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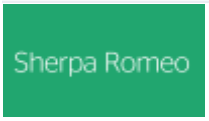

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The Impact of Financial Inclusion and Stability on Economic Growth in African Countries

Afrika Ülkelerinde Finansal Kapsayıcılık ve İstikrarın Ekonomik Büyüme Üzerindeki Etkisi

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ABSTRACT

This study investigates the effect of financial inclusion and financial stability on economic growth in a panel study of 30 African countries over the period between 2004 and 2020. Data were analyzed using the panel ARDL model. The panel ARDL estimation results demonstrate that financial inclusion has a statistically significant positive long-term effect on economic growth, though its short-term impact is insignificant. The study also found that the effects of financial inclusion on economic growth vary across different income levels. Specifically, there is a positive association in low-income countries, a negative association in lower-middle-income countries, and a positive but insignificant effect in upper-middle-income countries. On the other hand, the financial stability measured by the bank Z-score has a significant negative impact on long-run economic growth and a positive one in the short run. The effect is negative for low-income countries, positive for lower-middle-income countries, and negative but insignificant for upper-middle-income countries. Thus, the study findings suggest financial inclusion and financial stability policies should be tailored to the country's income level in African countries.

Anahtar Kelimeler:
Finansal Kapsayıcılık, Finansal İstikrar, Ekonomik Büyüme, Panel ARDL, Afrika

Jel Kodları:
G20, G21, O40

ÖZET

Bu çalışma, 2004-2020 yılları arasında 30 Afrika ülkesinde finansal kapsayıcılığın ve finansal istikrarın ekonomik büyüme üzerindeki etkisini araştırmaktadır. Veriler panel ARDL modeli kullanılarak analiz edilmiştir. Panel ARDL tahminlerinin sonuçlarına göre, finansal kapsayıcılığın uzun vadeli ekonomik büyüme üzerinde önemli bir pozitif etkisi olduğu, ancak kısa vadede anlamlı bir etkisinin olmadığı gözlemlenmiştir. Çalışmada ayrıca, finansal kapsayıcılığın ekonomik büyüme üzerindeki etkilerinin farklı gelir düzeylerine göre değiştiği tespit edilmiştir. Özellikle düşük gelir düzeyinde pozitif bir ilişki, alt-orta gelir düzeyinde ise negatif bir ilişki ve üst-orta gelirli ülkelerde pozitif olmakla birlikte istatistiksel olarak anlamlı olmayan bir etki gözlenmiştir. Diğer taraftan, finansal istikrarın (banka Z-skorunun) ekonomik büyüme üzerindeki etkisi uzun vadede negatifken, kısa vadede pozitif olduğu bulunmuştur. Bu etkinin düşük gelirli ülkeler için negatif, alt-orta gelirli ülkeler için pozitif ve üst-orta gelirli ülkeler için ise negatif ancak istatistiksel olarak anlamlı olmadığı ortaya konmuştur. Dolayısıyla, çalışmanın bulguları, Afrika ülkelerinde finansal kapsayıcılık ve finansal istikrar politikalarının ülkenin gelir düzeyine göre şekillendirilmesi gerektiğini önermektedir.

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1. INTRODUCTION

Financial inclusion and the stability of the financial system are considered the key tools for achieving sustainable economic growth. In recent times, the global economy has rapidly progressed, and the financial market system has become more dynamic and complex. As a result, financial inclusion has appeared as a focus of economic policymakers to reduce poverty and enhance economic growth (Ardic et al., 2011). Financial inclusion refers to having a widespread access to and usage of a range of quality formal financial services such as savings, payments, borrowing, and insurance at an affordable cost by all segments of the population (Patwardhan, 2018). Developing countries mostly suffers to address basic formal financial services to its majority portion of populations. According to Demirgüç-Kunt et al. (2015), only 24% of adults in Africa have formal bank accounts at financial institutions, while there are large regional and gender gaps in the access and usage of basic financial services. However, this number has recently grown to 55%, and the gender gap is significantly reduced due to the increase in access to and usage of financial innovations such as mobile money platforms (Demirgüç-Kunt et al., 2021).

