding is that increases in the complexity of the economy result in lower debt burden in the form of debt services for these countries. This finding confirms the findings of Sadik-Zada and Gatto (2019), whose study found that the share of oil rents, share of mineral rents and economic growth all have a negative impact on public debt growth.

Furthermore, we examined the effect of utilising the natural resources rent to deepen the export capacity of these oil countries on debt burden for these countries. This is achieved by considering the interactive effect of economic complexity and natural resources rent on the debt burden of the oil-rich countries. The result of the estimation reveals that greater utilisation of the natural resources rent towards enhancing the complexity of the economy reduces the public debt burden associated with these economies; this is as revealed in the third model result.

The results confirm the apriori expectation in the long run. It is, however, slightly different in the short run. In the short run, the results reveal that there is a positive impact of the natural economic complexity index on debt burden of the oil-rich economies without the interaction. The implication of this is that deepening the complexity of the oil-rich economies' export trade cannot reduce the debt burden of these countries in the short term (expect with the inclusion of interaction), but this will have significant effect in the long term. The introduction of the interaction term reveals that economic complexity and natural resource rents reduce the public debt burden of the selected oil-rich countries both in the short run and in the long run. Thus, countries with higher economic complexity are better positioned to manage debt service obligations when they have resource revenues. This implies that as countries with diversified and complex economies receive income from natural resources, they may use these funds more effectively, potentially reducing debt burdens by fostering more sustainable and productive investments. The interaction indicates that complex economies are more capable

of channelling resource rents toward long-term growth trajectory and debt reduction, instead of falling into the resource dependency trap that can exacerbate debt levels.

An examination of other factors that affect debt burden of the oil-rich economies reveals that deepening the investment profile of these countries reduces the debt burden associated with these economies in the long run, while controlling corruption in the long term also reduces the debt burden of the oil-rich economies. In the short run, greater deployment of the countries' labour force does not result in a reduction in the debt burden of the economies and this is also the same for trade openness in the third model.

6. CONCLUSION AND RECOMMENDATION

This study examines the impact of economic complexity on debt crises and the effect of oil resources on debt crises in SSA. The study has also examined the effect of deploying natural resources rents in deepening the complexity of these African countries' debt crises in SSA. In order to achieve these objectives, five oil-rich countries are selected from the IMF's classification of eight oil-exporting countries, while the data covered the period between 1995 and 2019 to measure the effect of economic complexity and natural resources on debt crises. The results the study show that economic complexity reduces the tendencies of these oil-rich countries to experience debt crises in the long term. Thus, the study concludes that there is a negative and significant impact of economic complexity on debt crises in these African countries. The study further examined how natural resources rent affects the debt burden of these countries and the results also show that the natural resources rent helps in ameliorating the debt burden experienced by these SSA countries due to the contraction of debt. More interestingly, the findings of the study indicate that greater utilisation of the natural resources rent towards enhancing the complexity of the economy reduces the public debt burden associated with these economies.

The study concludes that economic complexity and natural resources rent are significant predictors of the extent of a debt crisis in selected oil-rich SSA countries. More importantly, economic complexity and natural resources rents help in reducing the tendency towards debt crises in these countries. The study recommends greater deployment of natural resources rents for productive

purposes and the creation of a conducive investment climate so as to reduce the tendency of these fiscal authorities to contract more debts, which can lead to a debt crises. Furthermore, economies should take advantage of the returns from natural resources in diversifying the economy to deepen the complexity of the economy with respect to product sophistication and exporting networks. Despite the tendencies of natural resources rents to reduce the debt burden of these SSA oil-rich countries, it is important for these countries to contract debt for development purposes or productive purposes.

REFERENCES

Abdulahi, M. E., Shu, Y., & Khan, M. A. (2019). Resource rents, economic growth, and the role of institutional quality: A panel threshold analysis. *Resources Policy*, *61*, 293–303.

Adams, D., Ullah, S., Akhtar, P., Adams, K., & Saidi, S. (2019). The role of country-level institutional factors in escaping the natural resource curse: Insights from Ghana. *Resources Policy*, *61*, 433–440.

Ajide, K. B. (2022). Is natural resource curse thesis an empirical regularity for economic complexity in Africa? *Resources Policy*, *76*, 102755. https://doi.org/10.1016/j.resourpol.2022.102755

Ampofo, G. M. K., Jinhua, C., Bosah, P. C., Ayimadu, E. T., & Senadzo, P. (2021). Nexus between total natural resource rents and public debt in resource-rich countries: A panel data analysis. *Resources Policy, 74*, 102276.

Arezki, R., Ramey, V. A., & Sheng, L. (2017). News shocks in open economies: Evidence from giant oil discoveries. *The Quarterly Journal of Economics*, 132(1), 103-155. https://doi.org/10.1093/qje/qjw030

Arora, R. (2022). Rostow's stages of growth. In M. Clarke, & X. Zhao (Eds.). *Elgar Encyclopaedia of Development*. Sydney: Edward Elgar Publishing.

Auty, R. M., & Kiiski, S. (2001). Natural resources, capital accumulation, structural change and welfare. In R.M. Auty (Ed.). *Resource Abundance and Economic Development* (p. 19–35). Oxford: Oxford Academic. https://doi.org/10.1093/0199275785.003.0002

Badeeb, R. A., Lean, H. H., & Clark, J. (2017). The evolution of the natural resource curse thesis: A critical literature survey. *Resources Policy*, *51*, 123–134.

Breitung, J. (2001). The local power of some unit root tests for panel data. In B.H., Baltagi, T.B., Fomby, & R., Carter Hill (Eds.). *Nonstationary panels, panel cointegration, and dynamic panels*

(Advances in econometrics, Vol. 15) (p. 161–177). Leeds: Emerald Group Publishing Limited. https://doi.org/10.1016/S0731-9053(00)15006-6

Brunnschweiler, C. N., & Bulte, E. H. (2008). The resource curse revisited and revised: A tale of paradoxes and red herrings. *Journal of Environmental Economics and Management*, *55*(3), 248–264. https://doi.org/10.1016/j.jeem.2007.08.004

Canh, N. P., Schinckus, C., & Thanh, S. D. (2020). The natural resources rents: Is economic complexity a solution for resource curse? *Resources Policy*, *69*, 101800.

Chuku, C., Lang, L., & Lim, K. Y., (2021). *Public debt, Chinese loans and optimal exploration-extraction in Africa*. (Working Paper Series No. 355, African Development Bank).

Collier, P., & Hoeffler, A. (2009). Testing the neocon agenda: Democracy in resource-rich societies. *European Economic Review*, *53*(3), 293–308. https://doi.org/10.1016/j.euroecorev.2008.05.006

Corden, W. M., & Neary, J. P. (1982). Booming sector and de-industrialisation in a small open economy. *The Economic Journal*, *92*(368), 825–848. https://doi.org/10.2307/2232670

Deaton, A. (1999). Commodity prices and growth in Africa. *Journal of Economic Perspectives, 13*(3), 23–40. https://doi.org/10.1257/jep.13.3.23

Dong, B., Zhang, Y., & Song, H. (2019). Corruption as a natural resource curse: Evidence from the Chinese coal mining. *China Economic Review*, *57*, 101314.

Frynas, J. G., & Buur, L. (2020). The presource curse in Africa: Economic and political effects of anticipating natural resource revenues. *The Extractive Industries and Society*, *7*(4), 1257–1270.

Ghecham, M. A. (2020). Further attempt to explain the oil curse mechanism using a debt overhang concept. *Journal of Economic Studies, 48*(4), 852–868.

Hartmann, D., Guevara, M. R., Jara-Figueroa, C., Aristarán, M., & Hidalgo, C. A. (2017). Linking economic complexity, institutions, and income inequality. *World Development, 93*, 75–93. https://doi.org/10.1016/j.worlddev.2016.12.020

Hidalgo, C. A., & Hausmann, R. (2009). The building blocks of economic complexity. *Proceedings of the National Academy of Sciences, 106*(26), 10570–10575. https://doi.org/10.1073/pnas.0900943106

International Monetary Fund (2022). *Regional economic outlook. Sub- Saharan Africa: A New Shock and Little Room to Maneuver.* https://www.imf.org/en/Publications/REO/SSA/Issues/2022/04/28/regional-economic-outlook-for-sub-saharan-africa-april-2022

Khan, H., Khan, U., & Khan, M. A. (2020). Causal nexus between economic complexity and FDI: Empirical evidence from time series analysis. *The Chinese Economy*, *53*(5), 374–394.

Levin, A., Lin, C., & James Chu, C. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics*, 108(1), 1-24. https://doi.org/10.1016/S0304-4076(01)00098-7

Mazzucato, M. (2013). *The Entrepreneurial State: Debunking Public vs. Private Sector Myths*. Anthem Press.

Mehlum, H., Moene, K., & Torvik, R. (2006). Institutions and the resource curse. *The Economic Journal, 116*(508), 1–20. https://doi.org/10.1111/j.1468-0297.2006.01045.x

Melina, G., Yang, S. S., & Zanna, L. (2016). Debt sustainability, public investment, and natural resources in developing countries: The DIGNAR model. *Economic Modelling*, 52, 630-649. https://doi.org/10.1016/j.econmod.2015.10.007

Muda, I., Nurlina, E., & Nuradi, T. E. (2020). Stage of takeoff based on Rostow's theory for the role of manufacture of non-metals, except petroleum and coal manufacture to the economic increase. *Research in World Economy*, *11*(5), 177–185.

Ndikumana, L., & Sarr, M. (2019). Capital flight, foreign direct investment and natural resources in Africa. *Resources Policy*, *63*, 101427.

Odior, E. S. O., & Iwegbu, O. (2021). Sovereign debt and sovereign debt service dynamics and its burden on the Nigerian economy. *Saudi Journal of Economics and Finance, 5*(8), 342–353. https://saudijournals.com/media/articles/SJEF_58_342-353.pdf

Poelhekke, S. (2009). Volatility and the natural resource curse. *Oxford Economic Papers*, 61(4), 727-760. https://doi.org/10.1093/oep/gpp027

Ricardo, D. (1817). On the principles of political economy and taxation (London, John Murray). In P. Sraffa, & M. H. Dobb (Eds.). *The Works and Correspondence of David Ricardo*, Vol. 1. Cambridge: Cambridge University Press.

Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, *94*(5), 1002–1037. https://www.jstor.org/stable/1833190

Rostow, W. W. (1959). The stages of economic growth. *The Economic History Review*, 12(1), 1-16. https://doi.org/10.1111/j.1468-0289.1959.tb01829.x

Sachs, J. D., & Warner, A. M. (1995). *Natural resource abundance and economic growth.* (NBER Working Paper No. 5398). https://doi.org/10.3386/w5398

Sadik-Zada, E. R., & Gatto, A. (2019). *Determinants of the public debt and the role of the natural resources: A cross-country analysis.* (FEEM Working Paper No. 4. 2019). http://dx.doi.org/10.2139/ssrn.3364174

Sarr, M., Bulte, E., Meissner, C., & Swanson, T. (2011). Sovereign debt and the resource curse. In R.W. Kolb (ed.). *Sovereign debt: From safety to default* (p. 51–61). John Wiley and Sons. https://doi.org/10.1002/9781118267073.ch6

Tabash, M. I., Mesagan, E. P., & Farooq, U. (2022). Dynamic linkage between natural resources, economic complexity, and economic growth: Empirical evidence from Africa. *Resources Policy*, *78*, 102865.

The Growth Lab at Harvard University, (2019). *Growth projections and complexity rankings*, V6 [Data set], Harvard Dataverse. https://doi.org/10.7910/dvn/xtaqmc

van der Ploeg, F. (2011). Natural resources: curse or blessing? *Journal of Economic Literature, 49*(2), 366–420. https://doi.org/10.1257/jel.49.2.366

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BIMSTEC'S INCIPIENT COMPETITIVE ADVANTAGE AND TRADE SPECIALISATION IN RAW SUGAR

ABSTRACT: *Currently, there is a significant global focus on the growing impact of Asian nations within the realm of international trade. In the framework of 48 Asian nations, the raw sugar sector of BIMSTEC underwent a notable reorganisation, leading to enhanced revenue and employment opportunities. This study sought to explore the competitive advantage and trade specialisation of the member nations of BIMSTEC in the raw sugar commodities sector. Effective marketing strategies have significantly contributed to the enhancement of visibility and demand for these commodities in global markets, thereby further driving competitiveness. The data was obtained from the Observatory of Economic Complexity (OEC) database, and the analysis was conducted using "R" software. Furthermore, pertinent data sources were consulted in the literature review to guarantee the precision of the analysis concerning the theoretical framework. Utilising theoretical frameworks, the RSCA and Lafay indexes were applied to evaluate the competitive advantage and trade specialisation of raw sugar among the BIMSTEC member nations during the period 2005-2022. The study demonstrated that India and Thailand exhibited the greatest comparative advantage within the region, focusing their expertise on the trade of raw sugar products. The study further articulated the domains of potential collaboration or competition and proposed several overarching recommendations for each nation. Policymakers may draw upon the insights derived from this research to evaluate the respective nation's competitive standing.*

KEY WORDS: *Raw Sugar, Balassa Index, Lafay Index, BIMSTEC, RSCA, Marketing*

JEL CLASSIFICATION: B17, C13, F14, F19, N55, Q17

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1. INTRODUCTION

Due to its versatile applications, sugar is widely consumed in many sectors and households. Its versatility extends beyond the culinary realm, as it is utilised in producing ethanol, pharmaceuticals, and even cosmetic items. The sugar industry has a substantial impact on the Gross Domestic Product of countries that cultivate it and it generates jobs in the manufacturing and agricultural sectors (Hassan, 2008). Sugar is a fundamental need that is crucial for human survival. Moreover, it plays a vital role in the worldwide food industry, serving an essential function. The global sugar market and its associated goods are subject to constant fluctuations. Sugarcane, which accounts for over 80% of global sugar production, is the primary raw material utilised. Approximately 30% of sugar is traded globally, while 70% is consumed within local communities (Taylor, 2017). Raw sugar is a widely traded commodity internationally and within specific geographic regions (Bouët et al., 2021). To account for the distinct characteristics of sugar production from cane and beets, sugar has been divided into separate categories for cane and beet sugars. In general, the production of sugar beet faces higher competition than that of cane sugar. In regions where sugar beet is cultivated, cane sugar's production and processing capacity is supplemented with sugar beet production, increasing the output. Although the methods and production systems may be quite different, beet sugar, which is produced in specialty sugar beet processing plants and cane sugar, which is manufactured in large refineries often work quite well as substitutes for each other in most cooking applications. A distinct separation is maintained between the production, transportation, processing, and distribution of sugar beet and sugarcane. Imported raw sugar undergoes a refining process at domestic sugar refineries before being distributed for use. This process significantly impacts the farming and trade of sugar crops, greatly influencing the economics of sugar production and trade. Significant, transformative changes are occurring in the sugar market, fundamentally altering the dynamics and intensifying competitiveness. Europe and the United States, which are substantial participants in the worldwide food and agricultural markets, experienced a decline in their market influence due to the opening up and integration of markets that started in the 1990s with the Uruguay Round of GATT. Conversely, this enhanced Latin American nations' economic and commercial status, as it did with a number of Southeast Asian and Pacific island nations. Nevertheless, protectionist policies implemented by the European Union (EU), the Commonwealth of Independent

States (CIS), and China have a substantial impact on the sugar market, as evidenced by studies conducted by Dillen et al. (2008), Smutka et al. (2013), and Janda et al. (2012). Anticipated alterations in the global sugar market will impact exports, imports, and production capacity levels. In recent years, there has been significant and rapid growth in the development of sugar crops, mainly sugar cane, and an expansion of the global sugar market. As previously stated, growing use is made of sugar crops in producing biofuels, and this is the main driver behind this expansion (Janda et al., 2012; Smutka et al., 2013). Asian sugar-producing nations play a substantial role in the global sugar industry. Together, these countries contribute to almost 40% of the total sugar production worldwide. The primary contributors in this region are India, China, Sri Lanka, Bangladesh, Pakistan, and the Southeast Asian nations, specifically Thailand, Indonesia, Vietnam, The Philippines, and Myanmar, along with several minor producers (Solomon & Li, 2016).

However, in the context of South Asian nations, experts believed that integration was essential to stimulate prosperity in the southern part of the world (Khan & Larik, 2007). The South Asian Association for Regional Cooperation (SAARC) has not succeeded due to numerous political conflicts, leading producers to develop a misconception about the erosion of political and economic autonomy. The consolidation and progress of emerging Asian nations are pressing concerns after acknowledging the SAARC's failure. India's emergence as a growing power and a significant Asian trading partner prompted the Indian government to implement the Look East Policy in the 1990s. This policy strengthened India's relationship with Southeast Asia, East Asia, and the Asian-Pacific by opening up its economy. In addition, amidst several agreements, a notable organisation called BIMSTEC (Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation) is steadily gaining prominence. BIMSTEC was officially launched as a regional entity in June of 1997 following the adoption of the Bangkok Declaration. This document merged seven countries forming the central core of BIMSTEC, consisting of India, Thailand, Bangladesh, Sri Lanka, Nepal, Myanmar, and Bhutan. In the last few years, the group has participated in ministerial meetings annually. This process has been highly instrumental in enhancing and strengthening both the qualitative and quantitative aspects between the member countries. Recent studies have indicated that BIMSTEC members contribute substantially to commerce despite a delayed start.

Furthermore, most countries in the region exhibit comparable cultural practices, languages, and per-capita income levels, which will facilitate regional trade. BIMSTEC is a growing movement that combines Southeast and South Asia. It aims to promote trade and economic integration, bringing new development opportunities. As mentioned, it comprises seven member countries, representing around 22% of the global population, with a total GDP of over 2.7 trillion US dollars (Krishnankutty, 2021). Although established in 1997, the organisation did not initially significantly impact trade among member countries. However, interest in trade increased among members in 2020. India's 'Look East' Policy was changed to the 'Act East' policy in 2015 (Dutta, 2019). The prevalence of desired traits among the nations of BIMSTEC suggests a strong potential for a successful Free Trade Agreement (Banik, 2007). BIMSTEC member countries have seen an increase in raw sugar production, with many emerging as significant contributors to the global sugar market. The region's tropical and sub-tropical climate and abundant arable land provide an ideal environment for cultivating raw sugar. Several member nations, such as, India and Thailand are actively involved in exporting sugar, aiming to take advantage of the growing global demand for this vital commodity. Sugarcane production strongly correlates with the trade in raw sugar, mainly the export trade. Nations that cultivate larger quantities of sugarcane typically experience higher export volumes. As significant sugar cane growers, the Americas, and Asia are ranked in the top spots of international exporter regions (Mabeta & Smutka, 2023). Although BIMSTEC's share of global sugarcane production has averaged approximately 27.3%, its contribution to global sugar exports remains substantial, according to the Observatory of Economic Complexity (OEC, 2024).Thailand and India, member nations of BIMSTEC, account for significant levels of raw sugar production and exports worldwide. India and Thailand were the world's largest raw sugar producers in the period 2021–2022, surpassing Brazil and the European Union, and are essential exporters of sugar (OEC, 2024). The balance between trends in production and consumption shows that India is self-sufficient (Milovanovic & Smutka, 2016). However, for over seven decades, India's sugar business has been subject to tight oversight of the regulatory authorities. Despite these limitations, the Indian government does not provide direct cash benefits to sugarcane producers or producers in general; it only allows export subsidies of surplus raw sugar and imposes import duties on sugar (Sukhtankar, 2012; Vikas & Babu, 2017).

The global focus on Asia's economic influence, particularly on the raw sugar trade, has grown exponentially. This study addresses a pivotal need to analyse the competitive dynamics of BIMSTEC nations, which play a crucial role in global sugar production and trade. Unlike previous studies, the paper integrates advanced comparative indices to uncover trade patterns and the structured and policy-level implications of the raw sugar trade within BIMSTEC. It is the first to utilise multiple indices, offering a unique lens on intra-regional trade dynamics.

In this study, we have attempted to identify the structural features of BIMSTEC member nations' raw sugar trade pattern, considering the significance of openness and trade for the economic development of BISMTEC. The primary objective of this study is to examine the comparative advantage and trade specialisation of the raw sugar trade of BIMSTEC member countries from 2005 to 2022. By highlighting the BIMSTEC member nations' comparative advantage in trade, we aim to highlight the structural changes and features of the raw sugar trade.

After the introduction, the study is organised as follows: The next section presents a literature overview of the production, consumption, and trade of raw sugar in BIMSTEC nations, as well as empirical studies on the comparative advantage of trading raw sugar. Subsequently, the research elucidates the techniques and information employed, followed by an exposition and discourse on the findings. The last portion comprises concluding remarks with policy implications.

2. LITERATURE REVIEW

It is essential to undertake additional research to carry out an in-depth analysis of the raw sugar trade among the countries that are members of BIMSTEC. This is the case even though many empirical studies have been conducted on the growth and progression of regional economic integration. The concept of comparative advantage is an essential component of contemporary economic theory. In the context of international trade, comparative advantage is a concept that has been around for more than two hundred years and has remained unchanged to this day. It is believed to be a determinant of specialisation. Liesner (1958) was the pioneer in developing the measurement of revealed comparative advantage and later Balassa developed it further. Balassa published disclosed comparative advantage measures for manufacturing and other industries in 1965,

1977, and 1989. Shaped by various supply and demand factors, comparative advantage measures determine trade patterns, ultimately leading to international trade specialisation. The use of finite resources and well-being are improved through comparative advantage. Several new models in international commerce have so far failed to disprove the performance appeal of the comparative advantage metric. According to the law of comparative advantage, a nation is said to have a comparative advantage if it possesses specialised items that cannot be produced as effectively by another nation. The exporting competitiveness of any industry can be identified in the relative advantages that the different product categories have accumulated through engaging in international trade (Huo, 2014). This highlights that a country can import products with the greatest absolute disadvantage and export services with the smallest absolute disadvantage. In addition to this, it emphasises the fact that a nation that possesses all of the absolute cost advantages in its products would import goods that are associated with the smallest absolute benefits, not to mention that it will specialise and export the products that have the greatest absolute advantage (Krugman & Obstfield, 2000). The revealed comparative advantage measure is considered the most reliable and comparable method for determining comparative advantage. The basis of international trade lies in the differences in factor intensities between countries, where countries export goods in which they have a comparative advantage and import those in which they suffer a comparative disadvantage (Costinot & Donaldson, 2012). It considers factors such as trade specialization patterns and international trade advantage. Various researchers have extensively studied and validated this measure (Hilman, 1980; Yeats, 1985; Vollrath, 1991; Laursen, 2015; Dalum et al., 1996; Bojnec, 2001; Widodo, 2009). The Heckscher-Ohlin Theory states that a nation's comparative advantage is determined by its relative factor endowment. Trade influences the relative price of factors within and between nations (Salvatore, 2007). Comparative advantage factors include trade specialisation, demand bias, and national preferences. According to Lundbäck and Torstensson (1998), these factors influence net exports and trade specialisation. Bojnec (2001) suggests that supply and demand factors determine trade patterns. Furthermore, Bastos and Cabral (2007) argue that trade liberalisation increases specialisation in industries for larger economies. These findings represent the consensus of economists who have conducted the analysis. Conversely, Helpman and Krugman (1987) argue that developed nations seek to export non-standardised items and industries that

demand a large scale, whereas developing countries focus on producing standardised products (Bojnec, 2001). Numerous studies have been undertaken on the trade specialisation trend. Oberoi's (2018) study reveal that a country's production and trade in goods and commodities are directly linked to its level of specialisation, which in turn affects monetary growth. Török et al. (2020) address the issue of asymmetric value in the Balassa index by using the revealed symmetric comparative advantage index as a linear transformation. They combine this approach with other methodologies one of which is the panel data linear regression model, to assess export competitiveness. Moreover, Latruffe (2010) argues that it is crucial to prioritise the non-price factors of competitiveness and consider the impact of government intervention on competitiveness. Similarly, Vollrath (1991) found that agricultural exporters with minimal government intervention tend to exhibit the highest degree of competitiveness. In contrast, Mizik (2021) argues that a favorable legal and policy framework is key to enhancing domestic producers' competitiveness. Subsequently, there is a progression towards products with greater value-added and complexity and the implementation of highly efficient and profitable production methods. Their study concludes that, this situation requires a modification in the approach taken by decision-makers. To analyse the trade performance of specific countries in relation to specific goods, one can look at the performance within major group classifications (Balassa, 1965). Disdier et al. (2015) found in their study on this subject that Australia and New Zealand possess notable comparative advantages in the Asian and Pacific regions' marketplaces for fruit and vegetables, beverages, and dairy products. In their study on the comparative advantages and specialisation of agri-food sectors worldwide, Jambor and Babu (2016) found that the Netherlands, Spain, and Denmark were the most competitive nations. Wu (2010) analysed China's export structure and the competitiveness of peanuts and peanut products in terms of their comparative trade advantages. He found that there are significant opportunities for competitiveness in global marketplaces. However, Zhang and Liu (2008) discovered that the Chinese peanut trade was encountering a decrease in its competitive advantages, albeit within a period. The South Asian Free Trade Area (SAFTA) has had a beneficial effect on the export competitiveness of sugar, while also highlighting that India possesses a comparative advantage in commodities for which it has plentiful natural resources (Narayan & Bhattacharya, 2019). In addition, Chaudhary and Kumar (2016) conducted a

study in which it is found that sugar exports from India a member of SAFTA, have high levels of specialisation in all regions. Similarly, Narayan and Bhattacharya (2019) concluded that this competitiveness of exported sugar has improved over the years but the country still lags behind all others in terms of exports. Nagy and Jámbor (2019) identified that a substantial competitive advantage could be attributed to two main factors: manufacturing highly processed products and specialising in producing a limited number of commodities that directly compete with the products from other companies. Pawlak (2017) emphasises that countries gain significant competitive advantages in trade by focusing on trading specific product groups that align with their highest shares in global exports. This strategy allows them to consistently achieve a favourable trade balance and promote trade expansion. Consequently, their comparative advantages were the primary reason for their advantageous export specialisation profile. This is consistent with the classical theory of comparable costs, sometimes called the theory of comparative advantage. The hypothesis was originally formulated by David Ricardo and subsequently enhanced by Bojnec and Fertő (2014). (2014). Bojnec and Fertő (2014) highlight the importance of diversifying the range of products exported to acquire a competitive advantage in global marketplaces. According to Nowak (2016), the level of competitiveness is greatly influenced by the historical trajectory and natural conditions, along with their determining factors. Additionally, the length of time a country has been a member of the European Union plays a role in determining the amount of support the agri-food sector receives from EU funds. In addition, Pishgar-Komleh et al. (2021) introduced concepts similar to those discussed in this context but expanded them by incorporating ecological factors. The current literature needs to provide information showing the competitiveness level in the global raw sugar trade. Although there have been recent attempts to increase food production and exports, it is possible that there needs to be a more comprehensive policy focus on all food products traded with BIMSTEC and the global market. By analysing raw sugar trade dynamics in BIMSTEC, this study seeks to fill this gap in the literature and provide insights into respective nation's comparative advantage, fostering opportunities for trade expansion and economic cooperation.

3. MATERIALS & METHODS

The data used for this study were extracted from the OEC database (2024) for the years from 2005 to 2022. In particular, secondary data specifically focusing on the commodity raw sugar across the BIMSTEC countries were used. It is classified under HS (Harmonised System) Code: 1701 (OEC, 2024). One of the main reasons raw sugar is chosen is its role as a staple food. The research also draws on various scholarly articles and other relevant works from across the world. It is possible to evaluate a country's sectors using several different approaches. Statistical index comparisons, mathematical computations, a literature review, and scientific analysis are all part of the scientific research methodology used in this work.

Since the formation of comparative trade advantages is fundamentally a slow process, there must be a temporal dimension to the evolution of trade specialisation, a sign of structural changes in a country's economic system. International trade and national specialisation in products in which countries excel are evaluated using comparative advantage, a basic premise of classical trade theory that is widely utilised in modern economics. There are several ways to assess comparative benefits (Balassa, 1986). The most common of them is the index of revealed comparative advantage (RCA), which has been the most popular in empirical research since Balassa (1965) and all of his subsequent revisions. In 1965, Balassa first introduced the RCA index. Part of the process is examining how a country's exports compare to the global total for a specific sector. According to Balassa (1965), this comparison helps determine the country's competitive edge in that particular industry. A country's potential comparative advantage can be evaluated by categorizing its industries according to the Balassa Index (RCA). If the percentage of a particular good that a country exports exceeds the percentage of that good exported globally (i.e. relative to the country's total exports), we say that the country has achieved a RCA in that good. RCA is used to measure specialisation. This study used the RCA indices, the Balassa index and the Lafay index, to evaluate the competitiveness of BIMSTEC nations, including India, in sugar trade, according to several studies (Aksoy & Kaymak, 2021; Cicek & Bashimov, 2016; Kanaka & Chinadurai, 2012; Pilinkiene, 2014; Terin et al., 2018; Torok & Jambor, 2016). These indicators are regarded as reliable ways to assess specialization in international trade.

Due to a lack of comprehensive data on factor costs, Balassa stressed that measuring competitiveness is challenging. Therefore, the most widely accepted indirect method is the RCA index, which uses a country's trading history to calculate its comparative advantage. A country's comparative advantage might be inferred from its export performance without complete factor cost data. The export pattern of commodities reflects changes in non-price factors and relative costs, which impact the export structure:

$$B = \frac{x_{ij} / x_{it}}{x_{mj} / x_{mt}}$$

where

x_{ij} = exports of a specific product *i* (e.g. rice) by a specific country in a particular year

x_{it} = total exports of a specific country in a particular year

x_{mj} = world exports of a specific product in a particular year

x_{mt} = world's total exports in a particular year

According to Balassa, an RCA index> 1 indicates a country has a competitive advantage in a specific item or industry. An RCA less than 1 indicates a comparative disadvantage, on the other hand. Asymmetrical values and the fact that the Balassa index often ignores the various impacts of agricultural policies are two of its main points of criticism. State interventions and trade restrictions distort trade structures, and the asymmetric Balassa index value shows that it goes all the way to infinity for countries with a comparative advantage but ranges from zero to one for those with a comparative disadvantage, which overestimates the relative weight of a sector.

In response to criticisms of the Balassa index (B), Dalum et al. (1996) used the revealed symmetric comparative advantage (RCSA) index. The following format is used to express the converted index:

$$RSCA = \frac{B-1}{B+1}$$

The RSCA index ranges from -1 to 1, where values from 0 to 1 represent a relative export advantage and values from -1 to 0 represent a relative export disadvantage. The index portrays the median point of comparative advantage and neutral comparative advantage when its value equals 0.

To overcome the practical constraints of the Balassa index, Lafay (1992) devised an index that incorporates both trade and production characteristics. The Lafay index quantifies a nation's degree of trade specialisation with respect to a particular product. Positive values of the index suggest a higher level of comparative advantage, whereas negative values indicate a decrease in specialisation. The magnitude of the absolute values' indicates the levels of specialisation or despecialisation (Vollrath, 1991).This figure results from evaluating the country's standardised trade balance for a particular good, *j*. The trade balance for a given product is divided by the total value of trade to get the normalized trade balance, i.e.:

$$LFI_j = 100\left\{\frac{x_j - m_j}{x_j + m_j} - \frac{\sum_{j=1}^{N}(x_j - m_j)}{\sum_{j=1}^{N}(x_j + m_j)}\right\}\frac{x_j + m_j}{\sum_{j=1}^{N}(x_j + m_j)}$$

where,

x_j = exports of a specific product

m_j = imports of a particular product

A country with a positive product *j* index exhibits a comparative advantage and a high degree of specialisation. On the other hand, a negative value signifies a relative disadvantage and limited product specialisation. The Lafay index (LFI) is defined as a symmetrical measure across all products inside a country, guaranteeing that the total of all sector indices is equal to zero. Unlike RCA, the LFI is unaffected by the total global exports or imports of all countries. Instead, it depends exclusively on the individual values of a specific country. This metric can evaluate the degree of autonomy of a nation. It is essential to approach the evaluation of RCA indicators with caution and a clear understanding of their limitations. However, the RCA analysis of the industrial sector can provide valuable insights into the study of structural changes in export specialisation. As

far as the authors know, the LFI has yet to be used to assess the comparative and trade advantages of BIMSTEC nations in the raw sugar industry.