Bringing sustainable economic growth to Africa remains a pressing challenge (Anyanwu, 2014). Economic growth in African countries is significantly influenced by several factors such as population growth, trade openness, investment, education, governance, financial development, political instability, corruption, infrastructure, and research and development (Anyanwu, 2014; Fayissa & Nsiah, 2013; Gyimah-Brempong, 2002; Gyimah-Brempong et al., 2006; Odhiambo & Ntenga, 2016; Owusu-Manu et al., 2019; Savvides, 1995; Yakubu et al., 2020; Younsi & Nafla, 2019). Despite these challenges, reports show that the African countries exhibited progress in their level of economic growth and resilience in tackling the aftermaths of the coronavirus pandemic and other shocks in global financial conditions.

Over the last few decades, the financial landscape in African countries has also shown progress due to liberalization reforms, infrastructure developments, financial technology, and financial inclusion (Demirgüç-Kunt et al., 2021; Mu & Lin, 2016). Nevertheless, the financial system is challenged by the impacts of political instability, low institutional quality (Anayiotos & Toroyan, 2009), infrastructural inefficiency (Beck et al., 2011), regulatory quality, and government domestic debt arrears (Kulu et al., 2022).

Financial inclusion promotes economic growth by granting access to basic financial services to firms and households (Bazarbash & Beaton, 2020), stimulating entrepreneurship and innovation (Ajide, 2020), enhancing domestic financial markets (Jima & Makoni, 2023), reducing poverty (Inoue, 2019), supporting national development goals (Chibba, 2009), and narrowing gender gaps (Bhatia & Singh, 2019; Swamy, 2014), reducing income inequality (Kling et al., 2022; Neaime & Gaysset, 2018; Omar & Inaba, 2020; Verma & Giri, 2022), improving financial stability (Khan et al., 2022), and improving social inclusion and social justice (Ozili, 2020). According to Kim (2016), financial inclusion helps to offset the negative impacts of income inequality on economic growth. Likewise, studies by Mohieldin et al. (2019) and Boachie et al. (2023) have found that economic growth is positively associated with financial inclusion. Other studies have concluded that financial inclusion has no impact on economic growth and vice versa (Lucas, 1988; Stern, 1989).

With the realization of its potential to promote sustainable economic growth, there is growing scholarly attention, regulatory focus, and policy priority toward financial inclusion. However, there is a significant gap in the existing body of literature in the following areas: First, there is a dearth of comprehensive empirical evidence that effectively examines the effect of financial inclusion and financial stability on economic growth (Feghali et al., 2021; Mu & Lin, 2016). While individual studies have tried to shed light on specific aspects of this relationship, a comprehensive and integrated analysis is lacking, hindering a holistic understanding of how these variables influence economic growth over time.

Second, there is a limited utilization of relevant theories to explain the linkages between financial stability and economic growth (Ozili et al., 2023). The lack of a robust theoretical foundation may contribute to methodological inconsistencies. In addition, as demonstrated earlier in this section, the results from available studies are inconsistent and inconclusive, leading to a lack of consensus on the impact of financial inclusion and financial stability on economic growth. This inconsistency may stem from methodological variations that are not adequately addressed in the literature. Lastly, the empirical literature on the relationship between financial inclusion, financial stability, and economic growth in Africa is extremely limited in a few countries, and there are no comprehensive studies.

Thus, this study contributes to the literature and assists in the effort to settle the debate over the topic. The present study is distinguished from prior studies by analyzing the causal relationship between financial inclusion, financial stability, and economic growth from a holistic African perspective and further delves into

investigating the interactions across the three distinct income categories: low-income, lower-middle income, and upper-middle income.

The findings of this study could give additional insights to macroeconomic policymakers, multilateral institutions, and financial inclusion advocates on the appropriate strategies to enhance financial inclusion, maintain financial stability, and elevate economic growth.

The remainder of this paper is organized as follows: Section 2 provides a review of related literature, Section 3 describes the research methodology, Section 4 presents the results and discussions, and finally, Section 5 sets out the conclusions and suggestions.

2. LITERATURE REVIEW

2.1. Theoretical Literature Review

In financial economics research, there is a controversial argument on the direction and relationship between financial inclusion, financial stability, and economic growth. The literature employs two opposing theories, namely supply-leading theory and demand-following theory, to explain the relationship and causality direction between several aspects of financial sector development, including financial inclusion, financial stability, and economic growth.

The supply-leading theory advocates that financial inclusion is one of the key tools to promote economic growth and development in the nation's economy. By expanding access to financial inclusion, communities gain access to fundamental formal financial services such as savings, credit, and insurance. This access is instrumental in fostering economic growth and development (Jima & Makoni, 2023; Sehrawat & Giri, 2015). Accordingly, enhancing access to financial services plays a substantial role in supporting sustainable economic growth. This can be done through the mobilization of savings and investment, which in turn leads to the efficient allocation of resources, increased productivity, and overall economic development (Revell & Goldsmith, 1970).

On the other hand, the demand-following theory posits that as an economy experiences higher levels of economic growth, the demand for financial services increases. This increased demand, in turn, promotes financial inclusion. As the economy grows, there is an increase in the need for financial services for savers and investors, leading to the formation of financial institutions, the invention of financial assets, and the establishment of various financial services (Patrick, 1980). The findings of Jima & Makoni (2023) also align with the demand-following theory, emphasizing that economic growth drives financial inclusion.

According to a study conducted by Guha Deb et al. (2019), the causal relationship between the financial sector and economic growth is influenced by the level of economic development and the state of the economy. The study suggests the supply-leading theory and the demand-following theory apply to different types of economies. In developing economies, the supply-leading theory is supported, while in emerging economies, the demand-following theory is maintained.

Research also shows that the relationship between economic growth and financial stability follows the demand-following theory. For instance, Boachie et al. (2023) highlighted that economic growth drives bank stability, and the relationship is unidirectional. Some findings support both theories, suggesting a two-way mutual causality (Ali et al., 2021; Demetriades & Hussein, 1996; Greenwood & Smith, 1997; Jima & Makoni, 2023; Kim et al., 2018). On the contrary, Chang (2002) found an independent relationship supporting neither the demand-following nor the supply-leading theories.

2.2. Empirical literature

Despite the growing body of empirical research on the relationship between financial inclusion and economic growth, the findings of the results remain ambiguous. Some studies have found a positive relationship between financial inclusion and economic growth, suggesting that increased access to financial services can stimulate economic activity and productivity. By granting access to affordable and reliable financial services to underserved areas, financial inclusion promotes financial well-being (Nandru et al., 2021), improves welfare (Hidayat & Sari, 2022), enables them to get formal credit (Chen & Jin, 2017), increases their productivity (Hu et al., 2021; Peprah et al., 2021), expands their businesses (Chauvet & Jacolin, 2017), fosters financial innovation (Qamruzzaman & Wei, 2019), achieves efficiency (Afrin et al., 2017), and thereby contributes to overall economic growth (Kablana & Chhikara, 2013; Lenka & Sharma, 2017; Sethi & Acharya, 2018; Van et al., 2021).

Moreover, the empirical findings of Kablana & Chhikara (2013), Kim et al. (2018), and Van et al. (2021) emphasized that financial inclusion leads to higher economic growth. Similarly, Lenka & Sharma (2017) and Sethi & Acharya (2018) confirmed that financial inclusion has a strong and positive impact on economic growth both in the short run and the long run. A study by Domeher et al. (2022) also asserted that financial inclusion enables users to exploit financial innovation and accelerate economic growth.