4. EMPIRICAL ESTIMATION

4.1. Trends in the raw sugar trade at the world level

India, a South Asian nation, has emerged as a significant player in global raw sugar exports. While it did not rank among the top exporters in 2005, it is projected to secure second position by 2022, consolidating its status as a major industry player. These findings indicate significant growth in India's raw sugar export business. Thailand's export performance has also demonstrated consistent growth throughout the years. In 2005, it secured fourth position with a total export value of USD758,396,357. However, in 2022, it further advanced to third position, with a remarkable increase in export value to a total of USD3,224,226,771. This achievement solidifies Thailand's standing as one of the leading exporters in the world. Thailand's consistent performance demonstrates its enduring position in the global raw sugar industry. Most unrefined sugar exported from South Asia originates from India and Thailand. South Asian countries have shown fascinating trends as the world's leading importers of raw sugar from 2005 to 2022. Pakistan, as the sole South Asian country in the table 2, imported 397,683,220 units (USD) worth of raw sugar in 2005, placing it in ninth position. Throughout 2022, Bangladesh progressively emerged as the fourth largest importer, displacing Pakistan from its prominent position. This upheaval significantly strengthened Bangladesh’s position as one of the largest purchasers of sugar in the global market. This indicates a substantial increase in the country's need for raw sugar. Significantly, all these states, except Pakistan, are part of the burgeoning multilateral regional alliance, BIMSTEC.

Table 1: Top exporters of raw Sugar Worldwide (figures in USD)

Country	2005	Country	2022
Brazil	4,698,526,865	Brazil	11,506,671,903
France	1,427,717,244	India	6,034,263,140
Germany	767,658,729	Thailand	3,224,226,771
Thailand	758,396,357	Australia	1,223,339,283
Belgium	584,619,405	France	1,161,854,819
Australia	554,690,602	Germany	885,249,746
United Kingdom	384,449,490	Mexico	846,085,051
United Arab Emirates	372,935,804	Guatemala	815,549,010
Mauritius	355,979,231	United Arab Emirates	573,595,582
South Africa	317,420,889	Morocco	436,250,134

Source: Compiled by the authors from the OEC database, 2024

Table 2: Top importers of raw sugar worldwide (figures in USD)

Country	2005	Country	2022
Russia	1,207,765,706	Indonesia	2,367,900,157
United Kingdom	1,125,065,768	China	2,254,009,753
United States	888,547,566	United States	1,937,681,876
Indonesia	591,395,962	Bangladesh	972,026,884
United Arab Emirates	590,981,006	Sudan	956,825,855
Belgium	573,577,433	Italy	944,620,126
Italy	556,670,642	South Korea	865,465,455
Germany	445,141,746	Malaysia	843,854,375
Pakistan	397,683,220	United Arab Emirates	784,477,303
Spain	344,047,083	Algeria	773,560,546

Source: Compiled by the authors from the OEC database, 2024

4.2. Trends in the raw sugar trade at the BIMSTEC level

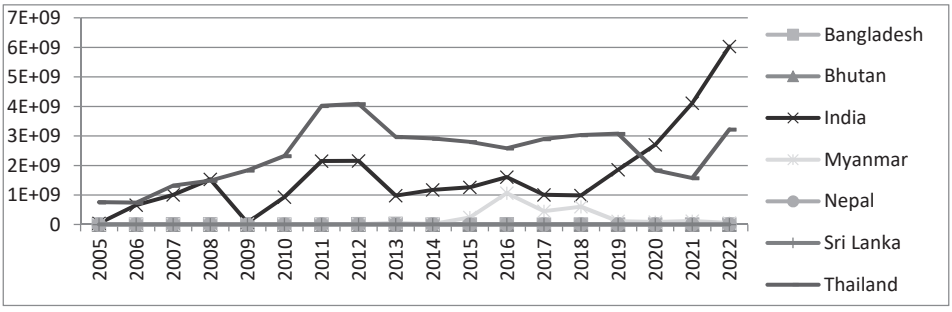
In Figure 1, **Panel A** illustrates the USD value of Raw Sugar exports from the BIMSTEC nations. The data covers the period from 2005 to 2022. It has been noted that, over time, India and Thailand are the only countries that stand out from the rest of the group due to their substantial global exports of raw sugar. Myanmar's growth in the mid-term has been comparatively moderate in contrast to the higher exports from India and Thailand. Conversely, the level of raw sugar

exports from Sri Lanka, Bangladesh, Nepal, and Bhutan places these countries at the bottom of the table of raw sugar exports (Table A1), meaning these countries are of less significance in this respect compared to India and Thailand. Figure 1 accurately illustrates the trajectory of these countries' exports.

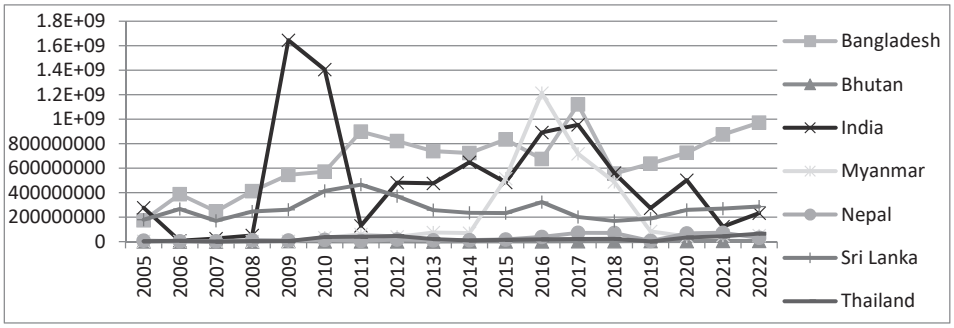
Panel B displays the trends in the value of imports of raw sugar by BIMSTEC nations. India imported substantial amounts of raw sugar in 2009 and 2010 to control domestic sugar prices. This phenomenon is observed in India due to the periodicity of manufacturing. Such a situation occurred in Myanmar in 2016 and 2017. Bangladesh and Sri Lanka also imported significant quantities of raw sugar during the stated timeframe. Nevertheless, Thailand exhibited a unique characteristic that set it apart from all other member nations of BIMSTEC in this specific case. Once again, it is clear that the value of imports in Nepal was more than that of Bhutan, although it was relatively small compared to other BIMSTEC members.

Figure 1: Trends in the raw sugar trade (exports and imports) at BIMSTEC level during the period 2005-2022

Panel A: Trends in raw sugar exports (USD) at the BIMSTEC level



Panel B: Trends in raw sugar import (USD) at the BIMSTEC level



Sources: Prepared by the authors on the basis of data from the OEC database, 2024

4.3. Pattern of trade in raw sugar at the BIMSTEC Level

4.3.1. Analysis of revealed symmetric comparative advantage of BIMSTEC member nations

Table 3 illustrates the progression of the RSCA index of the countries that are members of BIMSTEC throughout the period under study. Theoretically, as mentioned earlier, the RSCA index can range from minus to plus one. A negative result for this index indicates that the relevant countries are not experiencing any significant export disadvantage, whereas a value of one represents a relative advantage in terms of export production.

Thailand is the sole country among all BIMSTEC nations that consistently achieved positive scores throughout the entire period from 2005 to 2022. This indicates that Thailand has a relative export advantage and the highest comparative advantage compared to the other nations. India ranks second, consisting of mixed scores, with slightly more positive values, indicating a relatively better export of raw sugar than that of remaining member countries. Myanmar, Nepal, Bangladesh, Sri Lanka, and Bhutan all have consecutive negative scores, which indicates a relative export disadvantage or comparative disadvantage for the product raw sugar.

Table 3: RSCA index scores for raw sugar for BIMSTEC Level member nations

Year	**Bangladesh**	**Bhutan**	**India**	**Myanmar**	**Nepal**	**Sri Lanka**	**Thailand**
2005	-0.998	-0.993	-0.859	-0.908	0.224	-0.940	0.148
2006	-0.993	-0.997	0.057	-0.975	-0.801	-0.943	0.099
2007	-0.749	-0.997	0.217	-0.993	0.475	-0.943	0.347
2008	-0.754	-1.000	0.356	-0.542	0.348	-0.975	0.372
2009	-0.799	-1.000	-0.818	0.021	-0.880	-0.987	0.510
2010	-0.999	-1.000	-0.002	-0.460	-0.998	-0.966	0.477
2011	-1.000	-1.000	0.280	-0.638	-0.993	-0.990	0.607
2012	-0.758	-1.000	0.320	-0.681	-0.999	-0.988	0.642
2013	-0.693	-1.000	-0.126	0.020	-1.000	-0.904	0.534
2014	-0.918	-1.000	0.019	-0.687	-0.997	-0.972	0.558
2015	-0.986	-1.000	0.127	0.589	-1.000	-0.966	0.554
2016	-0.893	-1.000	0.274	0.904	-0.992	-0.956	0.539
2017	-0.964	-1.000	0.004	0.778	-0.987	-0.939	0.556
2018	-0.982	-1.000	-0.036	0.803	-0.979	-0.957	0.565
2019	-1.000	-1.000	0.291	0.237	-0.998	-0.965	0.604
2020	-1.000	-1.000	0.545	0.207	-0.999	-0.952	0.461
2021	-0.999	-0.978	0.556	0.327	-0.999	-0.875	0.305
2022	-0.999	-1.000	0.654	-0.180	-0.998	-0.957	0.586

Source: Calculated by the authors on the basis of data from the OEC database, 2024

4.3.2 Analysis of the trade specialisation of raw sugar of BIMSTEC member nations

Table 4 shows, the Lafay index scores for BIMSTEC member nations during the period under study. In theory, the Lafay index can take values between -∞ and +∞. A negative value for this index indicates that the countries in question do not make much use of trade specialisation.

Table 4: Lafay index scores for BIMSTEC member nations

Year	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand
2005	-0.619	-0.131	-0.104	-0.024	0.062	-0.860	0.314
2006	-1.175	-0.092	0.236	-0.035	-0.059	-1.097	0.258
2007	-0.649	-0.052	0.283	-0.019	0.361	-0.626	0.392
2008	-0.819	-0.061	0.343	0.040	0.105	-0.730	0.379
2009	-1.138	-0.425	-0.259	0.167	-0.082	-1.166	0.536
2010	-0.920	-0.092	0.009	-0.088	-0.094	-1.293	0.542
2011	-1.107	-0.083	0.325	-0.157	-0.026	-0.979	0.805
2012	-1.089	-0.081	0.291	-0.079	-0.063	-0.871	0.835
2013	-0.906	-0.048	0.093	0.017	-0.030	-0.585	0.619
2014	-0.895	-0.221	0.105	-0.109	-0.026	-0.457	0.605
2015	-0.810	-0.092	0.160	-0.363	-0.052	-0.474	0.604
2016	-0.782	-0.117	0.166	0.728	-0.084	-0.716	0.546
2017	-1.117	-0.233	0.052	-0.148	-0.116	-0.416	0.555
2018	-0.485	-0.180	0.088	0.557	-0.075	-0.396	0.557
2019	-0.556	-0.162	0.241	0.102	-0.007	-0.434	0.615
2020	-0.736	-0.167	0.397	0.125	-0.116	-0.758	0.362
2021	-0.553	-0.171	0.482	0.177	-0.087	-0.579	0.262
2022	-0.578	-0.126	0.600	0.009	-0.040	-0.714	0.505

Source: Estimated by the authors on the basis of data from the OEC database, 2024

Thailand once again achieved the highest scores among all member countries in terms of comparative advantage for the product raw sugar and a greater level of trade specialisation, similar to the results shown in Table 3. India has achieved the second-highest trade specialisation and comparative advantage among the remaining member countries, mirroring its earlier success. Remarkably, Nepal exhibited minimal positivity but neutrality, indicating that it lacks a comparative advantage and specialisation. Following this, Myanmar, Bhutan, Sri Lanka, and Bangladesh exhibit negative values, indicating a comparative disadvantage and a lack of or limited indications of trade specialisation.

4.3.3 Result of Welch one-way ANOVA of raw sugar trade at BIMSTEC Level

Using the three well-known indices developed between 2005 and 2012, this study attempted to run a one-way analysis of the variance model of the type.

$$x_{ij} = \mu + \alpha_i + \varepsilon_{ij}, \text{ where } \varepsilon_{ij} \sim N(o, \sigma_\varepsilon{}^2)$$

It turned out that the respective assumptions of normality and homoscedasticity were far from being satisfied when the necessary checks and diagnostic stages were carried out. In light of this, the Welch one-way analysis of variance was conducted. Table 5 provides a list of the details.

Table 5: Summary of Welch ANOVA findings on parameters relating to trade indices of BIMSTEC nations during the period 2005-2022

Sl No.	Trade index	Statistic	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand	F-statistic	Prob (F-statistic)
1	RSCA	Mean	-0.916	-0.998	0.103	-0.121	-0.754	-0.954	0.470	F(6.375,6,50.92)	0.000
		N	18	18	18	18	18	18	18		
2	Lafay	Mean	-0.921	-0.125	0.135	-0.059	0.009	-0.831	0.535	F(4.429,6,106.7)	0.000
		N	18	18	18	18	18	18	18		

Source: Estimated by the authors

Initially, the study applied a one-way ANOVA model to test whether there were any significant statistical differences between the two indices, namely the RSCA index and the Lafay index, among the selected countries, but due to lack of normality (Shapiro Wilk normality test statistic) and lack of homoscedasticity (Bartlett's test of homogeneity of variances) in the indices as presented in the Table 6. Welch's analysis of variance (ANOVA) and Games --Howell's post-hoc estimation were used.

Table 6: Summary of two parameters of ANOVA for all the indices:

Trade index	**Bartlett's K-squared test**	**p-value**	**The Shapiro Wilk normality test statistic**	**p-value**
RSCA	251.94	0.0000	0.8623	0.0000
Lafay	28.961	0.0000	0.9788	0.04508

Source: Estimated by the authors

Even though the Welch ANOVA reveals statistical differences between the nations in terms of each of the indices, the fact that this analysis discovers a statistical significance between the countries on a pair-wise basis is noteworthy.

Table 7: Summary of Games--Howell Post-hoc estimation relating to the RSCA index of BIMSTEC nations during the period 2005-2022

Sl No.	Between Countries	estimate	conf. low	conf. high	p.adj	p.adj.sig.
1	Bangladesh- Bhutan	-0.082	-0.169	0.005	0.071	ns
2	Bangladesh- India	1.019	0.694	1.344	0.000	****
3	Bangladesh- Myanmar	0.795	0.288	1.302	0.001	***
4	Bangladesh- Nepal	0.162	-0.245	0.568	0.839	ns
5	Bangladesh- Sri Lanka	-0.038	-0.127	0.050	0.783	ns
6	Bangladesh- Thailand	1.386	1.244	1.528	0.000	****
7	Bhutan- India	1.101	0.783	1.420	0.000	****
8	Bhutan- Myanmar	0.877	0.374	1.380	0.000	***
9	Bhutan- Nepal	0.244	-0.158	0.646	0.437	ns
10	Bhutan- Sri Lanka	0.044	0.021	0.067	0.000	****
11	Bhutan- Thailand	1.468	1.346	1.591	0.000	****
12	India- Myanmar	-0.224	-0.791	0.342	0.867	ns
13	India- Nepal	-0.857	-1.341	-0.374	0.000	****
14	India- Sri Lanka	-1.058	-1.376	-0.739	0.000	****
15	India- Thailand	0.367	0.035	0.699	0.024	*
16	Myanmar- Nepal	-0.633	-1.241	-0.025	0.037	*
17	Myanmar- Sri Lanka	-0.833	-1.337	-0.330	0.001	***
18	Myanmar- Thailand	0.591	0.080	1.102	0.017	*
19	Nepal- Sri Lanka	-0.200	-0.602	0.202	0.651	ns
20	Nepal- Thailand	1.224	0.812	1.636	0.000	****
21	Sri Lanka- Thailand	1.424	1.301	1.548	0.000	****

Source: Authors' estimation

Note: (1) *, **, ***, **** represent significance at the 10%, 5%,1% and 0.1% levels, respectively; (2) p-value >0.05 means normality assumption for ANOVA is satisfied; (3) p-value<0.05 means the homoscedasticity assumption for ANOVA is satisfied; (4) ns: result was insignificant at the second level and hence no question of post -hoc estimation

From Tables 5 and 6 above, it is found that the result is statistically significant for the RSCA index; hence, it is concluded that there exists a statistically significant difference in the RSCA index at the national level during the period 2005-2022. Accordingly, the post-hoc Games--Howel estimation at the country level is performed, and the result is summarised in Table 7. It can be seen that out of 21 central pairs of countries for the RSCA index, 15 statistically significant respective

differences exist at the BIMSTEC during the period under study. In addition, it was also found that there were no significant differences between six pairs.

Table 8: Summary of the Games--Howell post-hoc estimation relating to the Lafay index of BIMSTEC nations during the period 2005-2022

Sl No.	Between Countries	estimate	conf. low	conf. high	p.adj	p.adj.sig.
1	Bangladesh- Bhutan	0.689	0.502	0.875	0.000	****
2	Bangladesh- India	1.024	0.797	1.252	0.000	****
3	Bangladesh- Myanmar	0.880	0.628	1.131	0.000	****
4	Bangladesh- Nepal	0.806	0.614	0.997	0.000	****
5	Bangladesh- Sri Lanka	0.099	-0.162	0.360	0.892	ns
6	Bangladesh- Thailand	1.346	1.138	1.554	0.000	****
7	Bhutan- India	0.336	0.164	0.507	0.000	****
8	Bhutan- Myanmar	0.191	-0.015	0.397	0.080	ns
9	Bhutan- Nepal	0.117	0.011	0.223	0.023	*
10	Bhutan- Sri Lanka	-0.590	-0.807	-0.372	0.000	****
11	Bhutan- Thailand	0.657	0.517	0.797	0.000	****
12	India- Myanmar	-0.145	-0.387	0.097	0.508	ns
13	India- Nepal	-0.219	-0.396	-0.042	0.009	**
14	India- Sri Lanka	-0.925	-1.177	-0.673	0.000	****
15	India- Thailand	0.321	0.126	0.517	0.000	***
16	Myanmar- Nepal	-0.074	-0.284	0.136	0.911	ns
17	Myanmar- Sri Lanka	-0.780	-1.053	-0.507	0.000	****
18	Myanmar- Thailand	0.466	0.241	0.691	0.000	****
19	Nepal- Sri Lanka	-0.706	-0.928	-0.485	0.000	****
20	Nepal- Thailand	0.540	0.393	0.688	0.000	****
21	Sri Lanka- Thailand	1.247	1.011	1.482	0.000	****

Source: Author's estimation

Note: (1) *, **, *** and **** represent significance at the 10%, 5%, 1% and 0.1% levels, respectively; (2) p-value >0.05 means normality assumption for ANOVA is satisfied; (3) p-value<0.05 means the homoscedasticity assumption for ANOVA is satisfied; (4) ns: result was insignificant at the second level; and hence no question of post -hoc estimation

From Tables 5 and 6 above, it is found that the result is statistically significant for the Lafay index; hence, it is concluded that there exists a statistically significant difference in the Lafay index at the national level during the period 2005-2022. Accordingly, the post-hoc Games-Howell estimation at the country level is performed, and the result is summarised above in Table 8, it can be seen that for

the Lafay index out of 21 central pairs of countries, 17 statistically significant respective differences exist, at the BIMSTEC during the period under study. In addition, no significant differences were found between four pairs.

4.4 Discussions

Based on the empirical estimation, this study found that Thailand topped the list for exports in the raw sugar market, in the BIMSTEC region during the period under study, followed by India. Although India's exports of raw sugar have increased significantly in the recent years, surpassing the performance of Thailand, Thailand too, is steadily recovering after the COVID-19 pandemic. On the other hand, Bangladesh continues to be the top importer in the BIMSTEC in region. It is also evident that India headed the list of raw sugar importers from 20018 to 2010, but India overcame this situation and became a net exporter as opposed to a net importer of raw sugar. In this study the level of competitive advantage and trade specialisation in the raw sugar market was analysed in the context of the BIMSTEC region by using two well-known indices – the RSCA index and the Lafay index. The RSCA index was used to capture the export performance of member nations, whereas the Lafay index was used to identify the level of trade specialisation in the raw sugar market. These two trade indices were then, compared using a one-way ANOVA model. Due to the lack of normality in the residuals of this model as well as the absence of homoscedasticity in the variances, this study further developed the assumptions to address the failure to fulfill the two aforementioned assumptions for a pair wise comparison of the performance of the countries, using the Games-Howell post-hoc estimation, revealed that out of 21 (7C2) combinations, 15 pairs show statistically significant differences. The result is consistent with the trend shown in Figure 1. In the case the of the Lafay index, only 4 out of a total of 21 (7C2) combination pairs are not statistically significant. Another interesting fact is that, the combinations Bangladesh-Bhutan, Bangladesh-Myanmar and Nepal-Sri Lanka are not statistically significant in terms of the RSCA index of BIMSTEC, whereas the same pairs show statistically significant differences under the Lafay index. Moreover, the pair Myanmar-Nepal reported in serial number 16 in both Tables 7 and 8 shows opposite results. As mentioned earlier, the RSCA index captures the relative import performance during the period under study, with Bangladesh, Bhutan, and Sri Lanka being net importers, whereas Myanmar was also a net importer up to 2014, but then shows a continuous improvement in exports, at least untill 2021.

The Lafay index captures a member country's trade specialisation through both exports and imports, and the analysis reveals that Myanmar's export performance is, gradually surpassing its share of import. Similarly, Nepal's exports have exhibited better performance than its imports. Finally, this study found that majority of the member nations of BIMSTEC have significantly increased their raw sugar production as a part of their import substitution policy.

5. CONCLUSION

BIMSTEC is Asia's sole prospect for integration following the ineffectiveness of the SAARC area. It seeks to unite against other regional blocs by strengthening capabilities and achieving specialisation. This would also aid in mitigating the primary problem of its economy, namely poverty, by providing ample investment opportunities to the global community. The study's findings unequivocally demonstrated that India and Thailand are prominent raw sugar exporters and possess a robust comparative advantage in the raw sugar trade. India and Thailand exhibit more competitiveness in the raw sugar trade than the other BIMSTEC countries. Indian sugar has a major competitive advantage and thus needs to be monitored consistently to retain its promising position in the global market. Furthermore, Myanmar is a country that not only exports tomatoes but also possesses a significant competitive advantage in the sugar trade. India and Thailand are engaged in a competitive sugar trade with the other BIMSTEC members. India and Thailand have a substantial edge in sugar exports due to their high production capacities and favourable geographical proximity to major importing nations. Hence, it is advisable to implement export-oriented government policies in India and Thailand to enhance their competitive advantage in the global market. The study shows that India and Thailand have high capacity and potential in producing raw sugar. They outperform most countries in this regard. Therefore, the national governments need to amend their sugar policies to increase the market share of this commodity and optimise the terms of trade in agriculture. This will ultimately improve the nations' respective trade balances with the other BIMSTEC countries. This paper recommends governmental measures to enhance the growth of intra-BIMSTEC trade in sugar products. The findings support the enactment of beneficial policy measures by governments to enhance raw sugar production, exports, and imports between BIMSTEC states. A public-private partnership can significantly enhance anation's

raw sugar exports by offering upgraded infrastructure and extensive information. It is crucial to investigate new markets to improve competitive and comparative advantages and boost raw sugar export revenue. Furthermore, the progress of raw sugar will rapidly stimulate industrialisation and improve export growth.Marketing strategies aimed at entering untapped markets may enhance demand and improve the global positioning of raw sugar exports. However, the study asserts that the results are sufficiently reliable to formulate raw sugar policy recommendations. Nevertheless, it suggests that future research should include an analysis of both trade and non-trade barriers, as well as the influence of the local market factors that were not included within the scope of this investigation.

This study will be helpful for policymakers of BIMSTEC nations for formulate respective national policies to increase the raw sugar levels as this region is conducive to producing raw sugar. Moreover, geographical proximity can enhance the intra-regional trade among the member nations of the region, which can reduce the transaction costs in raw sugar trade. To reap the maximum benefit in this market, an integrated tariff and non-tariff policy can establish this region as a significant hub in the international trade of raw sugar, which can pave the way for a new beginning in 2030 when the BIMSTEC as a region will implement trade facilitation policies in the whole region.

In this study, we have utilized only two trade indices. However, this study could have been improved in multiple dimensions of trade specialisation of raw sugar by using other indices. Another limitation of the study is the use of raw sugar as a homogeneous commodity, whereas further classification of raw sugar commodities could be used by researchers in the future to gain a better understanding of the raw sugar trade.

REFERENCES:

Aksoy, A. & Kaymak, H. C. (2021). Competition power of Turkey's tomato export and comparison with Balkan countries. *Bulgarian Journal of Agricultural Science*, 27 (2), 253–258. https://agrojournal.org/27/02-03.pdf.

Balassa, B. (1965). Tariff protection in industrial countries: An evaluation. *Journal of Political Economy*, 73(6), 573-594. https://doi.org/10.1086/259085

Balassa, B. (1977). Revealed' comparative advantage revisited: An analysis of relative export shares of the industrial countries, 1953–1971. *The Manchester School*, 45(4), 327-344. https://doi.org/10.1111/j.1467-9957.1977.tb00701.x

Balassa, B. (1986). The determinants of intra-industry specialization in United States trade. *Oxford Economic Papers*, 38(2), 220-233.https://doi.org/10.1093/oxfordjournals.oep.a041737

Balassa, B. (1989). Policy responses to exogenous shocks in developing countries. *New Directions in the World Economy*, 32-38. https://doi.org/10.1007/978-1-349-10588-5_2

Banik, N. (2007). The BIMSTEC FTA and its relevance. *Centre for study in International Relations and Development*: Discussion Paper, 36.

Bastos, P., & Cabral, M. (2007). The dynamics of international trade patterns. *Review of World Economics*, 143, 391-415. https://doi.org/10.2139/ssrn.962332.

Batra, A., & Khan, Z. (2005). Revealed comparative advantage: An analysis for India and China (Working paper No. 168).

Bojnec, Š. (2001). Trade and revealed comparative advantage measures: regional and central and east European agricultural trade. *Eastern European Economics*, 39(2), 72-98. https://doi.org/10.1080/00128775.2001.11040990.

Bojnec, Š., & Fertő, I. (2014). Export competitiveness of dairy products on global markets: The case of the European Union countries. Journal of Dairy Science, 97(10), 6151–6163. https://doi.org/10.3168/jds.2013-7711

Bouët, A., Tadesse, G., & Zaki, C. (2021). Africa agriculture trade monitor 2021. Kigali and Washington, DC: *AKADEMIYA2063 and International Food Policy Research Institute*. https://doi.org/10.54067/9781737916406.

Çicek, R., & Bashimov, G. (2016). Determination of central Asia's comparative advantage in cotton trade. *International Journal of Management Economics and Business*, 12(28), 1-14.

Chaudhary, D. S., & Kumar, R. (2016), An analysis of export specialization and competitiveness of the Indian sugar industry. *Journal of Competitiveness Studies*, Vol. 24 No. 4, p. 219.

Costinot, A., & Donaldson, D. (2012). Ricardo's theory of comparative advantage: old idea, new evidence. *American Economic Review*, 102(3), 453-458. https://doi.org/10.1257/aer.102.3.453

Dalum, B., Laursen, K., & Villumsen, G. (1996). The Long-Term Development of OECD Export Specialization Patterns: Despecialization and "stickiness" https://doi.org/10.2139/ssrn.49727.

Dillen, K., Demont, M., & Tollens, E. (2008). European sugar policy reform and agricultural innovation. *Canadian Journal of Agricultural Economics*, 56(4), 533-553. https://doi.org/10.1111/j.1744-7976.2008.00146.x.

Disdier, A. C., Emlinger, C., & Fouré, J. (2015, July 26-28). Atlantic versus pacific agreement in agri-food sectors: does the winner take it all? [Paper Presentation] *Agricultural & Applied Economics Association and Western Agricultural Economics Association Annual Meeting*, San Francisco, CA, United States. https://doi.org/10.2139/ssrn.2639585

Dutta, A. C. (2019, July 10). Look east, act east~II. *The Statesman*. https://www.thestatesman.com/opinion/look-east-act-eastii-1502775767.html.

Hassan, S. F. (2008). Development of sugar industry in Africa. *Sugar Tech*, 10(3), 197-203.https://doi.org/10.1007/s12355-008-0037-6.

Helpman, E., & Krugman, P. (1987). Market structure and foreign trade: Increasing returns, imperfect competition, and the international economy. Cambridge, Massachusetts: *MIT Press*. https://doi.org/10.2307/2618391.

Hillman, A. L. (1980). Observations on the relation between" revealed comparative advantage" and comparative advantage as indicated by pre-trade relative prices. *WeltwirtschaftlichesArchiv*, 116(2), 315-321.https://doi.org/10.1007/bf02696859.

Huo, D. (2014). Impact of country-level factors on export competitiveness of agriculture industry from emerging markets. *Competitiveness Review*, 24(5), 393-413. https://doi.org/10.1108/cr-01-2012-0002

Jambor, A., & Babu, S. (2016). Competitiveness of global agriculture. *Policy lessons for food security*. Springer, Switzerland, p. 199.

Janda, K., Kristoufek, L., & Zilberman, D. (2012). Biofuels: Policies and impacts. *Agricultural Economics*, 58(8), 372.

Kanaka, S. & Chinadurai, M. (2012). A study of comparative advantage of Indian agricultural exports. *Journal of Management and Science*, 2 (3), 1-9. https://doi.org/10.26524/jms.2012.19.

Khan, H. A., & Larik, Z. (2007). Globalization and Regional Co-operation in South Asia: A Political and Social Economy Approach. *CIRJE-F-480 discussion paper.*

Krishnankutty, P. (2021, March). What is BIMSTEC & why it has emerged as the preferred grouping of countries in South Asia? *The Print*.

Krugman, P. R., & Obstfeld, M. (2000). *International Economics: Theory and policy*, New York: AddisonWesley,70(2),13.

Lafay, G. (1992). The measurement of revealed comparative advantages. *In International trade modeling* (pp. 209-234). New York: Springer US. https://doi.org/10.1007/978-1-4757-2150-8_10

Latruffe, L. (2010). Competitiveness, productivity, and efficiency in the agricultural and agri-food sectors. *OECD Food Agric. Fisheries Paper*. https://doi.org/10.1787/5km91nkdt6d6-en.

Laursen, K. (2015). Revealed comparative advantage and the alternatives as measures of international specialization. *Eurasian Business Review*, pp. 5, 99–115.https://doi.org/10.1007/s40821-015-0017-1.

Liesner, H. H. (1958). The European common market and British industry. *The Economic Journal*, 68(270), 302-316.https://doi.org/10.2307/2227597

Lundbäck, E. J., & Torstensson, J. (1998). Demand, comparative advantage and economic geography in international trade: evidence from the OECD. *WeltwirtschaftlichesArchiv*, 134(2), 230-249.https://doi.org/10.1007/bf02708094.

Mabeta, J., & Smutka, L. (2023). Trade and competitiveness of African sugar exports. *Frontiers in Sustainable Food Systems*, 7.doi.org/10.3389/fsufs.2023.1304383

Mehrotra, L. (2012). India's Look East Policy: Its Origin and Development. *Indian Foreign Affairs Journal*, 7(1), 75–85. https://www.jstor.org/stable/45341805.

Milovanovic, V., & Smutka, L. (2016). South Asian countries in the global sugar market: A critical assessment. *Sugar Tech*, 18, 647-658. https://doi.org/10.1007/s12355-016-0436-z

Mizik, T. (2021). Agri-food trade competitiveness: A review of the literature. *Sustainability*, 13(20), 11235.https://doi.org/10.3390/su132011235

Nagy, J., &, Z. (2019). Competitiveness in Dairy Trade–the Case of EU and the Visegrad Group Countries. *Agris on-line Papers in Economics and Informatics*, 11(4), 61-74.https://doi.org/10.7160/aol.2019.110406

Narayan, S., & Bhattacharya, P. (2019). Relative export competitiveness of agricultural commodities and its determinants: Some evidence from India. *World Development*, 117, 29-47. https://doi.org/10.1016/j.worlddev.2018.12.013

Nowak, A. (2016). The competitiveness of agriculture of EU member countries of Central and Eastern Europe. *Acta Scientiarum Polonorum. Oeconomia*, 15(2), 113-125.https://aspe.sggw.edu.pl/article/view/391/357

Oberoi, S. (2018). India's Rising Import Dependency and Comparative Disadvantage at Different Industry Level in Context of AIFTA. *Anvesha*, 11(1), 23-40.https://www.proquest.com/openview/35eea2c3e8bb0576e701b2737b8e86be/1?pq-origsite=gscholar&cbl=1216357.

Observatory of Economic Complexity. (2024). https://oec.world/en

Pawlak, K. (2017). Importance and Comparative Advantages of the EU and US Agri-food Sector in World Trade in 1995-2015. *Problems of World Agriculture*,17(4), 236-248.https://doi.org/10.22630/PRS.2017.17.4.100

Pilinkiene, V. (2014). Evaluation of International Competitiveness Using the Revealed Compar ative Advantage Indices: The Case of Baltic States. *Mediterranean Journal of Social Sciences,* 5(13). https://doi.org/10.5901/mjss.2014.v5n13p353

Pishgar-Komleh, S. H., Čechura, L., & Kuzmenko, E. (2021). Investigating the dynamic eco-efficiency in agriculture sector of the European Union countries. *Environmental Science and Pollution Research*, 28(35), 48942-48954.https://doi.org/10.1007/s11356-021-13948-w

Salvatore, Dominick, (2007). International economics. 9th Edition, *John Wiley & Sons*, Inc., New Jersey

Smutka, L., Rumánková, L., Pulkrábek, J., & BeneŠová, I. (2013). Hlavní determinanty nabídky a poptávky na světovém trhu s cukrem [Main determinants of supply and demand on the world sugar market] *Listy Cukrovarnicke a Reparske*, 129(4).

Solomon, S., & Li, Y. R. (2016). The sugar industry of Asian region. *Sugar Tech*, 18(6), 557-558. https://link.springer.com/article/10.1007/s12355-016-0500-8

Sukhtankar, S. (2012). Sweetening the deal? Political connections and sugar mills in India. *American Economic Journal: Applied Economics*, 4(3), 43-63. https://doi.org/10.1257/app.4.3.43

Taylor, R. D. (2017). 2017 Outlook of the US and World Sugar Markets, 2016-2026.*Agribusiness & Applied Economics Report*,767.

Terin, M., Yildirim, I., Aksoy, A. D. E. M., & Sari, M. M. (2018). Competition power of Turkey's honey export and comparison with Balkan Countries. *Bulgarian Journal of Agricultural Science,* 24(1). http://www.agrojournal.org/24/01-03.pdf

Torok, A., & Jambor, A. (2016). Determinants of the revealed comparative advantages: The case of the European ham trade. *Agricultural Economics*, 62(10). https://doi.org/10.17221/177/2015-agricecon

Török, Á., Szerletics, Á., & Jantyik, L. (2020). Factors influencing competitiveness in the global beer trade. *Sustainability*, 12(15), 5957.https://doi.org/10.3390/su12155957

Vikas, B.A. and Babu, M. (2017). State intervention: a gift or threat to India's sugarcane sector? (Working Paper No. 385), *Institute for Social and Economic Change*, Bangalore.

Vollrath, T. L. (1989). Competitiveness and protection in world agriculture (Agriculture Information Bulletin No. 567). *US Department of Agriculture, Economic Research Service.*

Vollrath, T. L. (1991). A theoretical evaluation of alternative trade intensity measures of revealed comparative advantage. *WeltwirtschaftlichesArchiv,* 127(2), 265-280.https://doi.org/10.1007/BF02707986.

Widodo, T. (2009) Comparative advantage: theory, empirical measures, and case studies. *Review of Economic and Business Studies (REBS)*, (4), 57–82. https://www.researchgate.net/publication/227367489_Comparative_Advantage_Theory_Empirical_Measures_And_Case_Studies

Wu, X. J. (2010). Analysis on Chinese export structure and competitiveness of peanut and peanut products: based on the import and export data from 1997 to 2007. *Chinese Journal of Oil Crop Sciences*, 2.

Yeats, A. J. (1985). On the appropriate interpretation of the revealed comparative advantage index: implications of a methodology based on industry sector analysis. *WeltwirtschaftlichesArchiv*, 121(1), 61-73. https://doi.org/10.1007/BF02705840

Zhang, X. L., & Liu, M. (2008). Experimental study on the international competition power of China's peanut industry. *Journal of Henan Agricultural Sciences*; 11.

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APPENDIX: LIST OF TABLES

Table A1: Raw Sugar Exports (in USD) of BIMSTEC Countries

Year	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand
2005	51,757	4,972	40,111,005	805,227	5,026,432	979,970	758,396,357
2006	230,928	2,805	656,762,773	239,411	292,614	939,260	740,123,559
2007	8,892,072	4,413	1,008,282,853	61,310	8,287,313	928,987	1,319,629,159
2008	8,957,140	0	1,529,061,210	6,446,575	6,978,398	388,981	1,486,902,146
2009	7,530,913	0	65,456,395	21,140,826	217,158	187,648	1,832,965,530
2010	31,809	76	930,015,053	9,651,623	4,332	612,037	2,324,078,043
2011	22,890	159	2,151,465,775	8,278,631	14,326	233,233	4,019,499,643
2012	14,597,823	0	2,155,731,136	6,957,175	1,277	222,258	4,084,542,390
2013	22,017,380	0	979,796,050	47,009,982	128	2,065,655	2,969,576,137
2014	4,942,667	0	1,171,418,664	17,813,118	6,108	584,039	2,914,359,118
2015	885,638	0	1,257,869,171	238,997,742	0	674,801	2,798,654,595
2016	7,180,903	0	1,604,903,899	1,067,719,804	13,180	835,603	2,584,861,911
2017	2,378,974	0	1,005,250,682	452,458,365	18,609	1,261,760	2,896,709,299
2018	1,252,666	0	985,020,698	605,421,326	31,355	837,250	3,033,482,554
2019	17,203	0	1,856,967,646	112,273,800	3,089	708,723	3,078,476,669
2020	20,077	0	2,701,513,992	84,741,120	1,182	765,132	1,841,375,451
2021	87,628	11,880	4,112,870,095	115,701,311	1,357	2,731,253	1,575,448,242
2022	69,916	0	6,034,263,140	50,431,627	4,138	876,275	3,224,226,771

Table A2: Raw Sugar Imports (in USD) of BIMSTEC Countries

Year	Bangladesh	Bhutan	India	Myanmar	Nepal	Sri Lanka	Thailand
2005	174,416,153	933,607	277,542,346	2,202,069	7,784,225	178,755,435	2,515,538
2006	386,821,158	655,739	6,567,693	2,563,270	2,772,479	267,472,678	6,494,491
2007	247,217,343	458,751	24,959,795	1,907,986	3,443,871	170,641,376	630,053
2008	411,690,553	548,209	51,708,447	1,512,007	11,898,372	246,191,953	3,871,601
2009	544,766,640	3,532,892	1,645,168,693	2,305,117	8,884,100	260,633,610	4,305,340
2010	571,170,875	1,330,280	1,405,681,342	32,394,231	14,163,139	414,208,776	38,237,049
2011	898,750,414	1,443,441	129,450,007	58,640,775	5,496,947	464,961,950	39,431,363
2012	820449,109	1,277,028	481,167,216	39,520,573	16,884,487	372,058,100	45,339,508
2013	738,537,160	257,045	476,398,361	74,974,637	10,454,980	258,139,879	21,314,531
2014	723,480,297	1,080,384	648,547,404	69,093,353	11,674,941	235,430,321	8,874,578
2015	833,558,223	942,430	483,470,647	514,621,855	16,983,887	232,668,796	15,120,062
2016	674,435,913	1,473,182	891,662,076	1,213,253,404	38,393,626	322,528,738	18,064,187
2017	1,119,856,598	3,084,748	954,768,766	717,674,965	71,724,123	201,870,551	21,437,041
2018	556,279,291	3,305,210	559,719,423	487,536,195	71,023,618	169,320,932	22,123,181
2019	636,908,501	3,526,812	273,951,064	83,305,224	5,605,875	18,8875,553	1,165,173
2020	725,121,540	4,398,785	502,371,474	44,010,415	6,6761,755	258,995,596	33,986,671
2021	874,271,196	5,199,956	123,403,727	50,406,788	72,778,752	26,8976,938	43,890,414
2022	972,026,884	4,908,092	233,482,168	50,533,792	31,283,367	286,570,860	65,194,089

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CAUSAL RELATIONSHIPS IN THE BALANCED SCORECARD: A SERBIAN BANKING PERSPECTIVE

ABSTRACT: *This paper examines cause-and-effect relationships within the balanced scorecard (BSC), focusing on the case of commercial banks operating within the territory of Serbia. Despite the widespread application of the BSC as a strategic management tool, the literature presents diverse conclusions regarding the efficacy of its cause-and-effect relationships. The research aims to investigate the interrelationships between perspectives, with a specific focus on the financial perspective and its causal factors. A study was conducted on five banks operating in the territory of Serbia using the method of documentation analysis, and data were collected for the period from 2010 to 2023. The conclusions are based on the results of simple panel data regression and multiple panel data regression. The results obtained provide empirical support for previously established cause-and-effect relationships within the BSC framework and also highlight new implications of causality among perspectives.*

KEY WORDS: *BSC (balanced scorecard), balanced scorecard perspectives, causality, banking sector*

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1. INTRODUCTION

The balanced scorecard (BSC), as a performance measurement tool, emerged due to the inadequacy of the traditional evaluation system to meet the needs of strategic management in an era of increasing competition (Liu, 2022). The fundamental critique of the traditional approach revolves around its inability to provide a complete picture of organisational performance.

The criteria used for performance evaluation in the financial sector have been criticised by many authors. Pradhan & Murari (2019) emphasise that financial performance alone is insufficient for assessing business success, primarily because it reflects business results only for a short period. Additionally, focusing on the short-term return on investment for new ventures can deter managers from pursuing them, even if they may bring significant long-term financial benefits (Dearden, 1969).

The BSC approach to performance measurement arose from the need to determine whether the management team's activities contribute to fulfilling the company's strategic objectives and vision. It was first introduced by David Norton and Robert Kaplan in 1992, and the primary characteristic of the BSC concept is its inclusion of both financial and non-financial parameters as significant indicators of business success (Jovičić et al., 2018). The BSC is conceived not only as a system of strategic measurement but also as a system of strategic control, capable of aligning the goals of organisational units and employees with the overall company strategy (Norreklit, 2000).

According to Kaplan and Norton (1996), the BSC offers two significant improvements over traditional financial performance evaluation approaches. The first improvement lies in the identification of four interconnected perspectives of business activities critical to all levels in companies: (1) the learning and growth perspective, (2) the internal processes perspective, (3) the customer perspective, and (4) the financial perspective. Furthermore, the BSC seeks to link these measures in a model that accurately reflects the cause-and-effect relationships between perspectives and indicators of those perspectives. This requirement for connecting perspectives leads to the development of strategic maps visually illustrating the cause-and-effect relationships, aiming to incorporate the four traditional perspectives of the BSC into the strategic management process. The

main goal of these relationships is to help managers recognise how improvement in one perspective affects other perspectives and whether this improvement will ultimately have a positive impact on the organisation's financial results (Elbanna et al., 2022).

The subject of this study is to determine the cause-and-effect relationships among non-financial perspective indicators within the BSC, i.e. the learning and growth perspective, the internal processes perspective, and the customer perspective, as well as to assess the impact of non-financial indicators on financial outcomes. The study aims to guide managers on which non-financial aspects to invest limited resources in, with the goal of ensuring long-term company growth and maximising financial performance.

In the literature, numerous empirical studies on the causality of BSC perspectives exist, based on examples from the public sector, such as healthcare institutions (Chan, 2006; Coop, 2006; Forgione, 1997; Kober & Northcott, 2021; Northcott et al., 2008; Zelman et al., 2003), libraries (Brui, 2018; Krarup, 2003), and hospitality industry companies (Brander Brown & McDonnell, 1995; Elbanna at al., 2022; Pham & Pham, 2019), with limited empirical evidence on the potential causality of perspectives based on data from the banking sector.

For public sector companies, the relationships between perspectives and primary objectives may not always be complementary to the primary goals of financial institutions, which involve profit maximisation. For instance, in healthcare institutions, as public sector companies, the primary perspective within the BSC is the customer perspective, and the main goal is patient satisfaction and efficient service delivery (Kober & Northcott, 2021). Previous research focusing on customer satisfaction primarily examines the influences of other non-financial perspectives on the customer perspective, with limited investigations into the impact of all non-financial perspectives on the financial perspective.

Moreover, the significance of applying the BSC as a strategic management tool in the banking sector has been the subject of research by many authors, but only a few studies have focused on the mutual influences of perspectives within the BSC model in the banking sector (Al-Gamazia & Kaddumi, 2020,, ;Tariq et al, 2014). Investigations into the causality of perspectives using examples of banks operating in Serbia have not been conducted.

This study contributes to closing the mentioned gap by examining the influence of perspectives using the example of commercial banks. Additionally, the study aims to indicate whether improvements in non-financial perspectives result in changes in financial performance, and to what extent. The study results should provide empirical evidence of the potential causality of BSC perspectives in the banking sector and fill the gap in the literature, as most research on the causality of perspectives has been conducted in the public sector. The paper is structured into three interconnected parts: the first part provides a theoretical overview of strategic maps, perspectives within the BSC, previous research on the application of the BSC model in the banking sector, and studies on the causality of perspectives. The second part describes the methodology of the research conducted in this study and presents the research model. The third part of the paper contains the results of simple panel data regression and multiple panel data regression, which were used to reevaluate the validity of the set hypotheses.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Balanced scorecard perspectives

The BSC was initially introduced as a model designed to assist managers in strategy implementation, providing a framework to measure company performance from four distinct perspectives: three non-financial and one financial. Financial performance metrics serve as the primary indicators of business success, offering top management relevant short-term feedback on the outcomes of prior initiatives. Non-financial metrics, crucial for gaining a competitive advantage and ensuring long-term success, are present in the other three perspectives of the BSC framework: learning and development, internal processes, and customer perspectives (Bento & Bento, 2013). By connecting these perspectives, Kaplan & Norton (2004) developed strategic maps to enable managers to test the company's strategy, assessing whether improvements in each non-financial perspective led to subsequent growth in financial performance.

2.1.1. Learning and growth perspective

The focus of the learning and growth perspective is primarily on a company's human resources, representing its most significant intangible asset. Liu (2022) notes that the dimension of learning and development includes three main goals: improving employees' technical abilities, enhancing their skills in performing

business processes, and increasing employee motivation, empowerment, and collaboration. Human capital is crucial for the long-term value creation of companies, primarily because technology can be replaced, and business properties can lose their significance and application (Savkin, 2019). Employees must continuously upgrade their knowledge and skills in line with changes in technology and the company's operating environment (Visalakshi & Kasilingam, 2015). Commonly used performance indicators for this perspective include employee satisfaction, employee retention rate, employee capabilities and skills (Domanović, 2019), the number of training hours per employee (Liang & Hou, 2007), employee turnover rate and employee stability rate (Kober & Northcott, 2021), and staff absenteeism rate (Koys, 2001), among others.

2.1.2. Internal processes perspective

The primary goal of the internal processes perspective is to incorporate customer expectations into company internal processes. Accordingly, the internal processes perspective should focus on internal procedures that must exceed customer expectations (Abueid, 2021). The quality of a company's products and services often depends on the processes of creating value in the internal value chain of the company (Liu, 2022). Commonly used metrics for this perspective include new product development (Marr, 2005), the number of improved internal processes (Daniel & Merigó, 2021), and the efficiency of service delivery (Chiang et al., 2020).

2.1.3. Customer perspective

The significance of the customer perspective lies in the fact that customers are a source of business revenue. Companies require information from customers to assess their expectations, building a strategy that would fulfil and respond to the desires and needs of future customers (Abueid, 2021). The customer perspective also aids organisations in introducing new products to the market with the help of customer feedback (Pradhan & Murari, 2019). Performance indicators for this perspective include market share, profitability per customer, brand value (Cunha Callado & Jack, 2015), customer retention rate, customer acquisition rate, and customer satisfaction (Kaplan & Norton, 1996).

2.1.4. Financial perspective

This perspective involves traditional methods for measuring company performance. Within the framework of benchmarks and indicators, it illustrates what will motivate shareholders and other investors to invest in the company and retain their shares (Rašić-Jelavić & Pajdaković-Vulić, 2021). The primary goal of the financial perspective is to improve financial business results by achieving objectives such as profit maximisation or cost minimisation. Financial performance indicators typically reflect profitability, solvency, operational capability, and company growth (Liu, 2022). Therefore, the financial perspective helps the company analyse whether the implemented strategy improves the financial outcome of the business (Pradhan & Murari, 2019). Commonly used indicators in most studies include revenue by product, revenue per employee, contribution margin, return on investment (ROI), return on assets (ROA), and level of indebtedness, among others (Cunha Callado & Jack, 2015).

2.2. Balanced scorecard in the banking sector

Similar to all organisations, banking institutions must find an efficient way to align their core activities with organisational objectives based on performance analysis. In order to gain a competitive advantage, banks must implement a performance evaluation model that considers both financial and non-financial indicators, which are a significant part of their operations and have a direct impact on financial performance (Stojkovski & Nenovski, 2019). The application of the BSC system, as a widely accepted strategic management tool, has been explored in various business sectors, including the banking sector.

Dave & Dave (2012) conducted research on the application of the BSC in the Indian banking sector and emphasised the importance of intangible aspects of business and non-financial performance as crucial indicators of banking sector success. They highlighted the necessity of the BSC as a strategic management tool that encompasses various aspects of banking operations and helps understand the complementarity between different performance indicators.

The mutual dependence of BSC model perspectives in the Islamic Republic of Pakistan's banking sector was the focus of the research by Tariq et al. (2014). The study results indicate that implementing the BSC in business operations will lead to increased customer satisfaction and improved financial performance of the

bank. Setting customer preference standards, obtaining feedback from them, and maintaining constant communication will generate a loyal customer base, ultimately enhancing the bank's financial performance.

The application of the BSC system as a performance measurement system in the banking sector was conducted in Libya using the Jumhouria Bank as a case study. On the basis of this case study, Abofaied (2017) concluded that the bank primarily focuses on financial performance indicators while neglecting non-financial metrics.

Al-Gamazia & Kaddumi (2020) tested the impact of non-financial perspectives of the BSC on the financial perspective using Jordanian banks as an example. The study findings showed a statistically significant influence of non-financial perspectives as well as their cumulative impact on the financial performance of banks. Their case study led to the conclusion that the management of commercial banks should adopt and implement the BSC due to its positive impact on performance, with a greater emphasis on addressing customer needs, as the customer perspective had the most statistically significant impact on the financial perspective.

Akinbowale et al. (2022) tested the implementation of the BSC model in the South African banking sector and concluded that the internal business processes perspective influences both the customer perspective and the financial perspective by improving customer trust through robust internal controls and by reducing financial losses.

2.3. Cause-and-effect relationships in the balance scorecard

The most significant contribution of the BSC in implementing corporate strategy relates to the cause-and-effect relationships between perspectives (Tucker et al., 1996). Kaplan and Norton (1996) assume the following causal relationship: the perspective of organisational learning and growth → internal processes perspective → customer perspective → financial perspective. Measures of organisational learning and growth, therefore, drive measures of the internal processes perspective. Furthermore, these processes drive measures of the customer perspective, which in turn impact financial performance. If companies have an innovative production process, efficiently manage orders, and adapt

quickly to changes, there is a high likelihood that the company's product/service will meet consumer needs, increase market share, and generate higher profits (Cohen et al., 2008).

Cravens et al. (2000) and Bukh & Malmi (2005) conducted research with results complementary to the claim that effectively linking all four perspectives in an organisation can be crucial for the implementation of corporate strategy. Essentially, the core aspect of the BSC is the articulation of the links between performance metrics and strategic objectives (Kober & Northcott, 2021). Similar findings about the existence of cause-and-effect relationships within the BSC, in addition to Kaplan and Norton (2004), were found by authors such as Norreklit & Mitchell (2007), Chenhall (2009), and Hoque (2014).

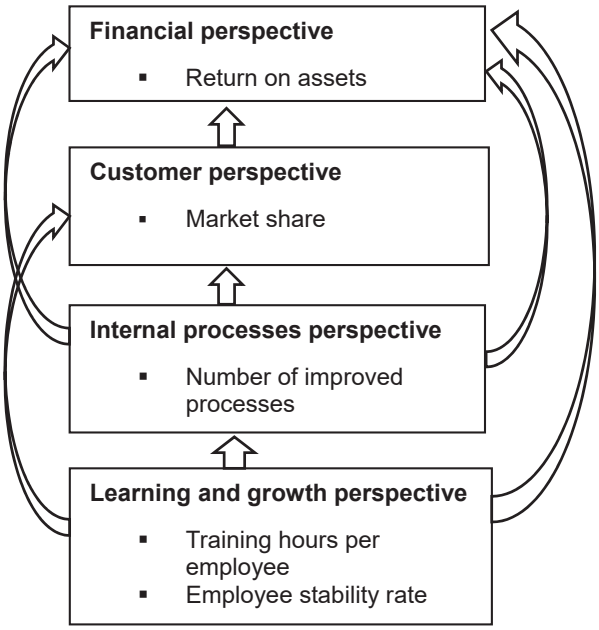
However, the literature also mentions research indicating limited evidence of causality in the BSC (Huelsbeck et al., 2011; Malina et al., 2007; Norreklit, 2000). These authors emphasise that each perspective is independent and the result of various internal and external factors. Ittner et al. (2003) conducted an examination of the results of applying the BSC to determine the compensation system in bank branches. The results showed that the implementation of this system did not help managers better understand and implement the bank's strategy or achieve strategic goals. Norreklit (2000) questions the validity of applying the BSC arguing that:

- A time dimension is missing in the BSC to establish cause-and-effect relationships;
- No evidence of a cause-and-effect relationship between individual perspectives has been found in previous research;
- The four dimensions themselves are not independent.

In addition to the causal relationships in the BSC proposed by Kaplan and Norton (1996), which involve the path of influence, i.e. the perspective of learning and growth → internal processes perspective → customer perspective → financial perspective, there are other observed mutual influences between perspectives. Spinelli & Canavos (2000) mention a statistically significant and positive connection between the learning and growth perspective and the customer perspective, while Koys (2001) concludes that the learning and growth perspective also influences the financial perspective. As the primary perspective

for companies is the financial perspective, some studies have examined the influence of the internal processes perspective on the financial perspective (Dossi & Patelli, 2010). Based on the previous findings, the subject of this study is all the cause-and-effect relationships in the BSC, presented through the adapted concept of strategic maps.

Figure 1: Strategic maps



Source: Adapted from Liang & Hou, 2007

2.3.1. Impact of the learning and growth perspective on the internal processes perspective

To support organisational strategy, companies need to measure the capabilities and skills of employees necessary during the strategy implementation process. Kaplan and Norton (2004) suggested that this perspective has a direct impact on the internal processes perspective, stating that competent and motivated employees will perform all internal processes more efficiently and productively. Studies conducted by Brown & Lam (2008) and Tahernejad et al. (2013) demonstrate that employees satisfied with the work environment and job are

more likely to become loyal to the organisation and make maximum efforts to ensure quality internal processes. Since every service provision requires a significant amount of human effort, it is vital for companies to maintain and meet the expectations of their employees, considering previous conclusions that satisfied employees will be more productive in their jobs (Lee & Way, 2010; Tahernejad et al., 2013; Spinelli & Canavos, 2000). Aldrich & Herker (1977) state that satisfied employees are also dedicated to providing better quality of business and motivated to perform all processes in a way that will result in providing greater value to customers. The number of training hours and employee training is considered a predictor of the learning and growth perspective, enabling them to be more competent and motivated to perform processes (Brown & Lam, 2008; Yee et al., 2008).

In order to determine the impact of the learning and growth perspective on the internal processes perspective, the first research hypothesis is formulated:

H1: The number of training hours per employee has a direct and positive impact on the number of improved business processes.

2.3.2. Impact of the learning and growth perspective on the customer perspective

Work organisation and investments in employee training are critical elements for implementing corporate strategy (Goldstein, 2003). The literature states that employee retention and customer retention are closely related. For employees satisfied with the work environment and the job itself, there is a lower chance of leaving the organisation. Satisfied employees also make efforts to provide better services to customers, ultimately resulting in increased customer satisfaction (Chi & Gursoy, 2009). Schneider et al. (1980) investigated the connection between employee and customer satisfaction in the banking sector by collecting data through surveys in larger bank branches. The results showed that the most significant impact on employee satisfaction is the kindness and competence of the staff.

Positive correlation between employee satisfaction and customer satisfaction has been confirmed in the research of other authors (Bettencourt & Brown, 1997; Brown & Lam, 2008; Schmit & Allscheid, 1995; Spinelli & Canavos, 2000; Wiley, 1991; Yee et al., 2008). Indicators such as the employee turnover rate, the

employee stability rate, and the employee sick leave rate have been used by Kober & Northcott (2021) as job satisfaction indicators, while other authors have used the number of hours of employee training, emphasising that employee development affects their productivity and job satisfaction (Banker et al., 2004; Lipe & Salterio, 2000;).

In line with the results of previous research, the following hypotheses are set:

H2: The employee stability rate has a positive impact on the market share.

H2a: The number of training hours per employee has a direct and positive impact on market share.

2.3.3. Impact of the learning and growth perspective on the financial perspective

Results from Koys' study (2001) suggest that employee satisfaction plays a crucial role in achieving financial performance. The positive impact of employee stability on the financial performance of the company is explained by the fact that higher employee stability rates lead to a reduction in hiring costs. Consequently, reduced costs would contribute to improved financial performance. However, there are different conclusions about the impact of employee satisfaction on the financial perspective of the company. For instance, Tornow & Wiley (1991) demonstrated a negative relationship between employee satisfaction and financial performance. This negative correlation is explained by the fact that an increase in employee satisfaction implies higher expenses for companies, such as wages and bonuses, subsequently reducing profit.

In order to determine the impact of the learning and growth perspective on the financial perspective, the following hypothesis is proposed:

H3: The employee stability rate has a positive and direct impact on ROA.

2.3.4. Impact of the internal processes perspective on the customer perspective

The improvement of internal processes within a company, as stated by Kaplan & Norton (1996), should result in increased customer satisfaction. Thus, positive financial performance is the result of customer loyalty, and loyalty is the consequence of improved and innovative internal processes. In addition to

improving existing internal processes, developing new products and services is necessary to achieve customer satisfaction (Liang & Hou, 2007). Conner-Spady et al. (2004) reached a similar conclusion about the impact of innovating internal processes on patient satisfaction during their study of determinants of patient satisfaction in healthcare institutions. Causality between these two perspectives has been confirmed by Kober & Northcott (2021) and Liang & Hou (2007).

In line with the results of the previously mentioned studies, the following hypotheses are proposed:

H4: The number of improved internal processes has a positive impact on the company's market share.

2.3.5. Impact of the internal processes perspective on the financial perspective

Studies conducted by Dossi & Patelli (2010) and Ittner et al. (2003) indicate a direct impact of the internal processes perspective on the financial perspective. This causality is explained by the fact that any improvement in internal processes will lead to reduced costs or increased sales through improved customer satisfaction. Jackson & Qu (2008), in their study on brand management in the hospitality industry using the BSC, demonstrated a direct and positive impact of the internal processes perspective on the financial perspective. Similar conclusions were reached by Elbanna et al. (2022) examining the causality of BSC perspectives in hotels.

Considering the results of these studies, the following hypothesis is proposed:

H5: The number of improved internal processes has a positive impact on the ROA.

2.3.6. Impact of the customer perspective on the financial perspective

The assumption that satisfied customers contribute to long-term profit growth through loyalty and repeat transactions has been confirmed by numerous studies (Anderson & Sullivan, 1993; Bernhardt et al., 2000; Hauser et al., 1994;; Nelson et al., 1992).

By testing assumed cause-and-effect relationships in the BSC, Norreklit (2000) concluded that an increase in customer satisfaction and loyalty will not lead to long-term profit growth for companies. This conclusion is explained by the fact that the costs of investing in product quality improvements and various loyalty programmes can be higher than the revenue increase due to increased sales volume. In contrast, Kober & Northcott (2021), testing cause-and-effect relationships within the BSC using healthcare as an example in the public sector, demonstrated mutual dependence between the customer perspective and the financial perspective. The authors demonstrated this causality by testing the impact of patient satisfaction rates and the percentage of resolved complaints and grievances (customer perspective) on net invested funds (financial perspective).

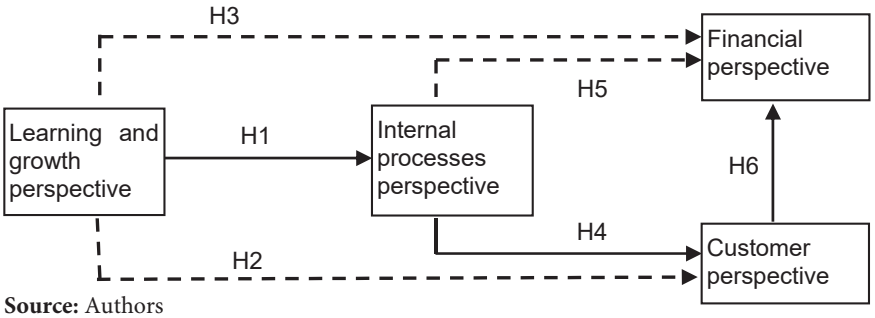
In order to determine the dependence of the customer perspective on the financial perspective, the following hypothesis is proposed:

H6: Growth in market share has a positive impact on ROA.

3. RESEARCH METHODOLOGY

The study was conducted using data from five banks operating in Serbia which, according to data from the National Bank of Serbia, had the highest total assets in the past business year. The panel regression method was used to test the research hypotheses presented in this paper (Figure 2). This method allows for a more thorough examination of the relationships between variables, tracking their mutual influences throughout the entire observed period. Panel regression analysis was conducted using R-studio software for statistical computing. The method of document analysis was used to collect data on the number of training hours per employee as well as on the number of improved business processes for the period of 14 years, from 2010 to 2023. Data on returns on assets and market share amounts were collected on the basis of publicly available financial reports and annual bank operation reports.

Figure 2: Research model



Source: Authors

The performance indicators for the learning and growth perspective included the number of training hours per employee and the employee stability rate. For the internal business processes perspective, the number of improved business processes in the bank was considered. Market share served as the indicator for the customer perspective, while ROA was observed for the financial perspective. ROA is a financial metric used to measure the profitability of a company relative to its total assets. The formula for calculating ROA is net income / total assets.

3.1. Stationarity test

As a prerequisite for performing panel regression analysis, the stationarity of all variables was first tested. Stationarity tests are crucial in time series analysis because non-stationary data can lead to spurious regression results (Çivak et al., 2021). The Augmented Dickey-Fuller (ADF) test was employed to assess the stationarity of the time series data (Table 1). Since the p-value of the ADF test is 0.01, which is less than the commonly used significance level of 0.05, we conclude that the time series is stationary.

Table 1: Augmented Dickey-Fuller Test

Test name	Augmented Dickey-Fuller test
Dickey-Fuller statistic	-4.3961
Lag order	4
p-value	0.01
Alternative hypothesis	Stationary

Source: Authors

3.2. Model suitability test

The Durbin-Wu-Hausman test was performed in order to determine whether a fixed effects model or a random effects model is more appropriate for accurate panel regression analysis (Table 2). A low p-value ($p \leq 0.05$) indicates that the fixed effects model is more appropriate, as it suggests a significant difference between the model, meaning the fixed effects model better accounts for the variability in the data (Stefko et al., 2021). The significant p-value ($p<0.05$) from the Durbin-Wu-Hausman test for all observed variable relationships suggests the use of the fixed (within) effects model.

Table 2: Durbin-Wu-Hausman test

Hypotheses	Variables	p-value
H1	Number of training hours per employee → number of improved business processes	0.010
H2	Employee stability rate, number of training hours per employee → market share	0.016
H3, H5, H6	Employee stability rate, number of improved business processes, market share → ROA	0.013
H4	Number of improved business processes → market share	0.000

Source: Authors

Note: " → " indicates the impact of the independent variable(s) on the dependent variable

3.3. Panel data regression analysis

Fixed effects models control variables that do not change over time by effectively subtracting their effects, thereby isolating the impact and responses of other variables. This analysis was applied to examine the interrelationships of variables across all five observed banks over a 14-year period, allowing for the analysis of both cross-entity (between banks) and temporal (within entity over time) variations.

Panel data regression with fixed effects model:

- $Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \cdots + \beta_k X_{kit} + u_{it}$,

where:

- Y = dependent variable;
- X = independent variable;
- $_i$ = number of banks, $_i = 5$;
- $_t$ = time dimension;
- $_t$ = number of time periods, $_t = 14$;
- β_0 = constant term;
- $\beta_{1...k}$ = regression coefficients;
- $_k$ = number of explanatory variables;
- u_{it} = is the error term.