In contrast, the findings of Mosley (2001) and Sandberg (2012) concluded that financial inclusion may result in the decapitalization and impoverishment of poor people and increase social inequality. Similarly, Lainez (2016) and Rahman (1999) highlighted that financial inclusion may have negative impacts on the economy by causing financial stress, over-indebtedness, and disempowerment.

The empirical literature on the relationship between financial stability and economic growth is relatively scarce, and the existing evidence is contradictory. A stable financial system positively influences economic growth by providing the foundation for investor confidence, foreign direct investments, and efficient resource allocation (Manu et al., 2011). Moreover, Creel et al. (2015) demonstrated that financial instability has severe negative impacts on economic growth. Similarly, Younsi & Nafla (2019) also demonstrated that financial crises in fragile financial systems deteriorate financial development as well as economic growth. The financial system also channels the adversities in other sectors to impact economic growth (Son et al., 2020). Financial instability leads to increased uncertainty, worsened borrowing conditions, and increased costs of finance, thereby reducing investments as well as economic growth (Carbó-Valverde & Sánchez, 2013).

Therefore, based on the existing literature review, the study develops the following research hypotheses:

H_1: Financial inclusion significantly positively or negatively affects economic growth in African countries.

H_2: Financial stability significantly positively or negatively affects economic growth in African countries.

H_3: The impact of financial inclusion and stability on economic growth may depend on the income levels of African countries.

3. METHODOLOGY

To investigate the interplay among financial inclusion, financial stability, and economic growth in African countries, this study employed a quantitative approach. In addition, trade openness, foreign direct investment, aid, and inflation were incorporated as control variables in the analysis. Secondary data were obtained from the World Bank indicators database and the International Monetary Fund's (IMF) Financial Access Survey for 30 African countries (see Table A1), selected based on the availability of comprehensive data covering the period 2004 to 2020.

3.1. Model Specification

This study uses the following panel ARDL model to examine both the long-run and short-run relationships between financial development and economic growth in African economies. We first specify the following benchmark regression model for our study:

$$\mathrm{RGDPG}_{i,t} = f(\mathrm{FI}_{i,t}, \mathrm{FS}_{i,t}, \mathrm{Trade}_{i,t}\ \mathrm{FDI}_{i,t}, \mathrm{Aid}_{i,t}, \mathrm{CPI}_{i,t}) \quad 1$$

The dependent variables are economic growth proxied by the annual growth rate of real GDP ($\mathrm{RGDPG}_{i,t}$), whereas the explanatory variables are the financial inclusion index ($\mathrm{FI}_{i,t}$), and financial stability proxied by bank -z-score ($\mathrm{FS}_{i,t}$), foreign direct investment scaled by GDP ($\mathrm{FDI}_{i,t}$), foreign aid measured by net ODA received % GDP ($\mathrm{Aid}_{i,t)}$, inflation proxied by consumer price index ($\mathrm{CPI}_{i,t}$).

Before running the panel ARDL model, the study first employed Dickey & Fuller (1979); Im et al. (2003); and Levin et al. (2002) panel root tests to check the stationarity of variables. Further, the study used the Johansen (1988) and Kao (1999) co-integration tests to see the long-run co-integration among the study variables. Finally, the study specifies the following panel ARDL model to estimate the long-run and short-run relationship effects of financial inclusion and financial stability on economic growth.

$$RGDPG_{i,t} = \sum_{j=1}^{p} \sigma_{i,j} RGDPG_{i,t} - j + \sum_{j=0}^{q} \beta 1_{i,j} FI_{i,t} - j + \sum_{j=0}^{q} \beta 2_{i,j} FS_{i,t} - j + \sum_{j=0}^{q} \beta 4_{i,j} Trade_{i,t} - j + \sum_{j=0}^{q} \beta 4_{i,j} FDI_{i,t} - j + \sum_{j=0}^{q} \beta 5_{i,j} Aid_{i,t} - j + \sum_{j=0}^{q} \beta 8_{i,j} CPI_{i,t} - j + \varphi_i + \varepsilon_{i,t} \quad 2$$

Where, $\sigma_{i,j}$ is the coefficient of lagged economic growth, $\beta_{i,j}$is the coefficient of the regressors. i=1, 2……, N: t=1, 2……., T: p q is the optima lag order: $\varepsilon_{i,t}$is the error term.

We specify the error correction model for the re-parameterized panel ARDL (p, q, q . . . . . q) as follows.

$$\Delta RGDPG_{i,t} = \theta i(Y_{i,t} - 1 - \gamma_i X_{i,t}) + \sum_{j=1}^{p-1} \sigma_i \Delta RGDPG_{i,t} - j + \sum_{j=0}^{q-1} \omega_i \Delta X_{i,t} - j + \varphi_i + \varepsilon_{it} \quad 3$$

Where X is a set of independent variables θi represents the coefficient of the speed of adjustment to the long-run status; γi is the vector of long-run relationships, $Y_{i,t} - 1 - \gamma_i X_{i,t}$ is the error correction term; σi and ωi are short-run dynamic coefficients, and φi is the fixed effect.

3.2. Measurement of key study variables

This study used commercial bank branches per 100,000 adults as a proxy for financial inclusion (Nguyen, 2021; Tram et al., 2023). Financial stability is measured using the Z-score, which measures the probability of default in a financial system, with higher values indicating lower stability and vice versa (Creel et al., 2015; Uhde & Heimeshoff, 2009). Several studies used the bank Z-score as a proxy to capture financial stability (Carbó-Valverde & Sánchez, 2013; Creel et al., 2015; Jima & Makoni, 2023). Economic growth is measured by annual real GDP per capita growth, one of the most commonly used indicators in the literature (Alsamara et al., 2019; Kim et al., 2018; Sethi & Acharya, 2018). The description of all the variables used in the study, along with the source of the data, is presented in Table 1 below.

Table 1. Variables Description

Variable ID	Variable name	Data source
	Dependent variable	
RGDPG	Real GDP per capita annual growth	World bank indicators
	Study variable	
FI	Financial inclusion commercial bank branches per 100,000	Global Findex
FS	Financial stability proxied by bank Z score	Global Findex
	Control variable	
TRADE	Trade % GDP (Trade openness)	World bank indicators
FDI	Foreign direct investment, net inflows (% of GDP)	World bank indicators
AID	Net ODA received per capita	World bank indicators
CPI	Consumer price index (Inflation)	World bank indicators

4. RESULTS

4.1. Unit root test

It is essential to perform a unit root test first to check the stationarity of the study variables before running the panel ARDL model. The results presented in Table 2 confirm that all the study variables are stationary at I (0) and I (1). This suggests that the study dataset is suitable for running panel ARDL models.

Table 2. Result of Unit Root Test

Variables	TEST	Levin, Lin & Chu t*	Im, Pesaran and Shin W-stat	ADF - Fisher Chi-square	PP - Fisher Chi-square	Status
RGDPG	At level	-3.27457***	-1.80074***	95.7638***	153.77***	I (0)
FI	At level	-7.03423***	-2.60749***	93.1921***	114.359**	I (0)
FS	At level	-2.85069**	-9.09275**	193.217***	94.6828***	I (0)
TRADE	At 1st	-7.43337***	-7.3319***	160.814***	266.787***	I (1)
FDI	At level	-7.78567***	-1.66175***	77.9142***	123.3***	I (0)
AID	At level	-9.12907**	-2.3219**	84.4059***	134.715***	I (0)
CPI	At 1st	-7.92627***	-6.26512***	144.302***	208.382***	I (1)

****, **, and * represent 1%, 5%, and 10% significance levels, respectively.*

4.2. Cointegration test

The study also performs the Johansen and Kao co-integration tests to check if there is a long-run relationship between the study variables. This helps to justify the use of panel ARDL analysis to estimate both the short-run and long-run effects. The results of both the Johansen and Kao co-integration tests presented in Table 3 confirm that there is co-integration among the study variables at 1% and 5% significance levels. Therefore, it is evident that there is a stable long-run relationship between financial inclusion, financial stability, and economic growth.