4. TESTING THE HYPOTHESIS

The first research hypothesis in this study examines the impact of employee training on the number of improved business processes. Through simple panel data regression with a fixed effects model, it was determined that the independent variable (training hours for employees) has a statistically significant impact on the dependent variable (number of improved business processes), as the p-value of the coefficient is very low ($p = 5.677e^{-10}$; $p < 0.05$). The estimated coefficient is 0.089, which means that for each additional hour of employee training, the number of improved business processes is expected to increase by approximately 0.089 units, holding other factors constant. The positive sign of the coefficient indicates a positive relationship between employee training and the improvement of business processes.

The coefficient of determination (adjusted R^2 = 0.411) indicates that approximately 41% of the variability in the number of improved business processes can be explained by the training hours per employee.

Table 3: Impact of employee training on the number of improved business processes

Independent variable	Estimate	Std. error	t-value	p-value	Dependent variable
Number of training hours per employee	0.089	0.012	7.293	$5.677e^{-10}$	Number of improved businesses processes
R-squared	0.454				
Adjusted R-squared	0.411				
F-statistic	21.365 (3, 62)				
p-value	0.00				

Source: Authors

To test the second hypothesis in the study, a multiple panel data regression with fixed effects was applied; market share is the dependent variable, while employee training and employee stability rate are the independent variables. In multiple panel regression analysis, it is necessary to test for multicollinearity (Table 4). Multicollinearity is not considered a problem if the variance inflation factor (VIF) is less than 5 for all pairs of variables (Kamel & Abonazel, 2023).

As the VIF coefficient for both variables is less than 5, multicollinearity was not detected.

Table 4: Multicollinearity analyses for number of training hours per employee and employee stability rate

Independent variables	Number of training hours per employee	Employee stability rate
VIF	1.057	1.057
Dependent variable	Market share	

Source: Authors

Following the confirmation of no multicollinearity, a multiple panel regression analysis was performed (Table 5). Since the significance coefficients for both variables are $p > 0.05$, it is concluded that there is no significant linear correlation between the independent and dependent variables. Additionally, the low R-squared (8.9%) and adjusted R-squared (0.3%) values suggest that the model does not effectively explain the variability in market share. On the basis of this, hypotheses H2 and H2a cannot be accepted.

Table 5: Impact of number of training hours per employee and employee stability rate on market share

Independent variables	Estimate	Std. error	t-value	p-value	Dependent variable
Number of training hours per employee	0.000	0.015	1.452	0.151	Market share
Employee stability rate	0.022	0.000	1.836	0.071	
R-squared	0.090				
Adj. R-squared	0.003				
F-statistic	3.112 (2, 63)				
p-value	0.051				

Source: Authors

The third hypothesis in this study examines whether the employee stability rate affects the ROA. To evaluate the combined influence of all observed independent variables within the research model on ROA, a multiple panel regression analysis was conducted. As a prerequisite, a multicollinearity test of the variables was performed (Table 6). Since the VIF coefficients for all variables are less than 5, panel regression analysis can proceed.

Table 6: Multicollinearity for employee stability rate, number of improved business processes, and market share

Independent variables	Employee stability rate	Number of improved businesses processes	Market share
VIF	1.004	1.003	1.003
Dependent variable	ROA		

Source: Authors

The results of the multiple panel regression analysis (Table 7) indicate that the employee stability rate has a statistically significant impact on ROA ($p = 0.014$; $p < 0.05$). Specifically, each unit increase in the employee stability rate is associated with an approximate increase of 0.023 units in ROA (Estimate = 0.023). Therefore, hypothesis H3 is accepted.

Table 7: Impact of employee stability rate, number of improved business processes, and market share on ROA

Independent variables	Estimate	Std. error	t-value	p-value	Dependent variable
Employee stability rate	0.023	0.009	2.528	0.014	ROA
Number of improved business processes	0.012	0.000	3.992	0.000	
Market share	0.231	0.057	4.046	0.000	
R-squared	0.509				
Adj. R-squared	0.454				
F-statistic	21.433 (3, 62)				
p-value	$1.213e^{-09}$				

Source: Authors

The fourth hypothesis tests the influence of the number of improved business processes on market share. The model is statistically significant ($p = 1.021e\text{-}07$; $p < 0.05$), and approximately 30.98% of the variance in market share is explained by the variance in the number of improved business processes ($R^2 = 0.310$). With

each one-unit increase in the number of improved business processes, the market share increases by approximately 0.412 units. Consequently, hypothesis H4 is accepted.

Table 8: Impact of number of improved business processes on market share

Independent variable	Estimate	Std. error	t-value	p-value	Dependent variable
Number of improved business processes	0.412	0.069	5.998	$1.021e^{-07}$	Market share
R-squared	0.360				
Adj. R-squared	0.310				
F-statistic	35.976 (1, 64)				
p-value	$1.021e^{-07}$				

Source: Authors

The next hypothesis tests the impact of the number of improved business processes on ROA. Based on the coefficient from Table 7 ($p = 0.000$; $p < 0.05$), we conclude that there is a statistically significant positive influence. The estimated coefficient indicates that for each additional improved business process, ROA increases by approximately 0.0115 units, assuming other variables are held constant. This suggests a positive relationship between the number of improved business processes and ROA. Based on this evidence, hypothesis H5 is accepted.

The final research hypothesis measures the impact of market share on ROA. From the coefficients in Table 7, we observe that the p-value is 0.000 ($p < 0.05$), indicating that the influence of market share on ROA is statistically significant. For each one-unit increase in market share, ROA increases by approximately 0.231 units, assuming other variables are held constant. Consequently, hypothesis H6 is accepted.

5. DISCUSSION OF RESULTS

The aim of this study is to determine potential causal relationships between perspectives in the BSC using a complex model that examines the influence of all

three perspectives on the financial perspective – the foundational perspective for every company's operation. An extended and adapted model of strategic maps developed by Kaplan and Norton (2004) was employed. The concept of strategic maps visually illustrates the connections between perspectives and emphasises that trained and motivated employees will contribute to the improvement of business processes within the company. Such improvements will impact customer satisfaction, ultimately resulting in increased company profits.

In general, the results of the study confirm the existence of causality within the BSC perspectives and are consistent with previous research (Banker et al., 2000; Chenhall, 2009; Davis & Albright, 2004; Hoque & James, 2000; Kaplan & Norton, 1996). However, the results differ from those of the study conducted by Malina et al. (2007), which did not confirm interdependencies between perspectives, despite acknowledging the significance of implementing the BSC as a strategic tool in American companies. Differences may be attributed to the research methodology, as the authors of that study apply Grenier's causality method for hypothesis testing, which is prediction-based. Additionally, their study focuses on the distribution segment in companies, which may not necessarily imply the absence of connections between perspectives in other organisational segments.

The first research hypothesis aimed to determine a direct connection between the learning and development perspective and the internal business processes perspective. It was established that there is a direct and positive impact of the number of training hours and employee development (as indicators of the learning and development perspective) on the number of improved business processes. This causality aligns with the results of previous research (Shamir, 1980; Spinelli & Canavos, 2000; Tahernejad et al., 2013), indicating that investing in employee development leads to improvements in internal company processes. Schneider et al. (1980) demonstrated that employee satisfaction and motivation are crucial for ensuring quality internal processes. Satisfied employees will make efforts to provide internal processes that add more value to customers.

On the other hand, there was no evidence of causality between the learning and development perspective and the customer perspective. Testing training hours per employee and employee stability rate on market share (as an indicator of the customer perspective) did not show that either variable has a statistically positive

impact on customer satisfaction. These results contradict previous research by Wiley (1991), Bettencourt and Brown (1997), Spinelli and Canavos (2000), and Brown and Lam (2008), which suggest that customer satisfaction is closely related to employee satisfaction and motivation. This can be explained by the fact that the training provided to bank employees and the workshops attended were more oriented toward improving business processes than providing value to end customers. Additionally, the stability rate of employees will not affect customer satisfaction if it involves staff not motivated to maximise value for the client. These results are in line with the study conducted by Liang & Hou (2007), emphasising that the staff stability rate does not always impact customer retention. To achieve a positive correlation, companies need to provide incentive programmes for employees, competitive salary schemes, and other ways to retain a competent workforce. In contrast to these conclusions, Reichheld (1996) states that the employee turnover rate is closely linked to customer satisfaction. For employees not loyal to the company, there is a low probability of building a base of loyal customers. Different conclusions regarding the existence of causality between the employee turnover rate and customer retention rate may be related to the nature of the company's activities under investigation. The human resources strategy perspective suggests that the effects of the employee turnover rate critically depend on the context or system in which the turnover occurs (Miller & Friesen, 1984). In the banking sector, improved business processes are more crucial predictors of customer satisfaction than trained and satisfied employees.

In contrast to the results indicating the lack of causality between the learning and growth perspective and the customer perspective, a statistically significant connection was found between the employee stability rate, as an indicator of the learning and growth perspective, and the financial perspective, represented through the ROA. The results align with those found by Koys (2001), indicating that hiring costs (selection and recruitment) and costs of training for new employees will fall directly if the employee turnover rate decreases. Increased employee satisfaction will lead to a lower employee turnover rate, subsequently influencing the financial health of the bank, expressed through ROA. On the other hand, there are conclusions in the literature suggesting that an increase in employee satisfaction would imply high expenses for companies, resulting in a decline in bank earnings (Tornow & Wiley, 1991). However, based on the results

obtained here, we can conclude that satisfied employees will be more concerned about the long-term interests of the company and positively impact financial performance through a decrease in the turnover rate and the associated cost reduction.

Internal business processes, as represented by the indicator of the number of improved business processes, have a positive impact on both the customer perspective and the financial perspective. Any improvement in processes, which in the banking sector involves reducing response times to customer requests, faster loan approval processes, quicker request processing, etc., will directly and positively affect customer satisfaction and contribute to increased ROA. This causality has been demonstrated by both Liang & Hou (2007) and Diamantini et al. (2016). However, the results are not consistent with the study conducted by Northcott et al. (2008), testing the influence of the internal business perspective on the customer perspective in the public sector. They demonstrated that the strength of this connection is weak and could not find evidence that process improvement will lead to increased customer satisfaction. The differences in results may be attributed to the fact that the study was conducted in a healthcare institution as part of the public sector, where indicators of customer satisfaction significantly differ from those of bank customers. For users of healthcare institutions, the motivation and adequacy of staff will have a more significant impact on satisfaction than improved internal processes.

A highly positive and statistically significant coefficient of the impact of customer satisfaction with services on loyalty indicates that higher customer satisfaction leads to greater loyalty and repeated purchases. This strong statistical connection has been confirmed by many authors (Ertemel et al., 2021; Lin & Yin, 2022; among others). This is significant for companies because by offering a high-quality product, they gain satisfied consumers, ultimately translating satisfied consumers into loyal ones. Additionally, retaining existing customers is cheaper for companies than attracting new ones (Gursoy et al., 2007). The positive impact of customer satisfaction on a company's financial health is often the subject of research, as some authors have concluded that investments in customer satisfaction can incur high costs that may outweigh revenue growth, thereby reducing profits for the company. Negative causality between these two perspectives has been demonstrated by Tornow & Wiley (1991) and Bernhardt et

al. (2000), indicating that employee satisfaction requires significant expenses for items such as benefits and salaries and that profits will increase more if management focuses on minimising business expenses. However, the present study has shown that customer satisfaction will lead to direct recommendations to other customers, repeated purchases, word-of-mouth promotion, and other activities that will result in generating a higher level of company earnings. These results are consistent with the findings of Reicheld & Sasser (1990), who state that repeated purchases are more profitable for companies than individual customer transactions.

6. CONCLUSION

In today's highly competitive environment and with the increasing demands of consumers, achieving financial growth represents a significant challenge for management in the banking sector. This case study examines the impact of different non-financial perspectives on the financial perspective, which is considered the primary one. Considering the significance of non-financial performance metrics as important indicators of business success, this study explores the causal relationships among non-financial perspectives and their synergistic role in achieving the financial goals of a bank.

The implications of this study, based on a literature review and previous empirical studies, are twofold. It emphasises the importance of implementing the balanced scorecard as an effective strategic management tool and provides specific guidelines for bank managers to improve financial performance, illustrating how investments in non-financial aspects can directly enhance net profit growth. Additionally, it enriches the literature by offering insights into the causal relationships between the balanced scorecard perspectives in the banking sector. A significant contribution of the study is the application of the complex concept of strategic maps to understand the multiple relationships between perspectives. Unlike prior research, which predominantly adopted a hierarchical approach as introduced by Kaplan and Norton (1996), this study employs a complex model to explore both hierarchical and non-hierarchical influences. By confirming the direct connections between all non-financial balanced scorecard perspectives and the financial perspective, it highlights the responsibility of managers at all levels for actions and outcomes that shape overall financial performance. Moreover, it

provides empirical evidence on the causality within the balanced scorecard framework in the banking sector.

The originality of the research lies in its comprehensive examination of all potential causalities, with a primary focus on the financial perspective. Conducted as a case study in the banking sector over a successive 14-year period, the study improves the reliability of the results regarding the interrelationships between perspectives. Additionally, it incorporates panel regression analysis, offering the advantage of controlling for variables that cannot be directly observed or measured. This methodology reduces the impact of omitted variable bias and provides more accurate and reliable estimates of relationships within the balanced scorecard framework, thereby enhancing the robustness of the findings and contributing to a deeper understanding of banking sector dynamics.

Recommendations

Investing in customer satisfaction is paramount, as it has the most significant influence on financial results. Banks should continuously develop initiatives such as loyalty programmes, premium services, cashback credit cards, and discounts with partners to enhance the customer experience. Strengthening the bank's brand image and equity is also a vital strategy for improving financial performance. Second, enhancing employee training and development programmes is crucial. While employee satisfaction does not directly impact customer satisfaction, it significantly influences profitability. Banks that invest in training and development programmes strengthen employee loyalty, decrease turnover rates, and subsequently reduce recruitment and selection costs, leading to improved financial performance. Furthermore, motivated and satisfied employees are more likely to contribute to business process improvements, adding value for customers, which indirectly enhances customer satisfaction.

Finally, continuous improvement of business processes leads to better financial results through cost reduction and increased efficiency. Improved processes lead to enhanced customer experiences, which, in turn, increase customer satisfaction and support market share growth.

Limitations

The primary limitation of this study is that the findings are based on data from banks operating in Serbia. Results may differ in other countries due to variations in competition, legal frameworks, and other factors. This research can serve as a foundation for future studies on the interdependence of perspectives in banking sectors of other countries, facilitating cross-country comparisons. Another limitation is that all perspectives were measured using a single indicator, treating them as one-dimensional concepts. However, employee and customer satisfaction are complex, multidimensional concepts influenced by numerous factors. This simplification may result in an oversimplification of the relationships between the variables studied. Future research should incorporate a greater number of indicators and account for other factors influencing customer satisfaction, such as service quality, company image, and customer value. Moreover, additional factors outside the current model may also affect a company's financial performance. Including a broader range of factors in future research could strengthen conclusions regarding the indicators of financial performance growth in companies.

REFERENCES

Abofaied, A. (2017). Evaluation of Bank's Performance by using Balanced Score card: practical study in Libyan Environment. International Journal of Business and Management, 5(1), 1–14. 10.20472/BM.2017.5.1.001

Abueid, R. (2021). Assessing the performance of Islamic banks in Malaysia based on balanced scorecard (BSC) measures and Shari'ah guidelines compliance. *International Journal of Emerging Markets*, *17*(7), 1700–1719. https://doi.org/10.1108/IJOEM-11-2020-1412

Akinbowale, O. E., Klingelhöfer, H. E., & Zerihun, M. F. (2022). The use of the balanced scorecard as a strategic management tool to mitigate cyberfraud in the South African banking industry. *Heliyon*, 8(12). https://doi.org/10.1016/j.heliyon.2022.e12054

Aldrich, H., & Herker, D. (1977). Boundary spanning roles and organization structure. *Academy of Management Review*, *2*(2), 217–230. https://doi.org/10.2307/257905

Al-Gamazia, R. Z., & Kaddumi, T. A. (2020). Balanced Score Card implementation and its effect on banks' financial performance. *International Journal of Innovation, Creativity and Change*, *13*(10), 654–673 https://doi.org/10.1016/j.mar.2003.11.001

Anderson, E. W., & Sullivan, M. W. (1993). The antecedents and consequences of customer satisfaction for firms. *Marketing Science, 12*(2), 125–143. https://doi.org/10.1287/mksc.12.2.125

Banker, R. D., Chang, H., & Pizzini, M. J. (2004). The balanced scorecard: Judgmental effects of performance measures linked to strategy. *The Accounting Review*, *79*(1), 1–23. https://doi.org/10.2308/accr.2004.79.1.1

Banker, R. D., Potter, G., & Srinivasan, D. (2000). An empirical investigation of an incentive plan that includes nonfinancial performance measures. *The accounting review, 75*(1), 65–92. doi:10.2308/accr.2000.75.1.65

Bento, A., & Bento, R. (2013). Validating cause-and-effect relationships in the balanced scorecard. *Academy of Accounting and Financial Studies Journal*, *17*(3), 45–55. https://www.researchgate.net/publication/259460965_Validating_Cause-and-Effect_Relationships_in_the_Balanced_Scorecard

Bernhardt, K. L., Donthu, N., & Kennett, P. A. (2000). A longitudinal analysis of satisfaction and profitability. *Journal of Business Research*, *47*(2), 161–171. https://doi.org/10.1016/S0148-2963(98)00042-3

Bettencourt, L. A., & Brown, S. W. (1997). Contact employee: Relationships among workplace fairness, job satisfaction and prosocial service behaviors. *Journal of Retailing*, *73(1)*, 39–61. https://doi.org/10.1016/S0022-4359(97)90014-2

Brander Brown, J., & McDonnell, B. (1995). The balanced score-card: Short-term guest or long-term resident?. *International Journal of Contemporary Hospitality Management*, *7*(2/3), 7–11. https://doi.org/10.1108/09596119510146751

Brown, S. P., & Lam, S. K. (2008). A meta-analysis of relationships linking employee satisfaction to customer responses. *Journal of Retailing*, *84*(3), 243–255. https://doi.org/10.1016/j.jretai.2008.06.001

Brui, O. (2018). Implementation of strategic management based on the balanced scorecard in a university library. *Library Management*, *39*(8/9), 530–540. https://doi.org/10.1108/LM-09-2017-0086

Bukh, P. N., & Malmi, T. (2005). Re-examining the cause-and-effect principle of the balanced scorecard. *Accounting in Scandinavia–The Northern Lights*, 87–113. https://www.researchgate.net/publication/291869343_Re-examining_the_Cause-and-effect_Principle_of_the_Balanced_Scorecard

Chan, Y. C. L. (2006). An analytic hierarchy framework for evaluating balanced scorecards of healthcare organizations. *Canadian Journal of Administrative Sciences*, *23*(2), 85–104. https://doi.org/10.1111/j.1936-4490.2006.tb00683.x

Chenhall, R. H. (2009). Developing integrative performance management systems. In J. Baxter, & C. Poullaos (Eds.). *Practices, Profession and Pedagogy in Accounting: Essays in Honour of Bill Birkett* (pp. 176–206). Sydney: Sydney University Press. https://doi.org/10.2307/j.ctv1wmz4c2.11

Chi, C. G., & Gursoy, D. (2009). Employee satisfaction, customer satisfaction, and financial performance: An empirical examination. *International Journal of Hospitality Management*, *28*(2), 245–253. https://doi.org/10.1016/j.ijhm.2008.08.003

Chiang, J. T., Chiou, C. C., Doong, S. C., & Chang, I. F. (2020). Research on the construction of performance indicators for the marketing alliance of catering industry and credit card issuing banks by using the balanced scorecard and fuzzy AHP. *Sustainability*, *12*(21), 9005. https://doi.org/10.3390/su12219005

Çivak, H., Küren, C., & Turgay, S. (2021). Examining the effects of COVID-19 data with panel data analysis. *Social Medicine and Health Management*, *2*(1), 1–16. 10.23977/socmhm.2021.020101

Cohen, S., Thiraios, D., & Kandilorou, M. (2008). Performance parameters interrelations from a balanced scorecard perspective: An analysis of Greek companies. *Managerial Auditing Journal*, *23*(5), 485–503. https://doi.org/10.1108/02686900810875307

Conner-Spady, B. L., Sanmugasunderam, S., Courtright, P., McGurran, J. J., & Noseworthy, T. W. (2004). Determinants of patient satisfaction with cataract surgery and length of time on the waiting list. *British Journal of Ophthalmology*, *88*(10), 1305–1309. https://doi.org/10.1136/bjo.2003.037721

Coop, C. F. (2006). Balancing the balanced scorecard for a New Zealand mental health service. *Australian Health Review*, *30*(2), 174–180. https://doi.org/10.1071/AH060174

Cravens, K., Piercy, N., & Cravens, D. (2000). Assessing the performance of strategic alliances:: Matching metrics to strategies. *European Management Journal*, *18*(5), 529–541. https://doi.org/10.1016/S0263-2373(00)00042-6

Cunha Callado, A. A., & Jack, L. (2015). Balanced scorecard metrics and specific supply chain roles. *International Journal of Productivity and Performance Management*, *64*(2), 288–300. https://doi.org/10.1108/IJPPM-05-2014-0071

Daniel, J., & Merigó , J. M. (2021). Developing a new multidimensional model for selecting strategic plans in balanced scorecard. *Journal of Intelligent & Fuzzy Systems*, *40*(2), 1817–1826. https://doi.org/10.3233/JIFS-189188

Dave, S. R., & Dave, S. R. (2012). Applying balanced scorecard in Indian banking sector: An empirical study of the State Bank of India. *Pacific Business Review International*, *5*(6), 108–120. http://www.pbr.co.in/2012/2012_month/Dec/12.pdf

Davis, S., & Albright, T. (2004). An investigation of the effect of balanced scorecard implementation on financial performance. *Management Accounting Research*, *15*(2), 135–153. https://doi.org/10.1016/j.mar.2003.11.001

Dearden, J. (1969). The case against ROI control. *Harvard Business Review*, *47*(3), 124–135. https://hbr.org/1969/05/the-case-against-roi-control

Diamantini, C., Genga, L., & Potena, D. (2016). Behavioral process mining for unstructured processes. *Journal of Intelligent Information Systems*, *47*, 5–32. https://doi.org/10.1007/s10844-016-0394-7

Domanović,V. (2019). Modeli izveštavanja o održivosti preduzeća [Business sustainability reporting models]. *Revizor*, *22*(87–88), 7–20. https://doi.org/10.5937/Rev1988007D

Dossi, A., & Patelli, L. (2010). You learn from what you measure: Financial and non-financial performance measures in multinational companies. *Long Range Planning*, *43*(4), 498–526. https://doi.org/10.1016/j.lrp.2010.01.002

Elbanna, S., Kamel, H., Fatima, T., & Eid, R. (2022). An investigation of the causality links in the balanced scorecard: The case of the Gulf Cooperation Council hospitality industry. *Tourism Management Perspectives*, *41*, 100934. https://doi.org/10.1016/j.tmp.2021.100934

Ertemel, A. V., Civelek, M. E., Eroglu Pektas, G. O., & Cemberci, M. (2021). The role of customer experience in the effect of online flow state on customer loyalty. *PloS One*, *16*(7), e0254685. https://doi.org/10.1371/journal.pone.0254685

Forgione, D. A. (1997). Health care financial and quality measures: International call for a "balanced scorecard approach". *Journal of Health Care Finance*, *24*(1), 55–58.

Goldstein, S. M.(2003). Employee development: An examination of service strategy in a high-contact service environment. *Production and Operations Management, 12*(2), 186–203. https://doi.org/10.1111/j.1937-5956.2003.tb00500.x

Gursoy, D., McCleary, K. W., & Lepsito, L. R. (2007). Propensity to complain: Effects of personality and behavioral factors. *Journal of Hospitality & Tourism Research*, *31*(3), 358–386. https://doi.org/10.1177/1096348007299923

Hauser, J. R., Simester, D. I., & Wernerfelt, B. (1994). Customer satisfaction incentives. *Marketing Science*, *13*(4), 327–350. https://doi.org/10.1287/mksc.13.4.327

Hoque, Z. (2014). 20 years of studies on the balanced scorecard: Trends, accomplishments, gaps and opportunities for future research. *The British Accounting Review, 46*(1), 33–59. https://doi.org/10.1016/j.bar.2013.10.003

Hoque, Z., & James, W. (2000). Linking balanced scorecard measures to size and market factors: Impact on organizational performance. *Journal of Management Accounting research*, *12*(1), 1–17. https://doi.org/10.2308/jmar.2000.12.1.1

Huelsbeck, D. P., Merchant, K. A., & Sandino, T. (2011). On testing business models. *The Accounting Review*, *86*(5), 1631–1654. https://doi.org/10.2308/accr-10096

Ittner, C. D., Larcker, D. F., & Randall, T. (2003). Performance implications of strategic performance measurement in financial services firms. *Accounting, Organizations and Society*, *28*(7–8), 715–741. https://doi.org/10.1016/S0361-3682(03)00033-3

Jackson, L. A. & Qu, H. (2008). A conceptual framework for managing lodging brands: A balanced-scorecard approach. *Journal of Quality Assurance in Hospitality & Tourism*, *9*(2), 108–134. https://doi.org/10.1080/15280080802235458

Jovičić, A. I., Kukobat, L. M., Đergović, D. M., & Tešanović, S. S. (2018). Impact of organizational learning on financial perspectives according to BSC model: Case study of 'Guca' foundry. *Tehnika*, *73*(4), 567–573. https://doi.org/10.5937/tehnika1804567J

Kamel, A. R., & Abonazel, M. R. (2023). A simple introduction to regression modeling using R. *Computational Journal of Mathematical and Statistical Sciences*, *2*(1), 52–79. https://cjmss.journals.ekb.eg/article_286631.html

Kaplan, R. S., & Norton, D. P. (1996). Strategic learning & the balanced scorecard. *Strategy & Leadership*, *24*(5), 18–24. https://doi.org/10.1108/eb054566

Kaplan, R. S., & Norton, D. P. (2004). *Strategy Maps: Converting Intangible Assets into Tangible Outcomes*. Boston: Harvard Business Press. https://www.hbs.edu/faculty/Pages/item.aspx?num=15760

Kober, R., & Northcott, D. (2021). Testing cause-and-effect relationships within a balanced scorecard. *Accounting & Finance*, *61*, 1815–1849. https://doi.org/10.1111/acfi.12645

Koys, D. J. (2001). The effects of employee satisfaction, organizational citizenship behavior, and turnover on organizational effectiveness: A unit-level, longitudinal study. *Personnel Psychology*, *54*(1), 101–114. https://doi.org/10.1111/j.1744-6570.2001.tb00087.x

Krarup, K. (2003). Balanced scorecard at the Royal Library, Copenhagen. *Liber Quarterly*, *14*(1), 37–57. https://doi.org/10.18352/lq.7756

Lee, C., & Way, K. (2010). Individual employment characteristics of hotel employees that play a role in employee satisfaction and work retention. *International Journal of Hospitality Management*, *29*(3), 344–353. https://doi.org/10.1016/j.ijhm.2009.08.008

Liang, C. J., & Hou, L. C. (2007). A dynamic connection of balanced scorecard applied for the hotel. *Journal of Services Research*, *6*(2), 91. https://ezproxy.nb.rs:3507/eds/pdfviewer/pdfviewer?vid=1&sid=a477bd35-ed3e-4450-8ba5-4496e2d14309%40redis

Lin, W., & Yin, W. (2022). Impacts of service quality, brand image, and perceived value on outpatient's loyalty to China's private dental clinics with service satisfaction as a mediator. *PloS One*, *17*(6), e0269233. https://doi.org/10.1371/journal.pone.0269233

Lipe, M. G., & Salterio, S. E. (2000). The balanced scorecard: Judgmental effects of common and unique performance measures. *The Accounting Review*, *75*(3), 283–298. https://doi.org/10.2308/accr.2000.75.3.283

Liu, S. (2022). Internal economic management and performance evaluation method of enterprise based on balanced scorecard. *Discrete Dynamics in Nature and Society*, 2022 (1), 5071667. https://doi.org/10.1155/2022/5071667

Malina, M. A., Norreklit, H. S., & Selto, F. H. (2007). Relations among measures, climate of control, and performance measurement models. *Contemporary Accounting Research*, *24*(3), 935–982. https://doi.org/10.1506/car.24.3.10

Marr, B. (2005). Business performance measurement: an overview of the current state of use in the USA. *Measuring Business Excellence*, *9*(3). https://doi.org/10.1108/mbe.2005.26709caf.006

Miller, D., & Friesen, P. H. (1984). A longitudinal study of the corporate life cycle. *Management Science*, *30*(10), 1161–1183. https://doi.org/10.1287/mnsc.30.10.1161

Nelson, E. C., Rust, R. T., Zahorik, A., Rose, R. L., Batalden, P., & Siemanski, B. A. (1992). Do patient perceptions of quality relate to hospital financial performance? *Journal of Health Care Marketing*, *12*(4), 6–13. https://www.researchgate.net/publication/13173563_Do_Patient_Perceptions_of_Quality_Relate_to_Hospital_Financial_Performance

Norreklit, H. (2000). The balance on the balanced scorecard a critical analysis of some of its assumptions. *Management Accounting Research*, *11*(1), 65–88. https://doi.org/10.1006/mare.1999.0121

Norrelkit, H., & Mitchell, F. (2007). The balanced scorecard. In T. Hopper, D. Northcott, & R. Scapens (Eds.). *Issues in Management Accounting* (pp. 175–198). https://www.researchgate.net/publication/313428796_The_balanced_scorecard

Northcott, D., Llewellyn, S., & Kober, R. (2008, October 1). *Testing the cause-and-effect relationships in a public sector balanced scorecard* [Paper presentation]. AAA 2009 Management Accounting Section (MAS) Meeting Paper. https://doi.org/10.2139/ssrn.1193863

Pham, T. K. Y., & Pham, D .C.(2019). Factors affecting to the application of balanced scorecard in Vietnamese hospitality firm. *Management Science Letters*, *9*(13), 2383–2390. https://doi.org/10.5267/j.msl.2019.7.017

Pradhan, A., & Murari, K. (2019). Performance evaluation of banks in Bhutan: An application of balanced scorecard approach. *IUP Journal of Bank Management*, *18*(1), 49–63. https://www.researchgate.net/publication/331983331_Performance_Evaluation_of_Banks_in_Bhutan_An_Application_of_Balanced_Scorecard_Approach

Rašić-Jelavić, S., & Pajdaković-Vulić, M. (2021). Sustainability balanced scorecard: Four performance perspectives or more? *Strategic Management*, *26*(4), 37–49. https://doi.org/10.5937/StraMan2104037R

Reichheld, F. F. (1996). *The Loyalty Effect: The Hidden Force Behind Growth, Profits, and Lasting Valu*e. Boston: Harvard Business School Press.