Table 3. The Johnsen and Kao Cointegration Test

Johnsen cointegration test					Kao co-integration test		
Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	P-value	Fisher Stat.* (from max-eigen test)	P-value		t-Statistic	P-value
None	0.000	1.0000	0.000	1.0000	ADF	-5.1452***	0.0000
At most 1	374.7***	0.0000	292.1***	0.0000	Residual variance	16.0126	
At most 2	1081.0***	0.0000	957.5***	0.0000	HAC variance	8.6698	
At most 3	1093.0***	0.0000	977.1***	0.0000			
At most 4	370.4***	0.0000	298.5***	0.0000			
At most 5	192.7***	0.0000	192.7***	0.0000			

***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

Therefore, by running the stationarity and co-integration tests, the study confirms that our dataset is suitable for employing a panel ARDL model. This provides a sound statistical basis for the analysis before estimating the ARDL equations.

4.3. Panel ARDL Estimation Results

4.3.1. Entire Africa Data Set

In this section, the study presents the results of the long-run and short-run effects of financial inclusion and financial stability on economic growth in a panel study of 30 African countries over the period from 2004 to 2020. The results of panel ARDL estimation in Table 4 show that financial inclusion has a significant long-term positive effect on economic growth. This implies that, through greater access to formal financial products and services, financial inclusion enables people to undertake successful business activities, use innovative financial solutions, and increase productivity and efficiency, which increases aggregate economic growth. The findings of this study are consistent with the findings of Boachie et al. (2023); Domeher et al. (2022); Lenka & Sharma (2017); and Sethi & Acharya (2018).

Whereas financial stability measured by bank Z scores is found to have a statistically significant negative effect on long-run economic growth. This agrees with the conclusion that financial instability creates uncertainty, reduces access to capital, reduces investments, and deteriorates overall economic growth (Carbó-Valverde & Sánchez, 2013; Son et al., 2020; Younsi & Nafla, 2019). A stable financial system, on the other hand, enhances productivity, improves capital accumulation, and allows for efficient resource allocation (Creel et al., 2015; Manu et al., 2011). However, the effect is positive and significant in the short run.

Additionally, consistent with the findings of Banday et al. (2021) and Sakyi et al. (2015), the control variables trade openness and foreign direct investment have a statistically significant positive impact on long-run economic growth. Similarly, inflation has a positive association with economic growth. By contrast, foreign aid slows down economic growth, reflecting the effects of aid dependency. The short-run error correction model gives insight into transient growth dynamics before returning to equilibrium. The large, significant adjustment parameter indicates that 77.39% of any deviation in growth from the long-run rate is eliminated each quarter, indicating a high endogenous growth momentum. Changes in financial stability have some short-run predictive power for growth fluctuations in the next quarter, indicating their influence on cyclical swings around equilibrium.

Table 4. Panel ARDL Estimation for the Entire Data Set Schwarz Criterion (SIC) Selection (1, 1, 1, 1, 1, 1, 1)

Long-run model estimation			**Short-run model estimation**		
Variable ID	Coefficient	P-value*	Variable ID	Coefficient	P-value*
			COINTEQ01	-0.7739***	0.0000
FI	0.1328**	0.0139	D(FI)	0.9987	0.2630
FS	-0.3532***	0.0000	D(FS)	0.2499**	0.0286
TRADE	0.0284**	0.0268	D(TRADE)	0.1107	0.0117
FDI	0.1272**	0.0431	D(FDI)	0.0609	0.6813
AID	-0.0185***	0.0006	D(AID)	-0.0007	0.9423
CPI	0.1193***	0.0034	D(CPI)	-0.1257*	0.0671
			C	3.5561***	0.0001

****, **, and * represent 1%, 5%, and 10% significance levels, respectively.*

4.3.2. Income Level Dynamics

The study also analyzed the impact of financial inclusion and financial stability on economic growth in Table 5 across low-income, lower-middle-income, and upper-middle-income countries in Africa. The results in Table 5 confirm that financial inclusion promotes the long-run economic growth of low-income countries in Africa. However, financial instability hinders long-run economic growth in those countries. The short-run effects of both financial inclusion and financial stability are insignificant.

In lower-middle-income countries, financial inclusion has a significant negative impact on long-run economic growth. This suggests that returns diminish as markets approach saturation. Similarly, prior evidence also supports the claim that financial inclusion may have negative effects on the economy through worsening poverty levels, financial stress, over-indebtedness, economic inequality, and disempowerment (Lainez, 2016; Mosley, 2001; Rahman, 1999; Sandberg, 2012). However, the state of financial stability has a significant positive influence on long-run economic growth. The short-run effects are insignificant for both financial inclusion and financial stability.

In contrast to low- and lower-middle-income countries, the effects of financial inclusion and financial stability on economic growth are insignificant both in the long run and in the short run. This implies that the level of financial inclusion and financial stability in upper-middle-income countries is likely to surpass the thresholds where marginal improvements have negligible impacts on their economic growth. Van et al. (2021) also indicates similar evidence, stating that the effect of financial inclusion on economic growth is stronger for countries with lower income levels.

Table 5. Income Level Dynamics Schwarz Criterion (SIC) Selection Model (1, 1, 1, 1, 1, 1, 1)

	Low-income		**Lower-middle income**		**Upper-middle income**	
Variable	Coefficient	P-value*	Coefficient	P-value*	Coefficient	P-value*
			Long-run model estimation			
FI	1.1637***	0.0000	-0.1382***	0.0075	0.1716	0.4916
FS	-0.2021***	0.0000	0.1523**	0.0224	-0.6587	0.1918
TRADE	0.1519***	0.0000	0.0510***	0.0035	0.0064	0.9384
FDI	-0.1623***	0.0000	0.4726***	0.0000	0.0649	0.8314
AID	0.0469***	0.0000	-0.0145***	0.0046	0.0167	0.4937
CPI	0.0043	0.8768	0.0703***	0.0025	-1.2245**	0.0241
			Short-run model estimation			
COINTEQ01	-0.7723***	0.0018	-0.7540***	0.0000	-0.3961	0.3163
D(FI)	2.4233	0.1968	-0.2874	0.7911	1.0030	0.1452
D(FS)	-0.1162	0.5564	-0.1120	0.3418	0.7627	0.1170
D(TRADE)	0.1998*	0.0681	0.0597	0.1076	0.1053	0.6692
D(FDI)	0.0017	0.9936	0.0478	0.8322	0.6512	0.3460
D(AID)	-0.0631**	0.0152	0.0098	0.5691	-0.0036	0.8916
D(CPI)	-0.1095*	0.0816	-0.1404	0.1400	0.4383	0.5677
C	-7.4366***	0.0041	-3.3014***	0.0005	3.3546	0.4641

***, **, and * represent 1%, 5%, and 10% significance levels, respectively.

5. CONCLUSION

The relationships between financial inclusion, financial stability, and economic growth have increasingly attracted attention in recent financial economics research, though empirical findings on their precise nature remain ambiguous. This study investigates the impacts of financial inclusion and financial stability on economic growth in a panel study of 30 African countries over a period from 2004 to 2020. The study uses the panel RADL model for the analysis. The panel ARDL estimation results demonstrate that financial inclusion plays a pivotal role in boosting long-run economic growth in African countries. But the short-run effect is insignificant. Whereas financial stability, as measured by the bank Z-score, has a significant negative effect on economic growth in the long run and is positive in the short run. Furthermore, the results also reveal that the impacts of financial inclusion and financial stability on economic growth vary across income levels. Specifically, financial inclusion has a significant long-term positive effect on growth in low-income African countries, highlighting the importance of policies that increase access to basic financial services. However, the effect of financial inclusion on economic growth is negative in lower-middle-income countries. Contrastingly, financial stability positively influences long-run growth in lower-middle-income countries yet negatively impacts growth in low-income countries, and the effects become statistically insignificant in upper-middle-income countries, implying thresholds at which marginal changes in financial inclusion have a negligible impact on economic growth.