Reichheld, F. F., & Sasser W. E., Jr. (1990). Zero defections: quality comes to services. *Harvard Business Review*, *68*(5), 105–111. https://hbr.org/1990/09/zero-defections-quality-comes-to-services

Savkin, A. (2019, February 22). *What Is a K&N Balanced Scorecard and the Role of Its Perspectives*. https://bscdesigner.com/four-perspectives.htm

Schmit, M. J., & Allscheid, S. P. (1995). Employee attitudes and customer satisfaction: Making theoretical and empirical connections. *Personnel psychology*, *48*(3), 521–536. https://doi.org/10.1111/j.1744-6570.1995.tb01768.x

Schneider, B., Parkington, J. J., & Buxton, V. M. (1980). Employee and customer perceptions of service inbanks. *Administrative Science Quarterly*, *25*(2), 252–267. https://doi.org/10.2307/2392454

Shamir, B. (1980). Between service and servility: Role conflict in subordinate service roles. *Human Relations*, *33*(10), 741–756. https://doi.org/10.1177/001872678003301004

Spinelli, M. A., & Canavos, G. C. (2000). Investigating the relationship between employee satisfaction and guest satisfaction. *Cornell Hotel and Restaurant Administration Quarterly, 41*(6), 29–33. https://doi.org/10.1177/001088040004100604

Stefko, R., Gavurova, B., Kelemen, M., Rigelsky, M., & Ivankova, V. (2021). Relationships between renewable energy and the prevalence of morbidity in the countries of the European union: A panel regression approach. *International Journal of Environmental Research and Public Health*, *18*(12), 6548. 10.3390/ijerph18126548

Stojkovski, V., & Nenovski, B. (2021). Digital services as a tool for creating competitive advantage in the banking sector in North Macedonia. *Journal of Liberty and International Affairs*, *7*(1), 79–93. https://www.ceeol.com/search/article-detail?id=939835

Tahernejad, A., Ghorban, Z. S., & Tahernejad, H. (2013). How employees' satisfaction affects quality and profitability in service industry. A case of Malaysian major shopping centers. *Advances in Business-Related Scientific Research Journal*, *4*(1), 13–25. https://www.academia.edu/7779344/how_employees_satisfaction_affects_quality_and_profitability_in_service_industry_a_case_of_malaysian_major_shopping_centers

Tariq, M., Ahmed, A., Rafi, S. K., & Ahmed, S. K. (2014). Investigating the impact of balanced scorecard on performance of business: A study based on the banking sector of Pakistan. *IBT Journal of Business Studies*, *10*(1), 125–136. https://doi.org/10.46745/ilma.jbs.2014.10.01.09

Tornow, W. W., & Wiley, J. W.(1991). Service quality and management practices: A look at employee attitudes, customer satisfaction, and bottom-line consequences. *Human Resource Planning*, *14*(2), 105–115. https://www.proquest.com/docview/224597264?sourcetype=Trade%20Journals

Tucker, M. L, Meyer, G. D., & Westerman, J. W. (1996). Organizational communication: Development of internal strategic competitive advantage. *Journal of Business Communication*, *33*(1), 51–69. https://doi.org/10.1177/002194369603300106

Visalakshi, S., & Kasilingam, R. (2015). Balanced scorecard approach to measure performance of banks. *NBR E-Journal*, *1*(1), 1–8. https://www.ncrdsims.edu.in/site/views/pdfs/Business-Review2015/7.pdf

Wiley, J. W. (1991). Customer satisfaction: A supportive work environment and its financial costs. *Human Resource Planning*, *14(2)*, 117–127. https://openurl.ebsco.com/EPDB%3Agcd%3A11%3A5852395/detailv2?sid=ebsco%3Aplink%3Ascholar&id=ebsco%3Agcd%3A7702979&crl=c&link_origin=scholar.google.com

Wu, H. Y., Tzeng, G. H., & Chen, Y. H. (2009). A fuzzy MCDM approach for evaluating banking performance based on balanced scorecard. *Expert Systems With Applications*, *36*(6), 10135–10147. https://doi.org/10.1016/j.eswa.2009.01.005

Yee, R. W., Yeung, A. C., & Cheng, T. E. (2008). The impact of employee satisfaction on quality and profitability in high-contact service industries. *Journal of Operations Management*, *26*(5), 651–668. https://doi.org/10.1016/j.jom.2008.01.001

Zelman, W. N., Pink, G. H., & Matthias, C. B. (2003). Use of the balanced scorecard in health care. *Journal of Health Care Finance*, *29*(4), 1–16. https://jsofian.files.wordpress.com/2006/12/use-of-bsc-in-health-care.pdf

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*David Acosta-Rosero**

ANALYSIS OF THE GENEROSITY OF SPANISH PENSIONS (2010-2020)

ABSTRACT: *This paper shows the impact of the legislative changes that increased the statutory retirement age and the number of contributing years on the generosity of the public pension scheme in Spain between 2010 and 2020. To do so, it was necessary to find a way to measure the generosity of the Spanish public pension programme. The methodology provided by Scruggs (2014), which in turn is a further development of that created by Esping-Andersen (1993), allows for the classification of different Welfare States based on their generosity. This article uses this method to quantify the public pension scheme during the observed period of time and then compare it against hypothetical data where legislative interventions that directly affected the variable data would not have taken place. The results show a clear quantifiable impact of the law over the generosity of the protection programme. However, the overall trend present in the index was not created by the legislative changes, it was only exacerbated by them.*

KEY WORDS: *Spain, welfare state, pensions, generosity, public policy, legislative changes.*

JEL CLASSIFICATION: I38, H55, P16

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INTRODUCTION

The public pension system is one of the key components of the Welfare State and it seeks to help maintain the ability of an individual to participate in the market even if he or she has stopped receiving income from work. One of the prerequisites for access to this protection is usually for the individual to have contributed to the system for many years. It can be said that contributory public pension schemes are mandatory programmed savings mechanisms that are tied to employment. Due to the substitutive nature of Spanish contributory pensions, in their standard sense, they allow people to have enough for retirement without the need to concern themselves with the complex decision-making processes necessary to set up and maintain savings and investments that will provide income in those later years. By having a mandatory pension system as the default, the user can overcome certain psychological barriers such as procrastination, and status quo bias (Reeson & Dunstall, 2009). Furthermore, like other programmes of the Welfare State, they are a way to maintain healthy local aggregate demand levels (Bilbao Ubillos & Ochando Claramunt, 2015, p. 318).

Throughout its history, the Spanish pension system has had many challenges and, in recent decades, it has faced two new ones: the sustainability of a pay-as-you-go system, which relies on intergenerational generosity from workers towards pensioners, and the ability to maintain acceptable long-term quality of life levels for its users (Urbano et al., 2021). The first point can be illustrated by considering that in 2007 Social Security in Spain had a surplus of 2.2% of GDP, while in 2015 it registered a deficit of 1.5% of GDP. This change can be mainly attributed to the increase in the contributory pension expenditures compared to GDP (Hernández de Cos et al., 2017, p. 8). This can be partially explained by the increase in number of people retiring and being able to receive a public pension, from 4.73 million people in 2007 to 5.5 million in 2015 and 5.94 million in 2020 (Ministerio de Inclusión, 2023).

Consistent with a broader European trend (Carone et al., 2016), the Spanish Government enacted a series of measures that aimed to correct one of the previously acknowledged challenges: the sustainability of the system. Changes to the Social Security Act (Ley General de la Seguridad Social) were implemented to limit, slow down and modify the mechanisms used to calculate public pensions. Among the most important changes are: increasing the statutory retirement age;

increasing the contributing period; penalties for accessing early pensions and rewards for accessing them later in life; modifying pensionable income standards, introducing the 'Pension Sustainability Factor'; and introducing the 'Pension Reappraisal Index'; among others.

Most of these changes focused on the future generosity of pensions and avoided impacting the current users when they were enacted. This delay aimed to limit the purchasing capacity of future pensioners, reducing the benefits of pensions over time (Devesa et al., 2017, p. 9). The estimates in other studies consider a historical average inflation rate of 2% when talking about the loss in purchasing power for future pensioners. In the current context, we are experiencing a dramatic increase in inflation. As a result, the loss in purchasing power described and forecasted (pension retaining 84.11% of their purchasing power after 10 years of retirement for those leaving the job market by 2017) by the above-mentioned authors falls short of current expectations. Other estimates forecast even more dramatic reductions in the average pensions due to differences in the rates of growth between maximum pensions and maximum contributions (Conde-Ruiz & González, 2016, p. 31).

More careful scrutiny reveals that the generosity of this protection programme depends on the laws that govern and regulate it, as well as external elements that factor in the evolution of the components that make up the variables selected to measure it. This paper examines the legislative changes that increased the age necessary to access a full pension, directly impacting the variables of the instrument utilised to quantify pension protection programmes. The effects of life expectancy on pension schemes are clear, especially when considering that longer life spans might result in pension benefits being awarded for longer periods, representing a higher cost for the system.

Many of the legislative changes introduced to combat the 2008 Crisis, especially between 2011 and 2013, were intended to reduce the number of years that a person could enjoy pension benefits by having users work more years and until a higher age. In addition to the increasing life expectancy observed in the last decades, Spain has an ageing population, and its pension system is based on intergenerational generosity. Due to factors such as baby boomers retiring and an inversion in the demographic pyramid, changes in the nature of work and

technology, among others, the public pension system has experienced great stress and its long-term sustainability has come into question (Urbano et al., 2021).

Another important factor to consider is that in the last several years young workers have had a difficult time finding stable jobs. This phenomenon makes it difficult for them to have an adequate pensionable income basis, to be reached after 35 years of paying into to the system, to draw a full pension (Belmonte et al., 2009, p. 127). In conjunction with the previous points, the present and future generations of workers will have a difficult time accessing a reliable, acceptable pension, forcing them to depend on other saving mechanisms within the financial market, consistent with a 'multi-pillar' approach. This can be considered as a partial commodification of the social right provided by adequate public pensions.

This paper will begin by outlining the methodology that is used. The design of the index, the type of variables and how to utilise them are shown in the first section. The method utilised to obtain the data is presented, along with the necessary steps to process the information so it can be used. The next section deals with the results obtained from applying the variable data to the index structure. Once the outcomes have been presented, the last section offers conclusions drawn from this process.

Even though the future of the public pensions system is heading towards a less socially responsible and more market-driven outcome, as many of the previously mentioned authors have pointed out, this paper does not seek to deal or address the changes in funding, demographics, sustainability of the programme or purchasing power of future pensions; these topics have already been discussed at length by other authors such as López Gandía (2017), Zubiri (2016), (Hinrichs, 2021), among others. This paper does, however, show the overall behaviour of the programme over time and how a specific change in the law can have extensive repercussions for the programme itself.

METHODOLOGY

The methodology used to quantify the generosity of the public pension schemes is one of the three components of the Social Welfare Generosity Scores (Scruggs, 2014). This methodology was, in turn, based on the work of Esping-Andersen (1993). The pension component of the decommodification index created by

Esping-Andersen, and later adapted by Scruggs for the Social Welfare Generosity Scores, is used to assess the overall generosity of public protection programmes of a country in general, taking into consideration the replacement rates of both: standard (contributory) and social (non-contributory) pensions, the expected duration of a public pension, the qualification period of a standard pension, the funding ratio from the employee and the take-up (coverage) rate.

By examining all the variables previously specified, we can generate a score with wider scope, one that is not only focused on more obvious factors such as the value of the pensions or their coverage alone. In contrast, the value of the index can help explain why a pension system could maintain its generosity even when specific variables were to fluctuate.

Even though this paper utilises the architecture provided by the above-mentioned authors, it has a clear differencing factor when considering the sources of the data used for its calculations. Whereas the data in the Comparative Welfare Entitlements Dataset (CWED), as (Scruggs et al. (2017) state in their 2013 codebook, were taken from various international organisations, including The US Social Security Administration, The European Commission, OECD, among others, the data in this study are gathered mostly from official Spanish sources, such as the National Spanish Statistics Institute, different pieces of legislation and various Spanish ministries. The only exception was the information regarding life expectancy, which was taken from EUROSTAT. The CWED provides an excellent comparison of homogenised international data, while this text offers an in-depth analysis of the Spanish situation.

Another critical difference between the results observed in the CWED and this work relates to the scope and aim of this article. The CWED presents a cross-country comparison using historical data. It also takes into consideration not only pensions, but also unemployment insurance and sick leave. Its goal is to compare the generosity of the welfare state of different countries, or rather the generosity of some programmes aimed to maintaining purchasing power within the local market. In contrast, this article utilises the same structure to present a comparison of the current historical data of one country, in this case Spain, that takes into consideration the effects of legislative changes, and compares it to a hypothetical

scenario in which no legislative changes were introduced. Furthermore, only the impact on the public pension System generosity level is considered here.

VARIABLE TREATMENT AND INDEX CONSTRUCTION

To compare and utilise the information provided by each variable, it is necessary to normalise the data and obtain their Z-scores. This process is applied to every variable except for the take-up rate because this represents the proportion of the population that is affected by the other characteristics of the public pension programmes. The following formula is necessary to achieve this result:

(Value in year t – the average value for 2010-2020 period) / Standard Deviation for t ranging from 2010 to 2020.

Once the Z-scores have been found, they can be used in the index, whose structure is the following:

*Public pensions generosity = {z(Standard Pension Replacement Rate) + z(Public Pension Replacement Rate) + z(Expected duration of the pension) + z(Qualification period of the standard pension * -1) + z(Employee Funding Ratio *-1) +12.5} * Take-up rate*

Three considerations are worth noting. The first is that an increase in the value of the qualification period or the employee funding ratio represents a decrease in the generosity of the pension system; hence, when used in the index they are multiplied by -1 in order to represent negative values. The second consideration is that in the particular case of this study, the employee funding ratio does not undergo any alteration. Therefore, it can be considered a non-influential variable and in the construction of the index presented in this paper, a value of 1 has been assigned to it for all its normalised values. Finally, a value of 12.5 is added before multiplication to avoid any negative values that might distort the results.

VARIABLES AND THEIR SOURCES

Standard Pension Replacement Rate

The replacement of the standard pensions can be considered as the proportion of income from the final year of work before retirement that is replaced by the

annual pension income once a person has retired. The average gross yearly income for a person 55 years old and older has been used as a proxy for the last income before retirement. However, due to the nature of complementary minimum pension payments, which are means-tested, it was necessary to find decile-specific information (Instituto Nacional de Estadísticas, 2022). The data for each decile is matched against the average contributory pension payment (Instituto Nacional de Seguridad Social - España, 2022). For the first decile, the minimum pension payment data, taken from the State General Budget Law (Ley 36/2014, de 26 de diciembre, de Presupuestos Generales del Estado para el año 2015, 2014) were used instead of the average pension payment.

Table 1: Standard pension replacement rate- Spain (2010-2020)

Year	Replacement Rate
2010	0.783
2011	0.808
2012	0.787
2013	0.802
2014	0.802
2015	0.821
2016	0.821
2017	0.833
2018	0.824
2019	0.827
2020	0.824

Source: Instituto Nacional de Estadísticas, Instituto Nacional de la Seguridad Social and General Budget Law from 2010 to 2020

Social Pension Replacement Rate

The social pension replacement rate is the proportion of the work-related income in the last year prior retirement covered by the average social pension amount paid to qualifying retirees. The social pension is not linked directly to labour contributions, but instead it is means-tested. Once again, the average gross yearly income of people 55 years old and older is used. The average social pension payment is taken from the IMSERSO yearly reports (IMSERSO, 2022).

Table 2: Social pension replacement rate

Year	Average Social Pension / year (€)	Average yearly salary (55 and older) (€)	Social pension replacement rate
2010	3847.08	22059.36	0.174
2011	3964.20	22107.90	0.179
2012	4110.00	22273.08	0.185
2013	4213.68	22302.01	0.189
2014	4249.80	22644.55	0.188
2015	4248.12	22659.01	0.187
2016	4271.88	22469.60	0.190
2017	4290.00	22600.46	0.190
2018	4424.40	23412.62	0.189
2019	4594.08	23859.64	0.193
2020	4668.96	24514.00	0.190

Source: Instituto de Mayores y Servicios Sociales and Instituto Nacional de Estadísticas

Expected length of a public pension

Due to the permanent nature of pension payments, this variable takes into consideration the statutory age for retirement and the life expectancy of the population. The former is taken from the legislation that regulates the protection programme, the Social Security Act - Ley General de la Seguridad Social or LGSS - (Real Decreto Legislativo 8/2015, de 30 de octubre, por el que se aprueba el texto refundido de la Ley General de la Seguridad Social, 2015, sec. Disposición transitoria séptima). The latter is taken from a data set provided by EUROSTAT, which shows the life expectancy of the Spanish population from 2010 to 2020(EUROSTAT, 2021). It is important to point out that the value for 2020 is an estimate. By subtracting one from the other, what is left is the number of years that a person should be able to enjoy a retirement pension.

Table 3: Expected lenght of a public pension

Year	Life expectancy (years)	Statutory retirement age (years)	Expected duration of a public pension (years)
2010	82.40	65.00	17.40
2011	82.60	65.00	17.60
2012	82.50	65.00	17.50
2013	83.20	65.08	18.18
2014	83.30	65.16	18.13
2015	83.00	65.25	17.75
2016	83.50	65.33	18.17
2017	83.40	65.42	17.98
2018	83.50	65.50	18.00
2019	84.00	65.67	18.33
2020	82.40	65.83	16.57

Source: EUROSTAT and Ley General de la Seguridad Social

The qualification period for the Standard Pension

The information for this variable is also contained in the LGSS mentioned above. It is worth mentioning that starting from 2013, both the statutory retirement age and the number of contribution years needed to access a full public pension have been increasing and will continue to do so until 2027.

Table 4: The qualification period for a full standard pension

Year	**Number of years**
2010	35
2011	35
2012	35
2013	35.25
2014	35.5
2015	35.75
2016	36
2017	36.25
2018	36.5
2019	36.75
2020	37

Source: Ley General de la Seguridad Social

Employee funding ratio

Once again, the State General Budget Law provides the necessary information for this variable. It is worth noting that this is the only variable that did not change during the study period.

Take-up rate

The take-up rate or coverage represents the number of people over the statutory retirement age that receive public pension payments, regardless of whether they are standard or social. To find this information, it was necessary to know the number of people receiving a standard pension, the number of people receiving a social pension and the number of people over the statutory retirement age. The first was taken from the National Social Security Institute (Instituto Nacional de Seguridad Social – España, 2022), the second from IMSERSO (IMSERSO, 2022; Subdirección General de Gestión, Área de Prestaciones Económicas, 2017) and the third from the National Statistics Institute (Instituto Nacional de Estadísticas, n.d.).

Table 5: Public pensions take-up rate- Spain (2010-2020)

Year	Standard pension users	Social pension users	Population over the retirement age	Public Pension take-up rate
2010	5,000.811	254,989	7,810,401	0.6729
2011	5,104.603	253,259	7,982,998	0.6712
2012	5,187.801	250,382	8,128,038	0.6691
2013	5,308.720	250,527	8,222,748	0.6761
2014	5,416.669	253,450	8,354,544	0.6787
2015	5,500.709	254,025	8,470,200	0.6794
2016	5,592.192	255,165	8,538,499	0.6848
2017	5,688.286	256,690	8,623,543	0.6894
2018	5,793.854	257,023	8,706,423	0.6950
2019	5,904.788	261,044	8,767,276	0.7033
2020	5,964.194	260,169	8,844,545	0.7038

Source: Based on information taken from INSS, IMSERSO and INE.

RESULTS

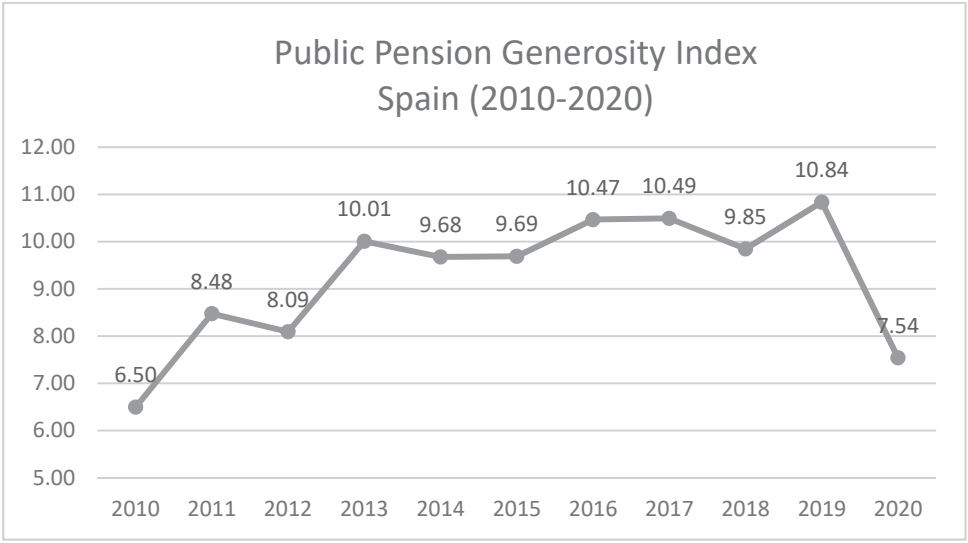
The natural and normalised values used for the calculations of the results provided can be seen in the tables of Annex 1. The process of finding the information necessary to feed the variables and construct the index presented some interesting outcomes. First of all, even though many legislative changes affected the calculation and access to public pensions in Spain during the last decade, the only legal change that directly affected the variables of this index came into effect in 2013. It specifically increased the number of contribution years necessary to access a full pension and also increased the statutory pension age. The Seventh Transitory Disposition of the Social Security Act effectively modified the data for three out of the six variables: the expected duration of the pension, the qualification period for a standard pension and the take-up rate.

Delving deeper into each of the variables that make up the index, some considerations can be noted. The standard pension replacement rate values increased during the observer period due to an increase in average pension payments (18%), as well as in the minimum pension (23%), an increase that

outpaced the growth of the average salary of people aged 55 and older (11%). The same is true for the social pension replacement rate, where the increase in the average benefit payment (21%) also surpassed the increase in the average salary.

As indicated before, the legislative changes had a direct impact on the expected duration of the pension by reducing its length by 0.83 years. Additionally, during the period of study, life expectancy grew until 2019 but fell sharply in 2020, ending up at the same levels as in 2010, which is shown in Table 3. The qualification period, also affected directly by the law, saw an increase in the required number of contributing years for a public pension, going from 35 to 37, as can be seen in Table 4. The employee funding ratio, as noted, saw no changes. The take-up rate, however, was indirectly affected by the law increasing the statutory retirement age. Nevertheless, there were gains in the number of people enjoying public pensions (19% for standard pensions and 2% for social pensions) which made this growth higher than the increase in the population over the retirement age (13%).

Figure 1: Public Pension Generosity Index - Spain (2010-2020)



Source: Author's calculations

Processing the information provided in the above variables illustrates the evolution of the index over time. However, when considering that the legislative

changes affecting three of the variables did not take place, the impact of those changes becomes clear. Table 6 presents the historical values and hypothetical values of the index. The natural and normalised values used in Table 6 can be found in Annex 1. As can be seen in Table 6, the values for both indexes, the historical one and the hypothetical one, are the same until 2012. From there on, the values continue to diverge due to the constant application of the changes.

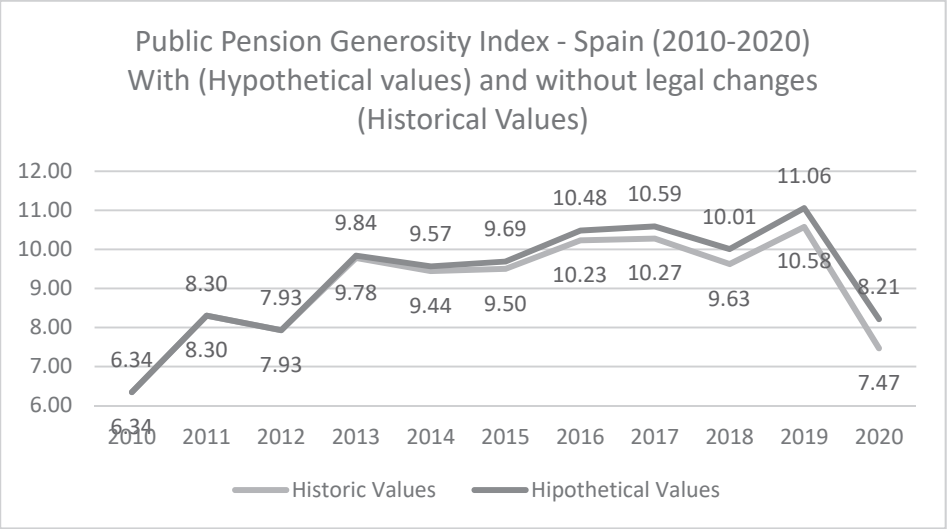
Table 6: Public pension generosity index - Spain (2010-2020) along with hypothetical values

Year	Historical Values	Hypothetical Values
2010	6.34	6.34
2011	8.30	8.30
2012	7.93	7.93
2013	9.78	9.84
2014	9.44	9.57
2015	9.50	9.69
2016	10.23	10.48
2017	10.27	10.59
2018	9.63	10.01
2019	10.58	11.06
2020	7.47	8.21

Source: Instituto Nacional de la Seguridad Social, Instituto Nacional de Estadísticas, Ley Genearl de la Seguridad Social, Ley de Presupuestos Generales del Estado, Instituto de Mayores y Servicios Sociales, EUROSTAT

This behaviour can be seen in Figure 2. The divergence between both sets of values is evident and can be traced to its starting point, 2013. Even though the difference between the historical and the hypothetical values is only 0.74 or close to 10%, the gap is large enough to be noticeable, portraying the latter as superior to the former.

Figure 2: Public Pension Generosity Index (2010-2020) - Historical vs. Hypothetical Values



Source: Author's calculations

CONCLUSION

It is evident from the analysis presented here that legislative changes have had an impact on the generosity of the pension programmes in Spain, at least with the measuring tool that has been used in this paper. A clear deviation from the historical values takes place as soon as the modifications are implemented. However, factors that go beyond the scope of the legislative changes considered and their direct influence have pushed significantly and more markedly contributed to the development of the index, such as the increase in the replacement rates in 2011 and 2013, with the most dramatic of the factors being the sharp fall in the life expectancy of the population in 2020.

Until 2020, the trend in pension programme behaviour was driven primarily by the high replacement rates of both the contributory and the social pensions. Moreover, the constant increase in life expectancy that took place until 2019 brought a sustained increase in the length of retirement pensions. Lastly, the take-up rate for both types of retirement benefits continued to rise year after year; in the case of the contributory pensions, this increase was even higher than the

growth rate of the population over the statutory retirement age. Nevertheless, when speaking about the variables that negatively affect the index, the worker's contribution had a null effect while the influence of the qualification time was not enough to counter the other variables.

The most important insgiht is that the legislative changes enacted during this period directly affected the index value and reduced the generosity of the pension system, but they did not create any new trends nor significantly alter the behaviour of the index variables in any meaningful way. They did, however, exacerbate the tendencies already present in the system.

Making the necessary changes to the architecture of the programme that would allow for retirees to have a dignified retirement, regardless of their income, is the crux of the matter. The challenge now, leading to future avenues of research, is trying to figure out how the Spanish public pension system will be able to maintain and expand its generosity for those currently working, taking into consideration the constantly changing labour market and conditions, and the growing dependency on this system.

REFERENCES

Belmonte, L.-J., Corrales, A.-J., & Ruiz, y. J. (2009). La sostenibilidad del sistema de pensiones en España. *European Journal of Education and Psychology*, *2*(2), 17.

Bilbao Ubillos, J., & Ochando Claramunt, C. (2015). Redistribución de la renta, protección social y actuaciones político-económicas. In Toboso F & Caballero G (Eds.), *Democracia y políticas Económicas* (pp. 297–328). Síntesis.

Carone, G., Eckefeldt, P., Giamboni, L., Laine, V., & Pamies, S. (2016). *Pension Reforms in the EU since the Early 2000's: Achievements and Challenges Ahead*. https://doi.org/10.2139/ssrn.2964933

Conde-Ruiz, J. I., & González, C. I. (2016). From Bismarck to Beveridge: the other pension reform in Spain. *SERIEs*, *7*(4), 461–490.

Devesa, M., Devesa, J. E., Dominguez, I., Encinas, B., & Meneu, R. (2017). Índice de Revalorización de las Pensiones, Factor de Sostenibilidad y poder adquisitivo de las pensiones de jubilación (Pensiones y Protección Social). Universidad de Valencia. https://www.uv.es/pensiones/docs/sistema-publico-pensiones/Poder_adq.pdf

Esping-Andersen, G. (1993). *Los tres mundos del estado del bienestar* (B. Arregui Luco, Ed.). Alfons el Magnànim-IVEI.

EUROSTAT. (2021, April 28). *Life expectancy by age and sex*. Eurostat. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=demo_mlexpec&lang=en

Hernández de Cos, P., Jimeno, J. F., & Ramos, R. (2017). *El sistema público de pensiones en España: Situación actual, retos y alternativas de reforma* (No. 1701; Documentos Ocacionales, p. 53). Banco de España. https://www.bde.es/f/webbde/SES/Secciones/Publicaciones/PublicacionesSeriadas/DocumentosOcasionales/17/Fich/do1701.pdf

Hinrichs, K. (2021). Recent pension reforms in Europe: More challenges, new directions. An overview. *Social Policy & Administration*, *55*(3), 409–422.

IMSERSO. (2022). *Pensiones no contributivas de la Seguridad Social. Prestaciones Sociales y Económicas para personas con discapacidad* (Enero 2022; Informe Del Seguimiento y Evolución de La Gestión). IMSERSO. https://www.imserso.es/interpresent3/groups/imserso/documents/binario/infene2022.pdf

Instituto Nacional de Estadísticas. (2022). Salarios medios por tipo de jornada, grupo de edad y decil (55+) [Data set]. In *INE*. https://www.ine.es/jaxiT3/Datos.htm?t=13928

Instituto Nacional de Seguridad Social - España. (2022). Series Cronológicas de Pensiones - Meses (toda la serie) por Clase de pensión [Data set]. In *Estadísticas del INSS*.

Ley 36/2014, de 26 de diciembre, de Presupuestos Generales del Estado para el año 2015, Pub. L. No. BOE-A-2014-13612, «BOE» núm. 315, de 30/12/2014 BOE (2014). https://www.boe.es/buscar/act.php?id=BOE-A-2014-13612&tn=1&p=20141230

López Gandía, J. (2017). Las reformas de las pensiones y sus efectos no inclusivos. In B. Cardona Rubert (Ed.), *Cambio laboral y políticas inclusivas* (pp. 195–201). Vicerectorat de Participació i Protecció Territorial. Universitat de València.

Ministerio de Inclusión, S. S. y. M. (2023). *Estadísticas de Pensiones (2007-2022)*. eSTADISS - Estadísticas del INSS. https://w6.seg-social.es/ProsaInternetAnonimo/OnlineAccess;jsessionid=0000wPjvl2t2y2mjUL2TfE6W8b6:1draslfjo?ARQ.SPM.TICKET=95bd949ab77c490aa0ab7e0126f05f99&SPM.CONTEXT=internet&ARQ.SPM.TMS_NAVEGACION=1691005357639

Población residente por fecha, sexo y edad. (n.d.). INE. Retrieved 28 March 2022, from https://www.ine.es/jaxiT3/Tabla.htm?t=31304

Real Decreto Legislativo 8/2015, de 30 de octubre, por el que se aprueba el texto refundido de la Ley General de la Seguridad Social, Pub. L. No. BOE-A-2015-11724, «BOE» núm. 261, de 31/10/2015 BOE (2015). https://www.boe.es/buscar/act.php?id=BOE-A-2015-11724&tn=1&p=20151031

Reeson, A., & Dunstall, S. (2009). *Behavioural Economics and Complex Decision-Making* (CMIS Report Number 09/110). CSIRO Mathematical and Information Sciences. http://www.taxreview.

treasury.gov.au/content/html/commissioned_work/downloads/csiro_afts_behavioural_economics_paper.pdf

Scruggs, L. (2014). *Social Welfare Generosity Scores in CWED 2: A Methodological Genealogy* (WP-01; CWED Working Paper Series, p. 19). University of Connecticut. http://cwed2.org/Data/CWED2_WP_01_2014_Scruggs.pdf

Scruggs, L., Detlef, J., & Kuitto, K. (2017). Comparative Welfare Entitlements Dataset 2. Version 2017-09 [Data set]. In *Comparative Welfare Entitlements Dataset 2. Version 2017-09*. http://cwed2.org/

Subdirección General de Gestión, Área de Prestaciones Económicas. (2017). *Pensiones no contributivas de la Seguridad Social. Prestaciones sociales y económicas para personas con discapacidad* (Sep 2017; Informe Del Seguimiento y Evolución de La Gestión). IMSERSO. http://www.imserso.es/InterPresent1/groups/imserso/documents/binario/infsep.pdf

Urbano, B., Jurado, A., & Rosado-Cebrián, B. (2021). What Will Retirement Pensions Be Like? Analysis of Spanish Future Pensioner Households in Terms of Poverty. *Sustainability*, *13*(4), 1–14.

Zubiri, I. (2016). Las pensiones en España: situación y alternativas de reforma. *Papeles de Poblacion / Centro de Investigacion y Estudios Avanzados de La Poblacion, Universidad Autonoma Del Estado de Mexico*, *147*, 167–187.

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Annex 1: Tables with natural and normalized values for the Pension Generosity Index. Historical and Hypothetical comparison.

Table A 1: Natural values: pension generosity index in Spain (2010-2020)

	Natural Values					
	Replacement Rate: Contributory Pension	**Replacement Rate: Social Pension**	**Duration of pensions in years**	**Qualification period in years**	**Employee funding ratio**	**Take-up**
2010	0.783	0.174	17.400	35.000	0.170	0.673
2011	0.808	0.179	17.600	35.000	0.170	0.671
2012	0.787	0.185	17.500	35.000	0.170	0.669
2013	0.802	0.189	18.117	35.250	0.170	0.676
2014	0.802	0.188	18.134	35.500	0.170	0.679
2015	0.821	0.187	17.750	35.750	0.170	0.679
2016	0.821	0.190	18.167	36.000	0.170	0.685
2017	0.833	0.190	17.984	36.250	0.170	0.689
2018	0.824	0.189	18.000	36.500	0.170	0.695
2019	0.827	0.193	18.334	36.750	0.170	0.703
2020	0.824	0.190	16.567	37.000	0.170	0.704

Source: Author's calculations.

Table A 2: Normalised values: pension generosity index in Spain (2010-2020)

			Z-Scores					
Average	0.812	0.187	17.778	35.818	0.170			
Standard Deviation	0.01602707	0.005153344	0.477968117	0.69976383	5.55112E-17			

	Replacement Rate: Contributiory Pension	**Replacement Rate: Social Pension**	**Duration of pensions**	**Qualification period in years**	**Employee funding ratio**	**Take-up**		**Public Pension Generosity Index**
2010	-1.82863151	-2.397087847	-0.789896734	1.16922564	1	0.673	**2010**	6.50
2011	-0.225696208	-1.443386801	-0.371458782	1.16922564	1	0.671	**2011**	8.48
2012	-1.561269067	-0.431185308	-0.580677758	1.16922564	1	0.669	**2012**	8.09
2013	-0.64392579	0.424477305	0.710203324	0.81196225	1	0.676	**2013**	10.01
2014	-0.623025797	0.179406697	0.74577055	0.45469886	1	0.679	**2014**	9.68
2015	0.581214106	0.141779033	-0.057630318	0.09743547	1	0.679	**2015**	9.69
2016	0.575592128	0.653640547	0.814812812	-0.2598279	1	0.685	**2016**	10.47
2017	1.311050567	0.595608588	0.431942086	-0.6170913	1	0.689	**2017**	10.49
2018	0.746915609	0.43180461	0.465417122	-0.9743547	1	0.695	**2018**	9.85
2019	0.952661664	1.124778469	1.164208502	-1.3316181	1	0.703	**2019**	10.84
2020	0.715114298	0.720164707	-2.532690805	-1.6888815	1	0.704	**2020**	7.54

Source: Author's calculations.

Table A 3: Natural values: historical vs. hypothetical values comparison (2010-2020)

	Natural Values					
	Replacement Rate: Contributory Pension	**Replacement Rate: Social Pension**	**Duration of pensions in years**	**Qualification period in years**	**Employee funding ratio**	**Take-up**
2010	0.783	0.174	17.400	35.000	0.170	0.673
2011	0.808	0.179	17.600	35.000	0.170	0.671
2012	0.787	0.185	17.500	35.000	0.170	0.669
2013	0.802	0.189	18.200	35.250	0.170	0.673
2014	0.802	0.188	18.300	35.500	0.170	0.672
2015	0.821	0.187	18.000	35.750	0.170	0.670
2016	0.821	0.190	18.500	36.000	0.170	0.673
2017	0.833	0.190	18.400	36.250	0.170	0.674
2018	0.824	0.189	18.500	36.500	0.170	0.675
2019	0.827	0.193	19.000	36.750	0.170	0.677
2020	0.824	0.190	17.400	37.000	0.170	0.672

Source: Author's calculations.

Table A 4: Normalized values: historical vs. hypothetical values comparison (2010-2020)

			Z-Scores					
Average	0.812	0.187	18.073	35.818	0.170			
Standard Deviation	0.01602707	0.00515334	0.510064	0.699763833	5.551E-17			
	Replacement Rate: Contributory Pension	**Replacement Rate: Social Pension**	**Duration of pensions in years**	**Qualification period in years**	**Employee funding ratio**	**Take-up**		**Public Pension Generosity Index**
2010	-1.82863151	-2.3970878	-1.31891	1.169225644	1	0.673	**2010**	6.14
2011	-0.225696208	-1.4433868	-0.9268	1.169225644	1	0.671	**2011**	8.10
2012	-1.561269067	-0.4311853	-1.12285	1.169225644	1	0.669	**2012**	7.73
2013	-0.64392579	0.4244773	0.249523	0.811962253	1	0.673	**2013**	9.65
2014	-0.623025797	0.1794067	0.445577	0.454698862	1	0.672	**2014**	9.38
2015	0.581214106	0.14177903	-0.14258	0.09743547	1	0.670	**2015**	9.50
2016	0.575592128	0.65364055	0.837685	-0.259827921	1	0.673	**2016**	10.29
2017	1.311050567	0.59560859	0.641631	-0.617091312	1	0.674	**2017**	10.40
2018	0.746915609	0.43180461	0.837685	-0.974354704	1	0.675	**2018**	9.82
2019	0.952661664	1.12477847	1.817954	-1.331618095	1	0.677	**2019**	10.88
2020	0.715114298	0.72016471	-1.31891	-1.688881486	1	0.672	**2020**	8.01

Source: Author's calculations.

Table A 5: Joint natural values (2010-2020)

		Natural Values					
		Replacement Rate: Contributory Pension	**Replacement Rate: Social Pension**	**Duration of pensions in years**	**Qualification period in years**	**Employee funding ratio**	**Take-up**
Natural values	**2010**	0.783	0.174	17.400	35.000	0.170	0.673
	2011	0.808	0.179	17.600	35.000	0.170	0.671
	2012	0.787	0.185	17.500	35.000	0.170	0.669
	2013	0.802	0.189	18.117	35.250	0.170	0.676
	2014	0.802	0.188	18.134	35.500	0.170	0.679
	2015	0.821	0.187	17.750	35.750	0.170	0.679
	2016	0.821	0.190	18.167	36.000	0.170	0.685
	2017	0.833	0.190	17.984	36.250	0.170	0.689
	2018	0.824	0.189	18.000	36.500	0.170	0.695
	2019	0.827	0.193	18.334	36.750	0.170	0.703
	2020	0.824	0.190	16.567	37.000	0.170	0.704
Hypothetical values	**2010**	0.783	0.174	17.400	35.000	0.170	0.673
	2011	0.808	0.179	17.600	35.000	0.170	0.671
	2012	0.787	0.185	17.500	35.000	0.170	0.669
	2013	0.802	0.189	18.200	35.250	0.170	0.673
	2014	0.802	0.188	18.300	35.500	0.170	0.672
	2015	0.821	0.187	18.000	35.750	0.170	0.670
	2016	0.821	0.190	18.500	36.000	0.170	0.673
	2017	0.833	0.190	18.400	36.250	0.170	0.674
	2018	0.824	0.189	18.500	36.500	0.170	0.675
	2019	0.827	0.193	19.000	36.750	0.170	0.677
	2020	0.824	0.190	17.400	37.000	0.170	0.672

Source: Author's calculations.

Table A 6: Joint normalized values (2010-2020)

		Z-Scores					
	Average	0.812	0.187	17.925	35.818	0.170	
	Standard deviation	0.01602707	0.005153344	0.515842	0.69976383	5.5511E-17	
		Replacement Rate: Contributory Pension	**Replacement Rate: Social Pension**	**Duration of pensions**	**Qualification period in years**	**Employee funding ratio**	**Take-up**
Natural values	**2010**	-1.82863151	-2.39708785	-1.01802	1.16922564	1	0.673
	2011	-0.225696208	-1.4433868	-0.6303	1.16922564	1	0.671
	2012	-1.561269067	-0.43118531	-0.82416	1.16922564	1	0.669
	2013	-0.64392579	0.424477305	0.371943	0.81196225	1	0.676
	2014	-0.623025797	0.179406697	0.404899	0.45469886	1	0.679
	2015	0.581214106	0.141779033	-0.33952	0.09743547	1	0.679
	2016	0.575592128	0.653640547	0.468872	-0.2598279	1	0.685
	2017	1.311050567	0.595608588	0.114112	-0.6170913	1	0.689
	2018	0.746915609	0.43180461	0.145129	-0.9743547	1	0.695
	2019	0.952661664	1.124778469	0.792615	-1.3316181	1	0.703
	2020	0.715114298	0.720164707	-2.63286	-1.6888815	1	0.704
Hypothetical values	**2010**	-1.82863151	-2.39708785	-1.01802	1.16922564	1	0.673
	2011	-0.225696208	-1.4433868	-0.6303	1.16922564	1	0.671
	2012	-1.561269067	-0.43118531	-0.82416	1.16922564	1	0.669
	2013	-0.64392579	0.424477305	0.532845	0.81196225	1	0.673
	2014	-0.623025797	0.179406697	0.726703	0.45469886	1	0.672
	2015	0.581214106	0.141779033	0.145129	0.09743547	1	0.670
	2016	0.575592128	0.653640547	1.114419	-0.2598279	1	0.673
	2017	1.311050567	0.595608588	0.920561	-0.6170913	1	0.674
	2018	0.746915609	0.43180461	1.114419	-0.9743547	1	0.675
	2019	0.952661664	1.124778469	2.083709	-1.3316181	1	0.677
	2020	0.715114298	0.720164707	-1.01802	-1.6888815	1	0.672

Source: Author's calculations

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EVALUATING THE HETEROGENEOUS ROLE OF INSTITUTIONAL QUALITY IN MITIGATING THE ADVERSE EFFECTS OF CAPITAL FLIGHT ON NIGERIA'S ECONOMIC GROWTH: FRESH INSIGHTS FROM A QUANTILE NONLINEAR ARDL FRAMEWORK

ABSTRACT: *This study seeks to examine whether institutional quality mitigated the adverse effect of capital flight on economic growth in Nigeria between 1996 and 2022. The study utilised the novel quantile-based nonlinear autoregressive distributed lag*

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(QNARDL) estimation procedure to estimate the size-based and sign-based heterogeneous link between the investigated series. The following outcomes were obtained: First, capital flight substantially reduces economic growth at diverse quantiles. Second, institutional quality significantly affects economic growth positively. Third, the effects of capital flight and institutional quality on growth are sign- and size-dependent, upholding their heterogeneous link. Fourth, while capital flight is detrimental to economic growth, institutional quality mitigates the devastating effect of capital flight on economic growth at diverse quantiles, both in the short run and long run. The study therefore recommends a business-friendly environment and investment-oriented policy to spur investors to massively invest in the country rather than transferring capital to other countries. Furthermore, quality institutions through good governance, political stability, a strong regulatory system, transparency, fighting corruption, and adherence to rules are required to reduce capital flight and thus enhance economic growth.

KEY WORDS: *capital flight, economic growth, institutional quality, heterogeneous, quantile nonlinear ARDL*

JEL CLASSIFICATION: B41, C32, C52, E22, F21.

1. INTRODUCTION

The persistent discourse in the policy and academic communities about the impact of capital flight on economic growth has been sparked by the dire consequences of capital flight in economies with insufficient capital. This debate involves economists, researchers, and policymakers. Over the past ten years, the focus of development policy literature has shifted to the capital flight out of African nations (Kasongo, 2022). Financial exodus from capital-poor countries creates a need for measures to support the achievement of development and economic growth goals. Since domestic investment declines as a result of capital flight, economic growth is adversely impacted (Ani et al., 2018). Capital flight may also be a sign of impending economic catastrophes, including rising levels of external debt, taxation, and unstable currency rates, Salandy and Henry (2017) assert. Capital flight, according to Hermes and Lensink (2001), jeopardises a country's creditworthiness and chances for economic expansion. Salandy and Henry (2017) argued that one major issue influencing economic growth is financial bleeding caused by capital flight. According to some academics, there is no explanation for the massive capital flight from capital-deficient economies in Africa to economies with ample capital in industrialised nations (Boyce & Ndikumana, 2008; Kollamparambil & Gumbo, 2018; Lucas, 1990).

The quality of institutions in developing countries has become a focal point in empirical discussions. Institutional quality encompasses the rule of law, individual rights, and high-quality government regulation and services. It reflects how well a country's institutions facilitate local and international transactions and ensure their security and predictability (Utile et al., 2021). Institutional quality assesses the effectiveness of a country's institutions in enabling secure and predictable international transactions. In a nutshell, institutional quality refers to the efficiency of a country's institutions in providing a stable, transparent, and predictable environment for economic activities. The importance of institutional quality in fostering investment and economic growth is substantial (Abubakar, 2020; Azam et al., 2021; Nathan et al., 2024). Robust institutions are essential for the regulation and implementation of political, social, and economic activities worldwide, ensuring adequate oversight. Strong institutions promote social cohesion and macroeconomic stability, which, in turn, stimulate investment and growth (Boukhatem & Ben Moussa, 2023; Paersa & Datta, 2023; Tran et al., 2021; Uddin et al., 2023).

Institutional quality can mitigate the adverse effect of capital flight on economic growth and stability, especially in developing countries such as Nigeria (Baek & Yang, 2010; Das et al., 2021; Ngono, 2022). As noted by Abubakar (2020), the relationship between institutional quality and capital flight is deeply intertwined, with the effectiveness of a country's institutions playing a critical role in either exacerbating or mitigating the outflow of capital. At the core of this relationship are corruption and governance. Alexiou et al. (2014) concluded that high levels of corruption and poor governance often drive capital flight as individuals and businesses look to protect their assets from unstable or exploitative environments. Conversely, effective governance reduces the incentive for capital flight by creating a stable and predictable economic setting, thereby fostering confidence among investors.

A robust regulatory framework is also essential in this context. Inconsistent regulations, characterised by arbitrary or frequently changing rules, create uncertainty that can prompt capital flight (Baek & Yang, 2010). On the other hand, clear, consistent, and fair regulations foster confidence and reduce the likelihood of capital flight. This stability encourages investors to keep their capital within the country, knowing that the regulatory environment is reliable and

predictable (Das et al., 2021; Ngono, 2022). Economic stability and the investment climate are other significant factors. Macroeconomic instability, manifested through high inflation, volatile exchange rates, and fiscal instability, can drive capital out of the country as investors look for more stable economic environments. Conversely, sound macroeconomic policies and stability create a conducive environment for retaining capital, reducing economic risks and uncertainties that typically drive capital flight. The investment climate is also influenced by institutional quality. Weak institutions can create a hostile investment climate, leading to capital flight as investors seek safer and more favourable environments. High institutional quality, however, promotes a positive investment climate, encouraging domestic and foreign investments to remain and grow within the country. This fosters economic development and stability, further reducing the incentive for capital flight (Abiodun & Yusuf, 2022; Boukhatem & Ben Moussa, 2023; Paersa & Datta, 2023; Tran et al., 2021; Uddin et al., 2023). Judicial efficiency further influences the movement of capital. Weak legal systems, marked by inefficiencies or biases, lead to a lack of trust in the enforcement of contracts and property rights, encouraging capital flight as investors seek more secure environments. In contrast, an efficient and fair judiciary ensures the protection of assets and contracts, reducing the incentive for capital to leave the country. This legal security is crucial for maintaining investor confidence and retaining capital. Some scholars have noted that the primary obstacles to economic growth in African countries include uncertainty and manipulation, deficiencies in the judicial system, corruption, bribery, tax evasion, poorly defined property rights, and the existence of inefficient institutions. These factors contribute to non-growth-enhancing policies and poorly conceived arrangements, making these nations unattractive to investors (Baliamoline, 2005). And all these seriously retard the growth of emerging economies, particularly those of Sub-Saharan Africa (SSA) Nigeria included.

The objective of Nigeria's Medium-Term National Development Plan (MTNDP) 2021–2025 is that 'Nigeria improves economic competitiveness with a gross domestic product (GDP) growth of 3.8% that drives job creation, generates inclusive national growth, and lifts at least 25 million Nigerians out of poverty' (Federal Ministry of Finance, Budget and National Planning [FMOFBNP], 2021, p. 5). Realising the economic growth rate of 3.8 per cent on average may become unrealistic with the magnitude of capital flight from Nigeria. The link between

capital flight and economic growth has been the focal point of past empirical studies on international capital flows. Past studies on capital flight in Africa have focused mainly on its linear relationship with economic growth (Ani et al., 2018; Bello & Shittu, 2018; Bredino et al., 2018; Mazadu & Usman, 2021; Obidike et al., 2015; Orimolade & Olusola, 2018). These studies, especially in the context of African countries, did not consider the possibility that the reaction of economic growth to capital flight may vary depending on the size and sign (Effiom, 2021). Additionally, the prior studies in the region did not consider the modulating influence of institutional quality on capital flight-growth connectivity. To the best of our knowledge, no known past study exists on the asymmetric distribution of capital flight and institutional quality on economic growth in Nigeria and Africa. Against this backdrop, this study adds to the existing literature by, first, investigating the asymmetric and heterogenous influence of capital flight on economic growth and, second, examining the moderating role of institutional quality in mitigating the adverse effect of capital flight on economic growth in Nigeria using the novel quantile-based nonlinear autoregressive distributed lag model (QNARDL) as suggested by Cho et al. (2020, 2021). The major advantage of QNARDL over other estimation procedures is that it permits sign asymmetry (sign-based) concerning locational asymmetry across the distributional quantiles of explanatory variables (Cho et al., 2020, 2021). Specifically, the novelty of this study is that it estimates the quantile-based and sign-based influence of capital flight on growth as well as the moderating role of institutional quality on the series connectivity and the response series. Furthermore, it examines the time-series features of the investigated variables across diverse quantiles.

The rest of the study is ordered as follows: Section 2 presents the literature review and theoretical framework; Section 3 discusses the methodology; the empirical results are presented in Section 4; Section 5 focuses on the conclusion and policy recommendations.

2. LITERATURE REVIEW

Capital flight poses a significant threat to the economic stability and growth of developing nations as it exacerbates financial vulnerabilities and undermines development efforts. This study thematically reviews the links between capital flight and economic growth, between institutional quality and economic growth, and between capital flight and institutional quality. By synthesising existing

research, this review aims to provide a comprehensive understanding of how institutional quality influences the dynamics of capital flight and economic performance.

Capital flight and economic growth

To investigate the capital flight–economic growth relationship, Orji, et al., (2020) employed the ARDL bounds estimation procedure, and the study identified a short- and long-term inverse relationship between unregulated financial outflows and economic growth. Additionally, they found that national investment, loans to the private sector, and money supply significantly predict economic growth. Their conclusion recommended preventative measures to reduce capital flight and create a more attractive economy to foster wealth development within the country. While the studies of Obidike et al. (2015); Igwemma et al. (2018), Musibau (2017), and Henry (2016) all found an adverse effect of capital flight on economic growth, the studies of Guesarova (2009), and Ameth (2014) found an inconsequential link between the investigated series. In another study, Rahmon (2017) found a positive relationship between capital flight and gross domestic product in Nigeria. Ogundipe et al. (2020) used secondary data sourced from the World Bank dataset from 1981 to 2019 to provide empirical evidence that capital flight exerts a negative impact on Nigerian economic growth. The error correction model was used to ascertain the long run relationship between the variables of the model. They further suggested that external debt and foreign direct investment should be employed in productive areas to ensure a steady increase in domestic production and reduce capital flight.

Institutional quality and economic growth

The relationship between institutional quality and economic growth has garnered considerable attention in the field of economic development. Numerous empirical studies have explored how various dimensions of institutional quality, such as governance, legal frameworks, property rights, and regulatory efficiency influence economic performance across different countries and regions. The consensus emerging from this body of research indicates that robust institutions are crucial for fostering sustainable economic growth. For instance, Utile et al. (2021) analysed the impact of institutional quality on Nigeria's economic development in the 21st century using annual time series data from 2001 to 2019. The findings revealed that institutional quality has a significant negative effect on

economic growth. Nguyen et al. (2018) explored the relationship between the two in emerging economics. The study utilised the system generalised method of moments (SGMM) estimation procedure and discovered a direct and substantial link between the investigated series. In the context of SSA, Mohammed et al. (2023) investigated the effects of financial inclusion and institutional quality on growth in five SSA countries. Their study adopted a similar approach to Nguyen et al. (2018) and found a similar outcome. In another related study, Hussen (2023) found a positive impact of institutional quality on economic growth in SSA using SGMM. In Asian countries, Tran et al., (2021) examined the role institutional quality plays in economic growth. A panel of 48 Asian countries was analysed and the study adopted a quantile regression estimation procedure. The study found a heterogeneous relationship between the series and also that lower-income countries within the sample recorded better growth following improved institutional quality than the high-income countries did. Azam et al. (2021) examined the influence of institutional quality on sustainable development in emerging economies. The study employed the SGMM method and found evidence of institutional quality having an increasing influence on sustainable development in the selected nations. It further observed that the positive effect of institutional quality on sustainable development is more pronounced in middle-income nations than in low-income nation. Dirir (2023) explored the economic growth effect of institutional quality in war-torn nations, employing diverse long-term dynamic estimation procedures and finding varying levels of outcomes. Notably, he observed an inverse relationship between the variables investigated in most of the war-torn nations. Wandeda et al. (2021) adopted SGMM in their study on the relationship between institutional quality and economic growth in SSA nations, finding a varying influence depending on the region, and that its positive effect is greater in West Africa than in other regions of SSA. Adu-Darko (2024) examined the inter-connectivity between institutional quality, financial inclusion, and economic growth in SSA using linear and nonlinear estimation. The study found a positive relationship between the investigated series. The study of Heras Recuero and Pascual González (2019) and discovered that institutional quality and economic growth are positively related and that institutional quality plays a pivotal role in a country's growth and development.

Institutional quality and capital flight

The study by Lehne et al. (2014) focused on the role of democratic institutions as a potential determinant of economic performance. It highlights institutions are interconnected, with their relationship characterised as U-shaped rather than linear. The study finds that economic institutions tend to be stronger in countries that are more open to trade, investment, and financial flows, particularly those lacking significant natural resource endowments. Furthermore, the study underscores the influence of historical and geographical factors in shaping a country's economic institutions. Using the autoregressive distributed lag, Forson et al. (2017) observed that in the long run and the short run, capital flight in Ghana is reduced by an increase in the real GDP growth rate, higher domestic real interest rates over foreign interest rates, improved financial development, good governance, and strong property rights. They used data sourced from the Central Bank of Ghana for the period of the study and recommended, among other things, that the Public Accounts Committee in Ghana should improve accountability and transparency so as to strengthen domestic investors and increase the economic growth rate. Akinlo and Aderounmu (2024) investigated the rise in capital flight and how institutional quality may mitigate its effects on the real sector in SSA. Using the SGMM, they analysed data from 26 SSA countries between 1989 and 2020. The results show that capital flight does not have a direct effect on the real sector, while institutional quality negatively influences both the agricultural and industrial sectors. Additionally, the study finds that institutional quality fails to lessen the negative impact of capital flight on the industrial sector. The study is unique in assessing whether institutional quality can reduce the effects of capital flight on the real sector, as reflected in industrial and agricultural value-added.

3. METHODOLOGICAL FRAMEWORK

3.1 Data description

The study uses yearly series covering the period from 1996 to 2022 to highlight the heterogeneous effects of capital flight, CPF, and institutional quality, IQY, on economic growth, EG. The data was obtained from the World Bank data repository and the Central Bank of Nigeria Statistical Bulletin in accordance with the study's goal. Table 1 provides a detailed explanation of the series.

Table 1: Data descriptions

Series	Notation	Unit of measurement	Source
Gross domestic product	GDP	Gross domestic product at 2010 constant prices (Local currency)	CBN
Capital flight	CPF	World Bank definition (difference between sources of funds and uses of funds)	WDI
Financial development	FID	Credit to private sector (% GDP)	CBN
Exchange rate	EXR	Nigerian exchange rate vis-à-vis US dollar	CBN
Interest rate differentials	ITD	Different between foreign lending rate (USD) and Nigeria's prime lending rate (percentage)	CBN/WDI
Institutional quality	IQY	Institutional quality (index)	WDI
Trade openness	OPS	The ratio of the sum of import and export to GDP	CBN

Note: CBN denotes Central Bank of Nigeria, WDI represents World Development Indicators at the World Bank repository.

3.2 Method of data analysis

This study examined the varied effects of capital flight and institutional quality on economic growth in Nigeria using the innovative QNARDL model proposed by Cho et al. (2020, 2021), which is an improvement on the QARDL model developed by Cho et al. (2019). The choice of estimation procedure is predicated on its several advantages over QARDL and nonlinear ARDL as it permits the estimation of both sign-based and magnitude-based asymmetric distributional quantiles effect of regressor(s) on response (Cho et al., 2020, 2021). This has prompted its use in scientific studies in recent times (Odionye, Duru, et al., 2024). Furthermore, it is used in fractionally integrated series. Moreover, this procedure offers the advantage of indicating both the degree as well as the trajectory of extreme (minor/major) positive changes and extreme (minor/major) negative changes in capital flight and institutional quality on the economic growth in the country. This knowledge is crucial as not all changes in capital flight (negative or positive) will affect growth via investment; however, some of these changes will influence domestic investment and hence economic growth. However, the QNARDL estimation procedure breakdowns if series are higher order stationary series, which is the primary limitation of the estimation approach (Cho et al., 2015, 2020, 2021; Odionye & Chukwu, 2023; Odionye, Odo, et al., 2024).

3.3 Model specifications

In line with previous studies and the theoretical view, the functional form is given as:

$$\text{LGDP} = \text{f (CPF, LIQY, LEXR, ITD, LFID, LOPS)} \tag{1}$$

$$\text{LGDP} = \text{f (CPF, LIQY, CAF*LIQR, LEXR, ITD, LFID, LOPS)} \tag{2}$$

Eq. 1 expresses GDP as a function of capital flight, institutional quality (an index consists of political stability, control of corruption, good governance, rule of law, a sound regulatory system and accountability) and other relevant covariates, such as the exchange rate, interest rate differentials, financial sector deepening, and openness, respectively. In order to ascertain the moderating role of institutional quality on the heterogeneous link between growth and capital flight, Eq. 2 specifies GDP as a function of the interaction between IQY and CPF and other series as in Eq. 1, where L represents the natural logarithm of the respective variables. Potentially, the components of institutional quality could be perfectly correlated as they are members of one family index. To address this challenge, the study utilised principal component analysis (PCA) to generate an index IQY to represent the various forms of IQY. The choice of the control variables was guided by economic theory and the prior studies. The first step is to compute the QARDL in line with Cho et al. (2015), which specifies the model following Pesaran and Shin (1998) as:

$$\begin{aligned} &Y_t[X(\tau)] = \beta_0(\tau) + \beta(\tau)Y_{\ t} + \sum_{i=1}^{m}\theta_i(\tau)Y_{t-i} + \sum_{i=0}^{n}\eta_i(\tau)X_{t-i} + \mu_t \\ &\text{where } \beta_i(\tau) = \sum_{i=0}^{m}\beta_i \text{ and } \eta(\tau) = -\sum_{i=1}^{n}\eta_i(\tau) \end{aligned} \tag{3}$$

The long-term quantile nexus is given as

$$\begin{aligned} &Y_t = \varpi(\tau) + \beta(\tau)X_t + \mu_t \\ &\text{where } \varpi = \alpha\left(1 - \sum_{i=1}^{m}\theta_i(\tau)\right)^{-1} \text{ and } \beta = \alpha_1\left(1 - \sum_{i=1}^{m}\theta_i(\tau)\right)^{-1}; \\ &\mu_t \text{ is a stationary process given by } (\Delta X_t, \varepsilon_t(\tau), \Delta X_{t-1}, \varepsilon_{t-1}(\tau), \ldots) \end{aligned} \tag{4}$$

The generalised form of the QNARDL framework as developed by Cho et al. (2020, 2021) is expressed in Eq. 5:

$$\Delta Y_t[X(\tau)] = \beta(\tau) + \lambda(\tau)Y_{t-1} + \sum_{i=1}^{m}\alpha_i(\tau)\Delta Y_{t-i} + \sum_{i=0}^{n}(\eta_i^{+}(\tau)\Delta X_{t-i}^{+} + \eta_i^{-}(\tau)\Delta X_{t-i}^{-}) + \varphi(\tau)ect + \alpha_1^{+}(\tau)X_t^{+} + \alpha_1^{-}(\tau)X_t^{-} + \varepsilon_t \quad (5)$$

$\varphi(\tau)$ measures the speed of adjustment at diverse quantiles and τ is the τ^{th} percentile as it drives changes in the response factor. $\alpha_1^{+}(\tau)X_t^{+}, \alpha_1^{-}(\tau)X_t^{-}$ measure the long-run positive and negative parameters, respectively. $ect_{t-1} = Y_{t-1} - \alpha_1^{+}(\tau)X_t^{+} - \alpha_1^{-}(\tau)X_t^{-}$ is the quantile error correction term, where $\alpha_1^{+}(\tau) = -{}^{\alpha_1^{+}(\tau)}\!/_{\lambda(\tau)}$ and $\alpha_1^{-} = -{}^{\alpha_1^{-}(\tau)}\!/_{\lambda(\tau)}$.

Cho et al. (2020) suggested that the QNARDL should first re-parameterised before the estimation in order to avoid the problem of singularity.

The QNARDL's framework in line with the operational designs in Eqs. 1 and 2 are given in Eq. 6 and 7, respectively, following the expression in Eq. 5:

$$\begin{aligned}\Delta LGDP_t(\tau) = {} & \alpha_0(\tau) + \alpha_1(\tau)LGDP_{t-1} + \sum_{i=0}^{m}\alpha_2(\tau)\Delta LGDP_{t-1} + \sum_{i=0}^{n1}\eta_1(\tau)\Delta CPF[{}^{Po}_{ne}]_{t-i} + \\ & \sum_{i=0}^{n3}\lambda_1(\tau)\Delta LIQY_{t-i} + \sum_{i=0}^{n3}\lambda_2(\tau)\Delta LEXR_{t-i} + \\ & \sum_{i=0}^{n4}\lambda_3(\tau)\Delta ITD_{t-i} + \sum_{i=0}^{n5}\lambda_4(\tau)\Delta LFID_{t-i} + \\ & \sum_{i=0}^{n6}\lambda_5(\tau)\Delta LOPS_{t-i} + \delta_1(\tau)CPF\,{}^{po}_{ne} + \\ & \theta_1(\tau)LIQY + \theta_2(\tau)LNEXR + \theta_3(\tau)ITD + \theta_4(\tau)LFID + \\ & \theta_5(\tau)LOPS + \phi(\tau)ECT + \mu_{it}\end{aligned} \quad (6)$$

$$\begin{aligned}\Delta LGDP_t(\tau) = {} & \alpha_0(\tau) + \alpha_1(\tau) LGDP_{t-1} + \sum_{i=0}^{m} \alpha_2(\tau) \Delta LGDP_{t-1} + \\ & \sum_{i=0}^{n1} \eta_1(\tau) \Delta CPF * LIQY[{}^{Po}_{ne}]_{t-i} + \sum_{i=0}^{n2} \lambda_1(\tau) \Delta CPF + \sum_{i=0}^{n3} \lambda_2(\tau) \Delta LIQY + \\ & \sum_{i=0}^{n4} \lambda_3(\tau) \Delta LEXR_{t-i} + \sum_{i=0}^{n5} \lambda_4(\tau) \Delta ITD_{t-i} + \sum_{i=0}^{n6} \lambda_5(\tau) \Delta LFID_{t-i} + \\ & \sum_{i=0}^{n7} \lambda_6(\tau) \Delta LOPS_{t-i} + \delta_1(\tau) CPF * LIQY^{\,po}_{ne} + \theta_1(\tau) CPF_t + \\ & \theta_2(\tau) LIQY + \theta_3(\tau) LNEXR + \theta_4(\tau) ITD + \theta_5(\tau) LFID + \\ & \theta_6(\tau) LOPS + \phi(\tau) ECT + \mu_{it},\end{aligned} \tag{7}$$

where the variables in Eqs. 6 and 7 are as defined in Eqs. 1 and 2; *ECT* is the error correction term; Δ is the difference operator; *m*, *n*1, *n*2, *n*3, *n*4, *n*5, and *n*6 represent the best lag values of the respective series which is selected using lag length information criteria; and μ is the white noise error term. Eqs. 6 and 7 are the QNARDL-ECM models. *Po* and *ne* represent increase and decrease in the respective threshold series, the threshold (asymmetric) series are capital flight and the interaction between capital flight and institutional quality. In line with Shin et al. (2014), we decomposed the asymmetric series (CPF and CPF*LIQY) as

$$CPF_t^{po} = \sum_{i=1}^{r} \Delta CPF_{t-i}^{po} = \sum_{i=1}^{s} \max(\Delta CPF_i, 0) \tag{8a}$$

$$CPF_t^{ne} = \sum_{i=1}^{r} \Delta CPF_{t-i}^{ne} = \sum_{i=1}^{s} \max(\Delta CPF_i, 0) \tag{8b}$$

$$CPF * LIQY_t^{po} = \sum_{i=1}^{r} \Delta CPF * LIQY_{t-i}^{po} = \sum_{i=1}^{s} \max(\Delta CPF * LIQY_i, 0) \tag{9a}$$

$$CPF * LIQY_t^{ne} = \sum_{i=1}^{r} \Delta CPF * LIQY_{t-i}^{ne} = \sum_{i=1}^{s} \max(\Delta CPF * LIQY_i, 0) \tag{9b}$$

The reliability of QNARDL lies in series integration orders of no more than 2; hence it is important to ascertain the series integration order. This work makes use of the Canova-Hansen test, which accounts for the seasonal component in

unit root computation and the quantile-based unit root estimation proposed by Koenker and Xiao (2006). This is done to make sure that the stationary processes I(1) and I(0) are used. Moreover, the Wald test of symmetry was used to estimate the symmetric relationship between the studied series across various quantiles. For each

of the threshold series in Eqs. 6 and 7, the null hypothesis is represented by $\eta(\tau)^{Po} = \eta(\tau)^{ne}\ as$ against the alternative that $\eta(\tau)^{Po} \neq \eta(\tau)^{ne}$ and

$\gamma(\tau)^{Po} = \gamma(\tau)^{ne}\ as$ against the alternative that $\gamma(\tau)^{Po} \neq \gamma(\tau)^{ne}$ An asymmetric link between the threshold series is implied by the decline in the null hypothesis.

4. EMPIRICAL OUTCOMES

4.1 Principal component analysis (PCA)

As stated earlier, we employed principal component analysis (PCA) to obtain an individual institutional quality metric for Nigeria, as indicated in Table 2.

Table 2: Principal component analysis (PCA) for institutional quality

				Scoring coefficient	
PCA	**EV**	**Proportion**	**Cumulative**	**Variable**	**Comp1**
CMP1	5.673**	0.71	0.71	Coc	0.41
CMP2	0.626	0.14	0.86	Gef	0.36
CMP3	0.414	0.06	0.94	Pav	0.32
CMP4	0.142	0.04	0.97	Rqu	0.41
CMP5	0.105	0.03	0.99	Rol	0.40
CMP6	0.075	0.02	1.00	Voc	0.33

Note: KMO is 89.24%; ** signifies the selected component

The Kaiser–Meyer–Olkin (KMO) statistic of the sampling capacity in Table 2 is 89.24%, which is higher than 50%, signifying that the collected data is suitable for factor and component analysis. Because its eigenvalue is greater than one, Table 2's first component is selected as the primary component. As a result, an individual institutional quality measure incorporates all the institutional quality metrics.

4.2 Descriptive statistics

Generally speaking, each scientific discussion begins with some descriptive statistics that serve as a foundation for further calculations. Therefore, summary statistics were applied to the pertinent series for this investigation. This test basically reveals the distributions' form and the behavioural pattern of the series, among other factors. In particular, the information provided by the descriptive statistics highlights whether or not the series are regularly distributed. Thus, Table 3 presents a summary of the test outcomes.

Table 3: Descriptive statistics

	LGDP	CPF	IQY	EXR	ITD	FID	OPS
Mean	8.680	9.157	67.983	158.91	-3.922	34.673	3.092
Maximum	11.87	10.545	87.982	458.98	15.711	67.863	10.389
Minimum	4.976	3.689	56.892	18.902	-74.45	4.5682	0.982
Skewness	-0.228	-0.791	1.8342	1.567	-2.632	1.4074	2.091
Kurtosis	3.873	4.982	3.9821	2.732	12.362	5.6541	3.981
Jarque–Bera	15.08**	8.091**	11.62**	17.02**	197.09**	74.82**	9.06**

Note: ** and * depict statistically significant at the 1% and 5% significance levels, respectively.

Based on the relevant Jarque-Bera statistics, Table 3 shows that the series deviate from the normal distribution. These results, which yield robust estimates in the face of anomalous distribution, notably justify the selection and use of a quantile-based nonlinear ARDL estimation approach (Cho et al., 2019, 2020, 2021; Koenker & Bassett, 1987; Odionye, Odo, et al., 2023; Odionye, Ojiaku, et al., 2024; Odionye, Ojiaku, & Uba, 2023; Odionye, Okorontah, et al., 2024). Only for the EXR does the kurtosis show a normal peak; the other series show an abnormal peak. Moreover, while other variables are favourably skewed, GDP, CPF, and ITD are inversely skewed.

4.3 BDS statistics

The Broock et al. (1996) estimation, also known as the BDS test, was used to substantiate the nonlinear attribute of the series. The estimation hypothesises the series is independent and identically distributed (i.i.d) in the residuals, while the

alternative hypothesis presupposes that the residual series exemplifies an anomaly of unconventionality, indicating nonlinear dependence.

Table 4: Summary of BDS statistics

Dimension	Series						
(m)	GDP	CPF	IQY	EXR	ITD	FID	OPS
2	0.196**	0.109**	0.091**	0.162**	0.081**	0.132**	0.176**
3	0.287**	0.165**	0.152**	0.235**	0.129**	0.203**	0.319**
4	0.356**	0.234**	0.173**	0.306**	0.167**	0.267**	0.423**
5	0.398**	0.287**	0.183**	0.323**	0.178**	0.290**	0.489**
6	0.426**	0.345**	0.193**	0.345**	0.199**	0.343**	0.523**

Note: ** and * indicate rejection of null hypothesis of linearity at 1% and 5% level of significance, respectively.

Table 4 shows that the alternative hypothesis was accepted while the null hypothesis of the BDS in the series was rejected. The findings demonstrate the nonlinear behaviour of the data series, necessitating the application of a nonlinear approach (Odionye, Ojiaku, & Uba, 2023).

4.4 Quantile unit root test

To ascertain the model series integration order, the quantile-based unit root test proposed by Koenker and Xiao (2006) was employed. In contrast to the alternative, which states that the variable has no unit root at a particular quantile, the unit root test postulates that the series has a unit root. The outcomes of the quantile-based unit root calculation are shown in Table 5.

Table 5: Quantile-based and seasonal unit root tests result

Variables	τ	0.05	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90	0.95
LGDP	β(τ)	1.09*	0.87*	0.87*	0.90*	0.93*	0.98*	1.00*	1.10*	0.99*	1.09*	1.21*
	t-stat	0.85	-1.9	-1.40	-0.79	0.19	0.65	1.43	1.33	1.90	1.43	1.08
	CV	-2.33	-2.31	-2.44	-2.33	-2.31	-2.44	-2.32	-2.34	-2.35	-2.39	-2.45
LCPF	β(τ)	0.68*	0.81*	083	0.77*	0.80*	0.81*	0.71*	0.81*	0.87*	0.91*	0.94*
	t-stat	-1.05	-2.13	-3.07	-2.05	-2.73	-2,53	-1.81	-1.50	-1.87	-1.84	-1.73
	CV	-2.33	-2.57	-2.75	-2.81	-2.95	-2.99	-2.96	-2.91	-2.96	-2.76	-2.74
LIQY	β(τ)	0.93*	0.91*	0.93*	0.92*	0.92*	0.94*	0.97*	0.93*	0.97*	0.92*	0.91*
	t-stat	-2.04	-1.91	-1.96	-1.95	-1.74	-1.31	-1.15	-1.15	-1.37	-1.09	-1.22
	CV	-2.45	-2.58	-2.82	-2.89	-2.99	-3.02	-3.02	-3.08	-2.98	-2.84	-2.72
LEXR	β(τ)	0.88	0.87*	0.93*	0.94*	0.87*	0.93*	0.98*	0.87*	0.91*	0.91*	0.92*
	t-stat	-2.97	-2.06	-2.01	-0.97	-1.84	-1.01	-0.75	-1.33	-1.04	-1.08	-1.61
	CV	-2.46	-2.65	-2.80	-2.41	-2.52	-2.67	-2.52	-2.71	-2.77	2.56	2.94
ITD	β(τ)	0.49*	0.51*	0.61*	0.76*	0.70*	0.69*	0.45	0.94*	0.96*	0.92*	0.91*
	t-stat	-0.69	1.21	1.98	-1.19	-1.18	-1.21	-2.33	-1.08	-1.59	-0.89	-1.88
	CV	-2.34	-2.34	-2.36	-2.37	-2.43	-2.36	-2.31	-2.34	-2.37	-2.33	-2.41
LFID	β(τ)	1.04*	1.02*	1.01*	1.00	1.00*	1.00	1.00*	0.99*	0.99*	0.98*	0.99*
	t-stat	0.94	0.93	2.15	2.61	2.01	2.86	1.36	-0.49	-0.78	-0.71	-0.27
	CV	-2.49	-2.45	-2.35	-2.34	-2.32	-2.34	-2.35	-2.38	-2.47	-2.63	-2.71
LOPS	β(τ)	0.79*	0.87*	0.87	0.91	0.96	0.96	0.85	0.87	0.89*	0.86*	0.61*
	t-stat	-1.03	-1.14	-7.93	-8.51	-9.14	-4.98	-6.34	-3.27	-1.44	-0.37	0.11
	CV	-2.32	-2.33	-2.33	-2.33	-2.32	-2.32	-2.33	-2.33	-2.31	-2.42	-2.42

Note: * indicates *t*-value < CV implying rejection of null hypothesis of unit root [β(τ)=1] at the quantile at the 5% level of significance.

Table 5 indicates that all the series are level stationary in diverse quantiles except trade openness (LOPS), which is level non-stationary in several quantiles. In particular, the test justifies the use of QNARDL since the series are fractionally integrated at diverse quantiles (Cho et al., 2019, 2020; Odionye, Nwosu Emmanuel, et al., 2023; Ullah et al., 2022). Our study, in line with Cho et al. (2019, 2020), adopted the two-step cointegration approach in order to generate the projected residual after—re-parameterised estimation to avoid the singularity problem. The result of cointegration is summarised in Table 6.

4.5 Cointegration test

Given that the condition for bound cointegration in the QNARDL model is satisfied, we estimate bound cointegration within the model framework of the QNARDL. The results are presented in Table 6.

Table 6: Two stage cointegration test

		Significance level			
Re-parameterised estimated residual	*t*-test	1%	5%	10%	Remark
Baseline model	-5.6744**	-3.489659	-2.887425	-2.530651	Cointegrated
Moderated model	-4.0983**	-3.489659	-2.887425	-2.580651	Cointegrated

Source: Author's computation. ** denotes statistically significant at the 1% level of significance.

Table 6 indicates a strong long-run relationship between capital flight, institutional quality, and economic growth given that the re-parameterised residual is level stationary. Thus, we estimate the QNARDL-ECM result.

4.6 Lag length selection

The best lag value for the series was selected based on the lag length information criteria and the results are presented in Table 7.

Table 7: Lag length choice based on information criteria

Lag	Logl	LR	FPR	AIC	SC	HQ
0	-310.0778	NA	0.000375	6.301556	6.431815	6.354274
1	218.9350	994.5442	1.57e-08	-3.778701	-2.997150	-3.462393
2	281.4143	111.2131	7.46e-09	-7.528286*	-3.095443*	-3.948389
3	293.8046	20.81575	9.70e-09	-4.276093	-2.191957	-3.432606
4	359.6786	104.0808	4.36e-09	-5.093571	-2.358142	-3.986494
5	429.7770	103.7457	1.82e-09	-5.995540	-2.608818	-4.624873
6	468.2094	53.03677*	1.46e-09*	-6.264188	-2.226175	-4.629932*

Note: * designates lag order nominated by the condition.

Table 7 shows lag 2 as the ideal lag value based on the information condition. Consequently, the QNARDL is estimated based on lag 2.

4.7 Quantile nonlinear autoregressive distributed lag result

As previously stated, the QNARDL technique is the model designed to determine the heterogeneous impact of capital flight and economic policy uncertainty on indigenous investment in Nigeria. For conciseness, the most pertinent empirical results are summarised in Table 8.

Table 8: Summary of quantile nonlinear ARDL result

	Quantiles								
Panel A: Short-term outcomes									
Variables	**Q_0.1**	**Q_0.2**	**Q_0.3**	**Q_0.4**	**Q_0.5**	**Q_0.6**	**Q_0.7**	**Q_0.8**	**Q_0.9**
LGDP(-1)	0.03**	-0.071	-0.08**	-0.08**	-0.10*	-0.09**	-0.12**	-0.15*	-0.17*
Δ(LGDP(-1))	0.04*	0.06**	0.08*	0.015**	0.22**	0.25**	0.034**	0.31**	0.047*
Δ(LCPF_PO)	-0.001	-0.009	-0.002	-0.005	-0.08**	-0.08**	-0.11**	-0.12**	-0.21**
Δ(LCPF_PO (-1))	-0.041	-0.039	-0.040	-0.043	-0.049	-0.051	-0.06**	-0.08**	-0.089**
Δ(LCPF_ NE)	-0.061	-0.041	-0.045*	-0.051	-0.054	-0.047	-0.031	-0.035	-0.042
Δ(LCPF_ NE(-1))	-0.003	-0.004	-0.003	-0.007	-0.008	-0.007	-0.012)	-0.026	-0.027
Δ(LIQY)	0.0113	0.0321	0.0371	0.043*	0.044**	0.079**	0.082**	0.181*	0.183**
Δ(LIQY(-1))	0.0041	-0.027	-0.016	0.002	0.035	0.063*	0.057**	0.059*	0.072**
Δ(LEXR)	0.081*	0.083**	0.086**	0.086**	0.085*	0.108**	0.110*	0.124*	0.145**
Δ(ITD(-1))	0.032	0.076	0.171	0.098	0.110	0.124	0.125	0.172	0.086
Δ(LFID)	0.104**	0.114**	0.112*	0.121**	0.127**	0.139**	0.141*	0..145*	0.163**
Δ(LOPS)	0.004	0.044	0.042	0.071	0.087	0.079	0.101	0..104	0.063**
ECP(-1)	0.012**	-0.037**	-0.042**	-0.069**	-0.073**	-0.073**	-0.076*	-0.081*	-0.097**
Validity test: RRT [0.89] SQT [41.56] QSET [37.86]** WT [36.32]****									
Panel B: Long-term outcomes									
LCPF_PO	-0.031	-0.035	-0.065	-0.086	-0.097	-0.121	-0.14**	-0.29**	-0.31**
LCPF_NE	-0.003	-0.007	-0.008	-0.009	-0.009	-0.011	-0.014	-0.013	-0.027
LIQY	0.024**	0.036**	0.043**	0.049*	0.052**	0.089**	0.123**	0.26**	0.481**
LEXR	0.091**	0.095**	0.098**	0.111**	0.121**	0.34**	0.56**	0.67**	0.72**
ITD	0.011	0.032	0.041	0.039	0.065	0.076	0.079	0.087	0.086
LFID	0.021*	0.034**	0.034**	0.047**	0.051**	0.075**	0.079*	0.083*	0.101**
LOPS	0.060)	0.031	-0.019	0.028	0.039	0.041	0.048	0.056	0.089
Validity test: RRT [1.31] SQT [26.11] QSET** [33.24] WT** [45.23]**									

Note: Standard errors are in parentheses; ** denotes $p<0.01$, * denotes $p<0.05$; RRT denotes the Ramsey RESET test model specification, SQT represents the slope quantile test, QSE denotes the quantile slope equality test for quantile symmetry, WT represents the Wald test of threshold variables.

Based on the results obtained from the QNARDL and summarised in Table 8, it is important to highlight that among other interesting outcomes, GDP (Δ(GDP (-1)) is self-reinforcing in all the quantiles. This outcome is demonstrated by the positive and substantial relationship existing between the past value of GDP and its present values.

Concerning the listed regressors, the short-term outcome (Panel A) indicates that elevated capital flight across different quantiles (Δ(LNCPF_PO)) largely reduces the country's GDP. The size of the coefficient indicates an increasing rate of deteriorating influence of capital flight on GDP along the upper quantiles,

suggesting a heterogenous influence of capital flight on GDP. In specific terms, elevated capital flight reduces the country's GDP in the middle and upper quantiles q-0.5, q-0.6, q-0.7, q-0.8, and q-0.9 by 0.08%, 0.08%, 0.11%, 0.12%, and 0.21%, respectively. The outcomes strongly uphold the hypothetical view that capital flight adversely influences a country's growth via the draining of investable funds in the country. Similarly, the long-term outcomes demonstrate that the country's GDP largely declined by 0.14%, 0.29%, and 0.31% in response to a 1% increase in capital flight at the upper quantiles, q-0.7, q-0.8, and q-0.9. This finding aligns with the findings of Orji et al. (2020), Igwemma, et al. (2021), Obidike et al. (2015), Ogundipe et al. (2020), and Uzoma Makwe et al. (2021) for Nigeria, Leykun Fisseha (2022) and Ngono (2022) for Africa. On the other hand, the reduction in capital flight (Δ(LNCPF_NE)) has no significant influence on GDP across the various quantiles. The implication of this outcome is that the adverse effect of capital flight on GDP is not reversed following a decline in capital flight. Clearly, the finding indicates that GDP responds asymmetrically to the sign and magnitude change in capital flight. The outcome validates the hysteresis attributes of these variables and the ratchet effects (Baldwin & Krugman, 1989; Dixit, 1989).

With regard to the institutional quality index (Δ(LIQY)), the short-term outcome (Panel A) demonstrates that institutional quality largely enhances Nigeria's GDP, especially between the 50^{th} and 90^{th} percentile change. Specifically, it demonstrates that a percentage increase in institutional quality (LIQY) causes Nigeria's GDP to increase by 0.043%, 0.044%, 0.079%, 0.082%, 0.181%, and 0.183% in the middle and upper quantiles (the 40^{th}, 50^{th}, 60^{th}, 70^{th}, 80^{th}, and 90^{th}, respectively) in the short run. However, in the low quantile (between the 10^{th} and the 40^{th}), it insignificantly influences GDP. Similarly, the long-run outcomes indicate that institutional quality enhances GDP in diverse quantiles. In particular, improvement in LIQY improves GDP at the 10^{th} to 90^{th} percentiles by 0.024%, 0.036%, 0.043%, 0.049%, 0.052%, 0.089%, 0.12%, 0.26%, and 0.48%, respectively, demonstrating an increasing positive effect of LIQY on GDP. What this means is that a strong institutional quality boosts investment and hence improves the country's GDP. This result aligns with the findings of Abubakar (2020) and Nathan et al. (2024) for Nigeria, Azam et al. (2021) and Uddin et al. (2023) for selected emerging nations, Tran et al. (2021) for Asian countries, Parsa and Datta (2023), Boukhatem and Ben Moussa (2023) for MENA nations.

In the case of the exchange rate coefficients, the estimation as demonstrated in panels A and B indicates that exchange rate (LEXR) significantly increases domestic investment in both the short run and long run across diverse quantiles. This validates the theoretical view that exchange rate depreciation enhances domestic production through improved international competitiveness of a country. Similarly, in both the short run and the long run, financial development (LFID), as expected, enhances Nigeria's GDP in all the quantiles. This result supports the finding of Adu-Darko (2024). On the other hand, interest rate differentials and trade openness have insignificant influence on Nigeria's GDP.

The speed of adjustment (ECP(-1)) is appropriately signed and significant in all the quantiles, indicating a long-run convergence of the variables.

The estimation outlining the validity test confirms the asymmetric attributes of the series across diverse quantiles since the null hypothesis of symmetric attributes is rejected. Similarly, slope equality is significant, implying asymmetric slope coefficients across different quantiles, whereas the Ramsy RESET test indicates appropriately stated models. The Wald test indicates that the threshold series (capital flight) exhibit asymmetric links between the threshold variables. These outcomes validate the asymmetric and heterogenous influence of capital flight and institutional quality on GDP.

4.8 Does institutional quality mitigate the devastating effects of capital flight on GDP?

To investigate whether institutional quality (LIQY) mitigates the inverse link between capital flight and GDP, the study examines the interaction effects of capital flight and LIQY on GDP in line with Eq. 1b. The outcome is displayed in Table 9.

Table 9: Interaction effects of capital flight and institutional quality on GDP

	Quantiles								
Panel A: Short-term outcomes									
Variables	**Q_0.1**	**Q_0.2**	**Q_0.3**	**Q_0.4**	**Q_0.5**	**Q_0.6**	**Q_0.7**	**Q_0.8**	**Q_0.9**
LGDP(-1)	0.04*	-0.06	-0.09**	-0.09**	-0.09*	-0.10**	-0.13**	-0.16*	-0.18*
Δ(LGDP(-1))	0.03*	0.06**	0.07*	0.11**	0.16**	0.22**	0.034**	0.32**	0.41*
Δ(LCPFLIQY_PO)	0.007	-0.011	0.014	0.021	0.026	0.027	0.009**	0.012**	0.021**
Δ(LCPFLIQY_NE)	0.023	0.025	-0.002	0.004	0.022	0.052	-0.045	-0.043	0.053
Δ(LCPF)	-0.003*	-0.004	-0.015	-0.009**	-0.014*	-0.023**	-0.027**	-0.028*	-0.031**
Δ(LIQY)	0.0113	0.0322	0.0041	0.045**	0.065**	0.081**	0.087**	0.091*	0.101**
Δ(LIQY(-1))	0.039	-0.011	-0.019	0.004	0.031	0.052*	0.053**	0.054*	0.081**
Δ(LEXR)	0.076*	0.079*	0.081**	0.086**	0.086*	0.088**	0.088*	0.093*	0.099**
Δ(ITD(-1))	0.011	0.034	0.045	0.044	0.037	0.042	0.062	0.101	0.098
Δ(LFID)	0.114**	0.121	0.105*	0.111**	0.117*	0.126**	0.136*	0..148*	0.159**
Δ(LOPS)	0.011	0.023	0.034	0.076	0.077	0.082	0.097	0..085	0.083
ECP(-1)	0.011**	-0.014*	-0.022**	-0.079**	-0.053*	-0.063**	-0.071*	-0.076*	-0.086**
Validity Test: RRT [1.29] SQT [34.56] QSET [51.86]** WT [46.11]****									
Panel B: Long-term outcomes									
LCPFLIQY_PO	-0.009	0.011	0.019*	0.086**	0.097**	0.098**	0.110**	0.181**	0.321**
LCPFLIQY_NE	-0.023	0.027	-0.028	-0.027	-0.029	-0.034	-0.037	-0.034	-0.046
LCPF	-0.011*	-0.009	-0.013	-0.017	-0.019*	-0.043**	-0.051**	-0.073**	-0.085**
LIQY	0.034**	0.03*	0.038**	0.043**	0.049**	0.069**	0.114**	0.145**	0.281**
LEXR	0.077**	0.079*	0.081**	0.084*	0.091**	0.098**	0.161**	0.47**	0.55**
ITD	0.031	0.192	0.121	-0.139	0.105	0.276	0.201	0.187	0.486
LFID	0.121*	0.124**	0.123**	0.147**	0.151**	0.275**	0.279*	0.243*	0.301**
LOPS	0.009	0.011	0.014	0.022	0.026	0.031	0.029	0.028	0.079
Validity Test: RRT [1.01] SQT [33.11] QSET** [41.24] WT** 28.83**									

Note: Standard errors are in parentheses; ** denotes p<0.01, * denotes p<0.05; RRT denotes the Ramsey RESET test model specification, SQT denotes the slope quantile test, QSE represents the quantile slope equality test for quantile symmetry, WT represents the Wald test of threshold variables. LCPFLIQY_PO and LCPFLIQY_NE represent the increase and decrease of the interaction between capital flight and institutional quality, respectively.

Table 9 clearly demonstrates that improvements in institutional quality (absence of political violence, adherence to rule of law, improved regulatory system, enhanced accountability, government effectiveness, control of corruption) mitigate the suppressing influence of capital flight asymmetrically on GDP. This obvious reason is based on the outcomes as demonstrated in Panel A (short-run outcomes) and Panel B (long-run outcomes), where the coefficients of interaction terms ((Δ(LCPFLIQY_PO)) and (LCPFLIQY_PO) significantly enhance GDP in several quantiles, particularly the upper quantiles. In particular, at the middle and upper quantiles (q-0.3, q-0.4, q-0.5, q-0.6, q-0.7, q-0.8, and q-0.9), the interaction between LIQY and capital flight substantially increases Nigeria's GDP in the long

run (Panel B) by 0.02%, 0.09%, 0.09%, 0.1%, 0.11%, 0.18%, and 0.32%, respectively, following a one-per cent increase, whereas in the short run (Panel A), it significantly increases the country's GDP only at the upper quantiles (q-0.7 to q-0.9) by 0.009%, 0.012%, and 0.021%, respectively. This result implies that the positive influence of institutional quality on GDP outweighs the adverse effect of capital flight on GDP. The implication of this outcome is that sound institutions demonstrated through good governance, control of corruption, political stability, rule of law, transparency, and a strong regulatory body reduce capital flight and thereby boost the nation's GDP via increased investment.

In relation to the covariates, the outcome as displayed in Table 9 (Panels A and B) demonstrates that the exchange rate (LEXR) and financial development (LFID) substantially affect Nigeria's GDP positively across different quantiles in both the short run and the long run, upholding the hypothetical view that financial stability largely affects the country's growth of foreign investment. Furthermore, the outcomes from the exchange rate uphold the flow-oriented model that exchange rate depreciation enhances the country's global competitiveness and, hence, increases GDP.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This study examined the heterogenous influence of capital flight and its interaction with institutional quality on economic growth in Nigeria using the novel QNARDL model. The study uniquely contributes to the existing literature by providing the sign-based and magnitude-based asymmetric link between the series. Secondly, it provides the effect of interaction between capital flight and institutional quality on GDP. The study's outcomes indicate, first, that capital flight substantially influences GDP adversely at diverse quantiles. The implication is that the Nigeria's GDP deteriorated through decline in domestic investment following massive capital flight. The study thus recommends a business-friendly environment and investment-oriented policy to spur investors to massively invest in the country rather than transferring to other countries. Second, it demonstrates that institutional quality significantly affects GDP positively. In order to guarantee higher production levels and increase GDP, sound institutions are required in the financial markets to fulfil their obligations to investors in terms of accessible loan facilities devoid of unnecessary bottlenecks. In addition, the government should strengthen growth-promoting institutions necessary to

achieve high and sustained growth. Third, while capital flight is detrimental to economic growth, institutional quality mitigates the devastating effect of capital flight on economic growth at diverse quantiles both in the short run and long run.

The study's main conclusions and policy recommendations are that, considering that strong institutional quality mitigates the deteriorating influence of capital flight on GDP, the country's government must strengthen its institutions. This includes: (i) Strengthening government regulatory bodies in order to enhance their efficacy in ensuring that market participants adhere to regulations. The government's judicial branch must be fully independent through legislation in order to achieve this goal. (ii) The government must ensure political stability and deliberately pursue policies that ensure a stable political system, as political crises weaken the business environment and instill the fear of losing money among investors. (iii) The government should eliminate institutional shortcomings and create an atmosphere that is beneficial to business. (iv) Since investors are concerned about citizens' adherence to the rule of law, the government must raise their citizens' ratings of its adherence to the law. This can be done through massive citizen awareness, and individuals in positions of power should set a good example for the executive, legislative, and judicial branches of government. (v) The fight against corruption must be taken seriously in Nigeria. This could include revisiting the act setting up all the antigraft agencies and overhauling their operations. At the moment, the executive branch of government in the country has taken over these agencies' functions and is now using them to 'witch-hunt' their political rivals. In order to halt this detrimental trend, the agencies must become more accountable for their actions by being established as fully autonomous branches of government, housed under the judiciary branch and endowed with the legislative authority to investigate, prosecute, and convict anyone found guilty of corruption. (vii) The government should institute and uphold a robust legal system that safeguards property rights and guarantees equitable enforcement of contracts. This gives entrepreneurs and investors confidence to make investments in the nation, which boosts development and productivity. (viii) The government should establish a predictable and transparent regulatory framework that lowers bureaucratic barriers to business. This can promote investment, growth, and development while also assisting firms in operating more effectively

REFERENCES

Abiodun, A., & Yusuf, I. (2022). Economic openness, institutional quality and economic growth in Nigeria. https://doi.org/10.21203/rs.3.rs-1986869/v1

Abubakar, S. (2020). Institutional quality and economic growth: Evidence from Nigeria. *African Journal of Economic Review*, *8*(1), 48–64.

Adu-Darko, E. A. (2024). The role of institutional quality and financial development in economic growth in Sub-Saharan Africa – Linear and nonlinear analysis with structural breaks. *African Review of Economics and Finance*, *16*(1), 221–238.

Akinlo, T., & Aderounmu, B. O. (2024). Capital flight, institutional quality and real sector in Sub-Saharan African countries. Journal of Money Laundering Control, 27 (5), 944 – 961, https://doi.org/10.1108/JMLC-07-2023-0123.

Alexiou, C., Tsaliki, P., & Osman, H. R. (2014). Institutional quality and economic growth: Empirical evidence from the Sudanese economy. *Economic Annals, 59* (203), https://doi.org/10.2298/EKA/1403119A

Ani, E. C, Dauda, I. M., & Baajon, M. A (2018). Capital flight and economic growth in Nigeria: An empirical analysis. *International Journal of Humanities, Art and Social Studies*, *3*(3), 1–11.

Azam, M., Hunjra, A. I., Bouri, E., Tan, Y., & Al-Faryan, M. A. S. (2021). Impact of institutional quality on sustainable development: Evidence from developing countries. *Journal of Environmental Management*, *298*, 113465. https://doi.org/10.1016/j.jenvman.2021.113465

Baek, S. C., & Yang, D. Y. (2010). Institutional quality, capital flight and capital flows. *Korean Economic Review*, *26*(1), 121–155.

Baldwin, R., & Krugman, P. (1989). Persistent trade effects of large exchange rate shocks. *The Quarterly Journal of Economics*, *104*(4), 635–654.

Baliamoune, L. M. (2015). Institution, social capital, and economic development in Africa: An empirical study. *International centre for Economic Research, Working Paper No. 18.*

Basorudin, M., Kusmaryo, O.H. & Rachmad, S.H. (2020). Preventing capital flight to reach lucrative investment in Indonesia. *Journal of Business, Economics and Environmental Studies, 10*(1), 29-36.

Bello, U.H.M. & Shittu, W. O. (2018). Impact of capital flight on economic growth in Nigeria. *Lapai Journal of International Politics, 5*(1), 36-46.

Boukhatem, J., & Ben Moussa, F. (2023). Financial inclusion, institutional quality, and economic growth in MENA countries: Some evidence from panel cointegration. *Macroeconomics and Finance in Emerging Market Economics*, 1–24. https://doi.org/10.1080/17520843.2023.2284455

Boyce, J. K., & Ndikumana, L. (2008). *New estimates of capital flight from sub-Saharan African countries: Linkages with external borrowing and policy options* (Political Economy Research Institute Working Paper No. 166).

Bredino, S., Fiderikumo, P., & Adesuji, A. (2018). Impact of capital flight on economic growth in Nigeria: An econometric approach. *Journal of Business and Economic Development*, *3*(1), 22–29.

Broock, W. A., Scheinkman, J. A., Dechert, W. D., & LeBaron, B. (1996). A test for independence based on the correlation dimension. *Economic Reviews*, *15*(3), 197–235. https://doi.org/10.1080/07474939608800353

CBN (2022). *Central Bank of Nigeria Statistical Bulletin*. Abuja: CBN.

Cho, J. S., Greewood-Nimmo, M. J., Kim, T.-H., & Shin, Y. (2020). *Hawks, Doves and asymmetry in US monetary policy: Evidence from a dynamic quantile regression model*. Mimeo: University of York.

Cho, J. S., Greewood-Nimmo, M. J., & Shin, Y. (2019). *Two-step estimation of the non-linear autoregressive distributed lag model* (Working Paper, 2019 rwp-154). Yonsei University, Yonsei Economics Research Institute.

Cho, J. S., Greewood-Nimmo, M. J., & Shin, Y. (2021). Recent development of the autoregressive distributed lag modelling framework. *Journal of Economic Surveys*, *37*(1), 7–32. https://doi.org//10.1111/joes.12450

Cho, J. S., Kim, T.-H., & Shin, Y. (2015). Quantile cointegration in the ARDL modelling framework. *Journal of Econometrics*, *188*, 281–300.

Das, N. C., Chowdhury, M. A. F., & Islam, M. N. (2021). Nonlinear threshold effects of institutional quality on capital flight: Insights from Bangladesh. *International Journal of Asian Business and Information Management*, *12*(1), 41–59, https://doi.org/10.4018/IJABIM.20210101.oa3

Dirir, S. A. (2023). The effect of institutional quality on economic growth: Evidence from tripartite approaches in the context of war-torn countries. *Organizations and Markets in Emerging Economies*, *14*(3), 508–535. https://doi.org/10.15388/omee.2023.14.3

Dixit, A. (1989). Hysteresis, import penetration, and exchange rate pass through. *The Quarterly Journal of Economics*, *104*(2), 205–228.

Effiom, L., Uche, E., & Otei, O. A. (2021). Asymmetric effects of capital flight on domestic investment in Nigeria: Evidence from non-linear autoregressive distributed lag model. *SN Business & Economics*, *1*(10), 134.

Federal Ministry of Finance, Budget and National Planning (FMOFBNP). (2021). *Nigeria's Medium Term National Development Plan (MTNDP) 2021–2025*. Abuja: Federal Ministry of Finance, Budget and National Planning.

Forson, R., Obeng, C. K., & Brafu-Insaidoo, W. G. (2017). Determinants of capital flight in Ghana. *Journal of Business and Enterprise Development*, *7*,108–130.

Gusarova, V. (2009). *The impact of capital flight on economic growth* [Unpublished Master's Thesis]. KYIV School of Economics.

Henry, A.W. (2016). Analysis of the effects of capital flight on economic growth: Evidence from Nigerian Economy (1980–2011). *European Journal of Business and Management*, *5*(17), 21–33.

Heras Recuero, L., & Pascual González, R. (2019). *Economic growth, institutional quality, and financial development in middle-income countries* (Banco de Espana Working Paper No. 1937). http://dx.doi.org/10.2139/ssrn.3489866

Hermes, N., & Lensink, R. (2001). Capital flight and the uncertainty of government policies. *Economics Letters*, *71*(3), 377–381.

Hussen, M. S. (2023). Institutional quality and economic growth in Sub-Saharan Africa: A panel data approach. *Journal of Economics and Development*, *25*(4), 332–348.

Igwemma, A. A, Egbulonu, K. G., & Nneji, A. C. (2018). Capital flight and Nigerian economy. *International Journal of Development and Economic Sustainability*, *6*(4), 11–28.

Kasongo, A. (2022). The impact of capital flight on domestic investment: Empirical evidence from South Africa. *African Review of Economics and Finance*, *14*(2), 88–102.

Koenker, R., & Bassett, G., Jr. (1978). Regression quantile. *Econometrica*, *46* (1), 33–50.

Koenker, R., & Xiao, Z. (2006). Quantile autoregression. *Journal of the American Statistical Association*, *101*(475), 980-990.

Kollamparambil, U., & Gumbo, D. (2018). Capital flight in Africa: An Analysis of macroeconomic and institutional quality determinants. *African Finance Journal*, *20*(2), 21–44.

Lehne, J., Mo, J., & Plekhanov, A. (2014). What determine the quality of economic institutions? Cross-country evidence. European Bank for Reconstruction and Development (EBRD) Working Paper No. 171, https://dx.doi.org/10.2139/ssrn.3121122

Leykun Fisseha, F. (2022). Effect of capital flight on domestic investment: Evidence from Africa. *Cogent Economics & Finance*, *10*(1), 2105975. https://doi.org/10.1080/23322039.2022.2105975

Lucas, R. E., Jr. (1990). Why doesn't capital flow from rich to poor countries?. *American Economic Review*, *80*(2), 92–96.

Mazadu, U. S., & Usman, M. D. (2021). Impact of capital flight on economic growth: Evidence from Nigeria. *Lapai Journal of Economics*, *5*(2), 55–69.

Mohammed, S. S., Kassem, G. M., & Ali, M. (2023). Financial inclusion, institutional quality and economic growth in Sub-Sahara African countries. *Energy RESEARCH LETTERS*, *5*(3). https://doi.org/10.46557/001c.77903

Musibau, H. O. (2017). The capital flight from Nigeria: An empirical analysis. *Journal of Indonesian Applied Economics*, *7*(2), 131–145.

Nathan, E., Stanley, U. K., & Adu, M. J. (2024). Institutional quality, government expenditure and economic growth nexus in Nigeria. *NG Journal of Social Science Development*, *13*(1), 1–19.

Ngono, J. F. L. (2022). Capital flight, quality of institutions and domestic investment in Africa. *Economics Bulletin, 42*(1), 193–302.

Nguyen, C. P., Su, T. D., & Nguyen, T. V. H. (2018). Institutional quality and economic growth: The case of emerging economies. *Theoretical Economics Letters*, *8*(11), 1943–1956. https://doi.org/10.4236/tel.2018.811127

Obidike, C. P., Uma, K. E., Odionye, J. C, & Ogwuru, H. O. R. (2015). The impact of capital flight on economic development: Nigeria in focus. *British Journal of Economics, Management and Trade*, *10*(3), 1–13.

Odionye, J. C., & Chukwu, J. O. (2023). Asymmetric reactions of stock prices and industrial output to exchange rate shocks: Multiple threshold nonlinear autoregressive distributed lag framework. *Economic Annals*, *68*(237), 165–191. http://doi.org/10.2298/EKA2337165C

Odionye, J. C., Duru, I. U., Nzeh, I. C., Uguru, N. E., & Uzoma, K. P. (2024). Heterogeneous influence of capital flight and economic policy uncertainty on domestic investment in Nigeria: New evidence from quantile nonlinear ARDL. *Journal of International Commerce, Economic and Policy*, *15*(3), 1–33. https://doi.org/10.1142/s1793993324500248

Odionye, J. C., Nwosu Emmanuel, O., Odo, A. C., Ugwuegbe, U. S., & Uba, C. N. (2023). Asymmetric impact of multifarious exchange rate shocks on stock prices: Fresh insights from multiple thresholds nonlinear autoregressive distributed-lag approach. *The Journal of International Trade & Economic Development*, *33*(5), 868–902. https://doi.org/10.1080/09638199.2023.2223320

Odionye, J. C., Odo, A. C., Ikpe, M., & Ojike, R. O. (2023). Threshold-based asymmetric reactions of trade balances to currency devaluation: Fresh insights from smooth transiton regression (STR) model. *International Review of Applied Economics*, *37*(4), 435–456. https://doi.org/10.1080/02692171.2023.2234311

Odionye, J. C., Odo, A. C., Orji, A., Agoh, N., Ihezukwu, V. A., Ojike, R. O., & Okpara, R. M. (2024). Threshold-based influence of currency devaluation on external deb sustainability: Insights from smooth transition regression and multiple thresholds nonlinear ARDL approaches. *The*

Journal of International Trade & Economic Development, 1–34. https://doi.org/10.1080/09638199.2024.2389873

Odionye, J. C., Ojiaku, E. U., Okpara, G. C., Agoh, N., & Okpara, R. M. (2024). Economic policy uncertainty and stock market index: Fresh insights from augmented-ARDL and multiple structural breaks. *Journal of International Commerce, Economics and Policy*, *15*(2), 1–24, https://doi.org/10.1142/s1793993324500108

Odionye, J. C., Ojiaku, E. U., & Uba, C. N. (2023). Impact of interest rate differential, exchange rate changes and political stability on foreign capital inflow in Nigeria: Discrete threshold regression model. *Cogent Economics & Finance*, *11*(1), 2203590. https:/doi.org/10.1080/23322039.2023.2203590

Odionye, J. C., Okorontah, C. F., Uruakpa, C. G., Odionye, N., Okpara, R. M., & Uba, C. N. (2024). Heterogeneous determinants of environmental sustainability: Assessing the roles of energy consumption, economic growth, and financial development. *Economic Annals*, *69*(241), 65–93. https://doi.org/10.2298/EKA2441065O

Ogundipe A A., Oye, Q. E., Ogundipe, O. M., & Osabohien, R (2020). Does infrastructural absorptive capacity stimulate FDI–growth nexus in ECOWAS. Cogent Economics and Finance, 8, https://doi.org/10.1080/23322039.1751487

Orimolade, E. M., & Olusola, A. B., (2018). Capital flight and the growth of Nigerian economy: An Autoregressive Distributed Lag (ARDL) Modeling. *International Journal of Economics and Business Management*, *4*(2), 1- 15

Orji, A., Ogbuabor, J. E., Kama, K., & Anthony-Orji, O. I. (2020). Capital flight and economic growth in Nigeria: Evidence from ARDL approach. *Asian Development Policy Review*, *8*(3), 171–184.

Parsa, M., & Datta, S. (2023). Institutional quality and economic growth: A dynamic panel analysis of MICs and HICs for 2000–2020. *International Economic Journal*, *37*(4), 675–712. https://doi.org/10.1080/10168737.2023.2261012

Pesaran, M. H., & Shin Y. (1998). An autoregressive distributed lag approach to cointegration analysis. In *Econometrics and Economic Theory: The Ragnar Frisch Centennial Symposium*. Cambridge: Cambridge University Press.

Rahmon, A. B. (2017). An empirical investigation of capital flight and domestic investment in Nigeria (1980–2015). *Journal of Economics and Sustainable Development*, *8*(24), 8–16.

Salandy, M., & Henry, L. (2017). The impact of capital flight from beautiful places: The case of the small open economy of Trinidad and Tobago. *Journal of Economics and International Finance*, *9(6)*,54–61.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In W. C. Horrace, & R. C. Sickles (Eds.). *Festschrift in Honor of Peter Schmidt: Econometric Methods and Applications* (pp. 281–314). New York: Springer Science and Business Media.

Tran, O. K. T., Le, H. D., & Nguyen, A. H. V. (2021). Role of institutional quality in economic development: A case study of Asian countries. *Problems and Perspectives in Management*, *19*(2), 357–369. https://dx.doi.org/10.21511/ppm.19(2).2021.29

Uddin, I., Ahmad, M., Ismailov, D., Balbaa, M. E., Akhmedov, A., Khasanov, S., & Haq, M. U. (2023). Enhancing institutional quality to boost economic development in developing nations: New insights from CS-ARDL approach. *Research in Globalization*, *7*, 100137. https://doi.org/10.1016/j.resglo.2023.100137

Ullah, A., Zhao, X., Amin, AA., Syed, A.A. & Riaz, A. (2022). Impact of COVID-19 and economic policy uncertainty on China's stock market returns: Evidence from quantile-on-quantile and causality-in quantile approaches. Environmental Sciences and Pollution Research, https://doi.org/10.1007/s11356-022-22680

Utile, T. I., Ijirshar, V. U., & Sem, A. (2021). Impact of institutional quality on economic growth in Nigeria. *Gusau International Journal of Management and Social Sciences*, *4*(3), 157–177.

Uzoma Makwe, E., N. Gbosi, A., & A. Gbanador, C. (2021). Hypotheses testing: Capital flight and human development index in Nigeria. *South Asian Journal of Social Studies and Economics*, *12*(4), 173–190.

Wandeda, D. O., Musai, W., & Myandemo, S. M. (2021). Institutional quality and economic growth: Evidence from Sub-Sahara Africa countries. *African Journal of Economic Review, 9* (4), https://doi.org/10.22004/ag.econ.315816

World Development Indicators (2022). The World Bank, Washington, D. C. Retrieved from http://data.worldbank.org/indicator.

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Capitalism in the 21st Century: Through the Prism of Value, by Guglielmo Carchedi and Michael Roberts, London: Pluto Press 2023.

JEL CLASSIFICATION: B51, F54, D46

1. MARX'S VALUE THEORY IN A NEW ERA

This book aims to explain 21st-century capitalism through Marx's value theory, aligning with the efforts to reintroduce value theory into mainstream discourse (Mazzucato, 2018; Milanović, 2019; Picketty, 2013). However, unlike these contributions, which remain within the framework of heterodox or critical political economy, this book adopts a distinctly Marxist approach, placing it within the tradition of radical economics. As mainstream economic discourse continues to marginalise value theory, this book's engagement with Marxian categories offers a necessary counterpoint and challenges dominant economic paradigms.

Reinvigorating Marx's value theory is not just an intellectual exercise but a necessary response to contemporary capitalism's crises. As financial instability, rising inequality, ecological degradation, and geopolitical tensions intensify, mainstream economic frameworks often fail to offer coherent explanations (Streeck, 2017; Tooze, 2018). By returning to the foundational concepts of labour, value, and exploitation, Carchedi and Roberts provide an analytical lens that helps decode capitalism's contradictions in the 21st century. More than just an analysis of crisis, the book also contributes to the search for alternatives, offering socialist solutions to the systemic failures it describes. In this sense, it is part of an

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ongoing effort to rethink economic structures beyond capitalism, engaging with debates on democratic planning, worker self-management, and post-capitalist production models (Albert and Hahnel, 1991; Ellerman, 2021; Wolff, 2012).

The book's strength lies in its original research, particularly in chapters on the value-based theory of inflation and economic imperialism. Additionally, it engages with contemporary issues such as COVID-19, examining how the law of value manifests during crises. Throughout the book, the authors expose how misconceptions and distortions in modern capitalism are often exploited to protect capital's interests, particularly at the expense of labour. The book comes with a helpful introduction, which explains the law of value and related Marxist concepts, such as surplus value.

2. VALUE, PRICE, AND THE ECOLOGICAL COSTS OF CAPITAL ACCUMULATION

The book begins by addressing how capitalism disrupts the relationship between humans and nature. Using Marxist value theory, the authors critique methods such as natural capital accounts (NCA), arguing that they fail to accurately measure natural wealth due to a fundamental confusion between value and price. The authors argue that as long as natural goods are not market transactions, their value cannot be accurately estimated.

They proceed from a classical Marxist premise that capitalism tends to invest more in machines, factories, and infrastructure (fixed capital) rather than in wages, raw materials, and other day-to-day expenses (circulating capital). This shift allows businesses to produce more goods while spending less on inputs, ultimately increasing profits. The chapter demonstrates how energy revolutions have created new opportunities for capitalist accumulation waves by reducing fixed capital costs.

Their original research quoted in the book shows a strong correlation between carbon emissions and profits, which in the authors' opinion, suggests that faster profit growth leads to increased emissions. The chapter critiques market-based climate solutions, arguing they fail because mitigation is not profitable for companies. The degrowth movement, which advocates for reducing economic production and consumption to address environmental limits, is also criticised for lacking a class perspective and an ecological theory of capitalist accumulation. While degrowth theorists (Hickel, 2020; Latouche, 2009; Kallis et al., 2018) argue that endless economic expansion is unsustainable, Carchedi and Roberts contend that degrowth fails to address the structural imperatives of capitalism, which

drive accumulation regardless of ecological constraints. Without a class analysis, degrowth risks framing ecological collapse as a problem of overconsumption rather than a consequence of capitalist exploitation and unequal distribution of resources.

The authors conclude that controlled and planned growth under socialism could provide an alternative to capitalism's inherently expansionary nature. However, it is important to clarify what they mean by this. Their argument (developed more in the book's last chapter) does not advocate for unrestricted industrial expansion but rather for a model where production is consciously directed to meet social needs while minimising ecological harm. The authors argue that a socialist system – if explicitly oriented towards ecological priorities and democratic planning – could avoid the pitfalls of 'real socialism' (not least in Yugoslavia), where economic planning did not necessarily lead to ecological sustainability.

3. CHALLENGING CONVENTIONAL WISDOM: MMT, CRYPTOCURRENCIES, AND INFLATION

This chapter critically examines the relationship between value and money, focusing on a critique of modern monetary theory (MMT). The authors argue that MMT misunderstands the fundamental nature of money by ignoring its connection to value production in a capitalist economy. MMT treats money primarily as a creation of the state, issued through government spending and taxation (Wray, 2015), whereas Marxist theory sees money as a representation of socially necessary labour time – the value produced by workers. According to the authors, MMT's approach leads to a 'fictitious economic world' because it treats money as an independent tool of policy rather than as a reflection of underlying economic and class relations. They argue that by equating money with state-issued credit and debt, MMT detaches it from its historical and material roots in the production process, overlooking the exploitative dynamics of capitalism.

MMT's assumption that the state can create money without limits is critiqued, as it ignores the necessity of production to increase money value. The chapter argues that profits drive investment, not vice versa, and that private savings enable government deficits, contrary to the MMT claims. The authors contend that MMT benefits rich countries through currency seigniorage, while smaller economies risk hyperinflation if money is printed excessively.

Of course, critiques of MMT are not exclusive to Marxists. Many mainstream economists, including both neoclassical and Keynesian scholars, have raised

significant objections to MMT, albeit from different perspectives. Larry Summers (2019) famously dismissed it as 'voodoo economics' arguing that it politicises public finances and risks leading to fiscal dominance. Similarly, Kenneth Rogoff (2019) labelled MMT a 'recipe for hyperinflation', warning that excessive reliance on money creation could destabilise the economy. In this respect, Carchedi and Roberts offer a different angle, critiquing MMT not merely for its potential macroeconomic risks but for its fundamental misunderstanding of capitalism's value dynamics.

Building on their critique of MMT's detachment of money from value production, the authors apply the same value-theoretic approach to analyse why cryptocurrencies cannot serve as an alternative foundation for capitalism. They argue that, like MMT, proponents of cryptocurrencies overlook the fundamental connection between money and labour-based value creation. Carchedi and Roberts contend that Bitcoin fails as a reliable currency because it lacks stability as a store of value, a means of exchange, and a unit of account.

This critique, once again, is not unique to Marxists. Many mainstream economists have also expressed scepticism about cryptocurrencies, though their critiques often focus on financial stability, regulation, and economic inefficiencies rather than deeper structural issues related to production and exploitation. Paul Krugman (2018) has argued that Bitcoin is a 'cult' rather than a viable alternative to fiat money, primarily due to its inefficiency as a medium of exchange and its deflationary tendencies.

The authors analyse inflation through the Marxist theory of value, rejecting the Friedmannian view that it is 'always and everywhere a monetary phenomenon'. Instead, they argue that inflation stems from the declining relative share of labour and capital's combined purchasing power (CPP) as a percentage of total value. Dismissing both the cost-push Keynesian and demand-pull mainstream approaches, they propose the value rate of inflation (VRI) as a more comprehensive measure.

The VRI reflects the interplay between the percentage change in CPP (the value factor) and the percentage change in M2 (the money factor). Their research finds that VRI explains over a third of CPI variations in the US between 1960 and 2018 and is consistently higher than CPI, indicating that conventional inflation measures underestimate real purchasing power losses. As a result, they argue that wage negotiations based on CPI adjustments fail to fully compensate labour and advocate for VRI as a more accurate benchmark. Their perspective aligns with

emerging heterodox critiques, such as Isabella Weber's work on 'greedflation' (Weber & Wasner, 2023), which challenges conventional inflation narratives.

4. MARX'S THEORY OF CRISIS AND ECONOMIC IMPERIALISM

Carchedi and Roberts discuss Marx's theory of crises, attributing capitalist crises to the tendential fall in the profit rate, which involves tendencies and countertendencies. Using US corporate profit and investment statistics, they show that every post-WWII crisis followed a peak in profit rates, leading to investment collapse. The authors reject underconsumption as a crisis cause, noting that 11 of 12 post-WWII crises were preceded by rising wages.

In line with the long-established Marxist tradition (Baran & Sweezy, 1966), the authors claim that economic crises stem from the shrinking ability to valorise capital due to falling profitability as capitalists are increasingly struggling to generate surplus value at the same rate as before. However, imperialist exploitation of the capitalist periphery can expand this space. The authors define imperialist exploitation as the long-term net appropriation of surplus value by high-tech countries from low-tech ones, through channels like currency seigniorage, investment income flows, unequal trade exchange, and exchange rate changes. Surplus value is one of the most fundamental concepts in Marxist economics and refers to the unpaid labour extracted from workers, which is the source of profit, rent, and interest in a capitalist economy.

The authors apply this concept to international trade and present new data to support the Marxist theory of unequal exchange, which argues that trade under capitalism systematically transfers value from lower-wage economies to higher-wage economies (Amin, 1976). Unlike mainstream trade theories – such as Ricardian comparative advantage, which suggests that trade benefits all parties by allowing specialisation, or Heckscher-Ohlin theory, which explains trade patterns based on factor endowments – the theory of unequal exchange contends that global trade under capitalism structurally favours developed economies. This perspective aligns with elements of the Prebisch-Singer hypothesis, which empirically demonstrated that developing countries suffer from a long-term deterioration in their terms of trade (Prebisch, 1950). The authors reinforce this argument with empirical evidence, finding that from 1950 to 2019, the annual surplus value transfer (i.e. the movement of the unpaid labour of workers) from dominated to imperialist countries averaged 1% of dominated countries' GDP. Measured against annual export profits, this transfer accounted for over 40% of imperialist countries' profits.

The authors extend their surplus value transfer analysis to assess China's position in the global economy to determine whether China qualifies as an imperialist state in the classical sense. Whereas mainstream economics debates whether China is capitalist, predominantly capitalist, or a hybrid system (Ang, 2018; Milanović, 2019; Rodrik, 2018), Carchedi and Roberts focus on the empirical dynamics of its exchange with the capitalist centre. Their analysis finds that surplus value transfers from China to the imperialist bloc have averaged 5–10% of its GDP since the 1990s, indicating that China remains a net contributor to imperialist economies rather than an exploiter of global labour. Based on this, they conclude that China is not an imperialist country but part of the dominated bloc. They note that emerging economies can only develop by raising productivity with efficient technologies, which imperialist countries will always oppose, as seen in efforts to throttle China's chip industry (Umbach, 2024).

5. THE PATH TO DEMOCRATIC SOCIALISM

The authors briefly treat the topic of state capitalism, which is often mentioned to describe the socio-economic systems in both countries (USSR and China). This point of view was popular among Yugoslav economists who described the Soviet economy as 'etatism' (Horvat, 1982), more aligned with state capitalism rather than true socialism. However, Carchedi and Roberts argue that the concept of 'state capitalism' cannot be applied to the Soviet Union because there was no capitalist competition, and the allocation of resources was not left to the decision of individual capitals.

But what about China? While acknowledging the significant capitalist elements in China's economy, they argue that China's state-owned sector and economic planning represent socialist elements crucial to its industrial policies. Hence, they disagree with the view that China is a capitalist country (Ang, 2018; Milanović, 2019) but describe China as a 'trapped transition', where capitalist and socialist accumulations compete, leading to inconsistent development.

The authors argue that social planning can be rational, efficient, and democratic, examining models like negotiated coordination and participatory economics, which bear similarities to Yugoslav self-management socialism. A key feature of Yugoslav self-management was its emphasis on employee participation in decision-making, distinguishing it from both centralised socialist planning and traditional capitalist firms. Workers' councils had formal control over enterprise decisions, though market forces and state interventions often constrained their autonomy. Branko Horvat, a leading Yugoslav economist, defended self-management as a

genuine alternative to both state socialism and capitalism, asserting that greater market reliance within a self-managed economy could enhance efficiency without sacrificing democratic workplace governance (Horvat, 1982).

While the Yugoslav model ultimately failed, its viability under different conditions remains debated. Some radicals argue that Yugoslavia's system was capitalism disguised as socialism (Katalenac, 2013), while others suggest that its failure resulted from an inadequate balance between self-management and state governance, as well as insufficient reliance on market mechanisms (Estrin, 1991; Nove, 2003). This view is shared by Branko Horvat (2001) who argued that self-management was progressively undermined by later reforms, particularly the 1976 reform, which he claimed reduced self-management to a façade well before Yugoslavia's collapse.

The concept of cooperative self-management has recently re-emerged in mainstream economics, even within capitalist frameworks. Piketty (2020) advocates greater worker participation in corporate decision-making, reflecting renewed interest in democratising economic governance. Similarly, Ellerman (2021) and Wolff (2012) argue that worker self-management could provide a more equitable and democratic alternative to traditional corporate structures. Empirical research by Pérotin (2013) suggests that worker cooperatives are as productive as conventional firms while offering greater job security and resilience during crises. This suggests that, despite its challenges, self-management remains an idea with potential, and its historical lessons should not be dismissed outright.

To conclude, Carchedi and Roberts' book offers two ways of engaging with its arguments: readers can approach it as an analysis of major contemporary economic issues – such as environmental sustainability, inflation, productivity and wages, and global trade – or as a broader demonstration of how Marxist value theory can be applied to modern capitalism. The authors use this framework to explain key economic dynamics: for example, the capitalist drive to exploit natural resources stems from the need to reduce production costs, while economic crises recur as profit rates decline over time, leading to cycles of instability. Their approach also sheds light on global economic inequality, showing how wealthier nations maintain dominance by extracting economic benefits from less-developed economies.

Rather than engaging in abstract Marxist debates, the book addresses pressing real-world issues but through a distinct analytical lens – one that mainstream economics often overlooks. By demonstrating how Marxist value theory remains

a powerful tool for understanding capitalism today, the authors contribute to the ongoing renaissance in Marxist economics – a revival marked by renewed engagement with capitalist crisis tendencies (Kliman, 2012; Roberts, 2016), financialisation (Lapavitsas, 2013), labour exploitation (Smith, 2016), and global trade inequalities (Amin, 2018). Anwar Shaikh's *Capitalism: Competition, Conflict, Crises* (2016) has been central to this revival, integrating Marxist value theory with advanced empirical and mathematical modelling, reinforcing the argument that profit-driven accumulation inherently leads to inequality, crises, and systemic instability.

Carchedi and Roberts' book effectively demonstrates the versatility, continued relevance, and value of Marxist value theory (pun intended). They bridge critical economic theory with contemporary policy debates, challenging readers to rethink the structural forces shaping today's economy.

REFERENCES

Albert, M., & Hahnel, R. (1991). *The Political Economy of Participatory Economics*. Princeton: Princeton University Press.

Amin, S. (1976). *Accumulation on a World Scale*. New York: Monthly Review Press.

Amin, S. (2018). *Modern Imperialism, Monopoly Finance Capital, and Marx's Law of Value*. New York: Monthly Review Press.

Ang, Y. Y. (2018). *How China Escaped the Poverty Trap*. New York: Cornell University Press.

Baran, P., & Sweezy P. (1966). *Monopoly Capital*. New York: NYU Press.

Ellerman, D. (2021). *The Democratic Worker-Owned Firm (Routledge Revivals): A New Model for the East and West*. London: Routledge.

Estrin, S. (1991). Yugoslavia: The case of self-managing market socialism. *Journal of Economic Perspectives*, *5*(4), 187–194.

Hickel, J. (2020). *Less is More: How Degrowth will Save the World*. New York: Random House.

Horvat, B. (1982). *The Political Economy of Socialism: A Marxist Social Theory.* New York: M. E. Sharpe, Inc.

Horvat, B. (2001). *Ekonomika brzog razvoja* [The Economics of Rapid Development]. Sarajevo: Forum Bosna.

Kallis, G., Kostakis, V., Lange, S., Muraca, B., Paulson, S., & Schmelzer, M. (2018). Research on degrowth. *Annual Review of Environment and Resources*, *43*(1), 291–316.

Katalenac, J. (2013). Yugoslav self-management: Capitalism under the Red Banner. *Insurgent Notes: Journal of Communist Theory and Practice*.

Kliman, A. (2012). *The Failure of Capitalist Production: Underlying Causes of the Great Recession*. London: Pluto Press.

Krugman, P. (2018, January 29). *Bubble, bubble, fraud and trouble.* The New York Times. https://www.nytimes.com/2018/01/29/opinion/bitcoin-bubble-fraud.html

Lapavitsas, C. (2013). *Profiting Without Producing: How Finance Exploits Us All*. New York: Verso Books.

Latouche, S. (2009). *Farewell to Growth*. London: Polity.

Mazzucato, M. (2018). *The Value of Everything: Making and Taking in the Global Economy*. London: Allen Lane.

Milanović, B. (2019). *Capitalism, Alone: The Future of the System that Rules the World*. Cambridge, MA: Harvard University Press.

Nove, A. (2003). *The Economics of Feasible Socialism Revisited*. London: Routledge.

Pérotin, V. (2013). Worker cooperatives: Good, sustainable jobs in the community. *Journal of Entrepreneurial and Organizational Diversity*, *2*(2), 34–47.

Piketty, T. (2020). *Capitalism and Ideology*. Cambridge, MA: Harvard University Press.

Prebisch, R. (1950). *The economic development of Latin America and its principal problems*. United Nations Economic Commission for Latin America (ECLA). https://repositorio.cepal.org/entities/publication/9a00fa5b-ad04-4520-ae4c-e3adba791790

Roberts, M. (2016). *The Long Depression: How It Happened, Why It Happened, and What Happens Next*. Chicago: Haymarket Books.

Rodrik, D. (2018, December 10). *China's boldest experiment*. Project Syndicate. https://www.project-syndicate.org/commentary/china-experiment-high-growth-renewed-repression-by-dani-rodrik-2018-12

Rogoff, K. (2019, March 4). *Modern monetary nonsense*. Project Syndicate. https://www.project-syndicate.org/commentary/federal-reserve-modern-monetary-theory-dangers-by-kenneth-rogoff-2019-03

Shaikh, A. (2016). *Capitalism: Competition, Conflict, Crises*. Oxford: Oxford University Press.

Smith, J. (2016). *Imperialism in the Twenty-First Century: Globalization, Super-Exploitation, and Capitalism's Final Crisis*. New York: Monthly Review Press.

Streeck, W. (2017). *How will Capitalism End?: Essays on a Failing System*. New York: Verso Books.

Summers, L. H. (2019, March 4). *The left's embrace of Modern Monetary Theory is a recipe for disaster.* The Washington Post. https://www.washingtonpost.com/opinions/the-lefts-embrace-of-modern-monetary-theory-is-a-recipe-for-disaster/2019/03/04/6ad88eec-3ea4-11e9-9361-301ffb5bd5e6_story.html

Tooze, A. (2018). *Crashed: How a decade of financial crises changed the world*. Penguin.

Umbach, F. (2024, April 29). The escalating chip war between China and the West. *GIS*. https://www.gisreportsonline.com/r/escalating-chip-war/

Weber, I. M., & Wasner, E. (2023). Sellers' inflation, profits and conflict: Why can large firms hike prices in an emergency?. *Review of Keynesian Economics*, *11*(2), 183–213.

Wolff, R. D. (2012). *Democracy at Work: A Cure for Capitalism*. Chicago: Haymarket Books.

Wray, L. R. (2015). *Modern Money Theory*. London: Palgrave Macmillan.

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Rodrik, R., Subramanian, D., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131-165.

https://DOI: 10.1023/B:JOEG.0000031425.72248.85.

• Books

Author surname, initial(s). (Year). *Title*. Publisher location: Publisher

De Grauwe, P. (2020) *Economics of Monetary Union* (13th ed.). Oxford: Oxford University Press.

• Edited Book

Author surname, initial(s). (Ed(s).). (Year). *Title*. Publisher location: Publisher

Baltagi, B.H. (Ed.). (2003). *A Companion to Theoretical Econometrics*. Oxford: Blackwell

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Acemoglu, D., & Robinson, J.A. (2006). *Economic Origins of Dictatorship and Democracy*. Cambridge: Cambridge University Press.

Baumol, W. J., Panzar, J. C., & Willig, R.W. (1982). *Contestable Markets and the Theory of Industry Structure*. New York: Harcourt, Brace, Jovanovich, Inc.

• Chapter in Book

Last name of the chapter author, initial(s). (Year). Chapter title. In editor initial(s), surname (Ed.). *Title* (ed., pp.). Publisher location: Publisher

McMillan J., & Woodruff C. (2003) The central role of entrepreneurs in transition economies. In G. S. Fields, & G. Pfefferman (Eds.). *Pathways Out of Poverty* (pp. 105-121). Dordrecht: Springer. https://doi.org/10.1007/978-94-010-0009-3_6.

• E-Book

Author surname, initial(s). (Year). *Title*. URL

Perry, R.B. (1909). *The Moral Economy*.

https://manybooks.net/book/137844/read#epubcfi(/6/2[id00000]!/4/2[id00000]/1:0)

• Technical Reports or Working Papers

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Author surname, initial(s) or corporate name. (Year). *Title*. (Report or Working Paper No.). URL.

Cătuți, M., Kustova, I. and Egenhofer, C. (2020) *Delivering the European Green Deal for Southeast Europe: Do we need a regional approach?* (CEPS Research Report No.2020/1). https://www.ceps.eu/wp-content/uploads/2020/06/RR_2020-01_European-Green-Deal-for-South-Eastern-Europe.pdf.

Corporate authors

American Psychological Association, Task Force on the Interface Between Psychology and Global Climate Change. (2009). *Report of the APA Task Force on the Interface Between Psychology and Global Climate Change*.

http://www.apa.org/science/about/publications/climate-change.aspx

• Newspaper Articles

Author surname, initial(s). (Year, Month Day). Title. *Title of Newspaper*, p. or pp. URL*

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Smialek, J. (2020, May 2). Hotel Group Will Return Tens of Millions in Small Business Loans. *The New York Times*, pp. 10.

https://www.nytimes.com/2020/05/02/business/economy/ashford-hotels-virus-monty-bennett.html

• Website

Author surname, initial(s). (Year, month day). *Title*. URL

Mitchell, J.A. (2017, May 21). *How and when to reference*.

https://www.howandwhentoreference.com