Thus, the results of the present study suggest that governments and policymakers in African countries should follow tailored financial inclusion initiatives and reforms based on specific dynamics to expand access to financial services for the marginalized sections of their population. This can stimulate long-term economic growth, and a nuanced approach is required that calibrates appropriate financial inclusion and stability policies in different economic settings.

This study is not immune to certain limitations as it relied entirely on macroeconomic indicators, which may mask the micro-level dynamics between financial inclusion, stability, and growth. Furthermore, due to the lack of comprehensive data on the variables, many countries are excluded from the sample. Also, the effects of financial inclusion and financial stability may vary in different contexts, such as country-specific factors, extraordinary events, crises, policy changes, and changes in the global economy. Thus, further research can be conducted considering these factors.

AUTHORS' DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support.

AUTHORS' CONTRIBUTIONS:

The entire research is written by the author.

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APPENDIX

Appendix 1. List of sample countries

Algeria	Eswatini	Niger
Angola	Gabon	Nigeria
Benin	Ghana	Rwanda
Botswana	Kenya	Senegal
Burkina Faso	Lesotho	Sierra Leone
Burundi	Madagascar	South Africa
Cabo Verde	Mali	Tanzania
Cameroon	Mauritius	Togo
Côte d'Ivoire	Morocco	Tunisia
Egypt, Arab Rep.	Mozambique	Uganda

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Crab Syndrome in Business Life and Collectivist/Individualist Culture

İş Yaşamında Yengeç Sendromu ve Kolektif/Bireyci Kültür

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ABSTRACT

In the business world, employee competition can cause individual and organizational issues, potentially fueled by the "crab syndrome," where individuals view others as obstacles to success. In a workplace, it is thought that the manifestation of crab syndrome in employees may be caused by the culture they have. This study aims to determine the impact of collectivist/individualist culture on the crab syndrome. In this study, the one of quantitative techniques, the survey technique was used. Data was collected through surveys from different public institution employees. The analysis revealed that the collectivist culture had a positive, but statistically insignificant effect on the cognitive, emotional, and behavioral components of the crab syndrome. Based on this result, it can be said that having a collectivist or individualist culture does not significantly influence individuals experiencing the crab syndrome. Considering that businesses can be affected by the cultural environment they operate in, it can be stated that this phenomenon is independent of the culture (collective or individualist) prevalent in the society.

Anahtar Kelimeler:

Yengeç Sendromu,
Kolektif Kültür,
Bireyci Kültür

Jel Kodları:

M12, M14

ÖZET

İş yaşamında, çalışanlar arasındaki rekabet bir düzeyden sonra hem bireysel hem de örgütsel açıdan sorunlara yol açabilmektedir. Bu durumun olası sebeplerinden biri yengeç sendromuyla ilişkili davranışlardır. Bir işyerinde çalışanlarda yengeç sendromunun ortaya çıkmasının sahip oldukları kültürden kaynaklanabileceği düşünülmektedir. Bu çalışma, kolektivist/bireyci kültürün yengeç sendromu üzerindeki etkisini belirlemeyi amaçlamaktadır. Bu çalışmada nicel yöntemlerden biri olan anket yöntemi kullanılmıştır. Araştırma kapsamında farklı kamu kurumu çalışanlarından anket yoluyla veriler toplanmıştır. Yapılan analizler, kolektivist kültürün yengeç sendromunun bilişsel, duygusal ve davranışsal bileşenleri üzerinde pozitif yönde, ancak istatistiksel olarak anlamlı olmayan bir etkiye sahip olduğunu ortaya çıkarmıştır. Elde edilen bulgulara dayanarak kolektivist veya bireyci bir kültüre sahip olmanın bireylerin, yengeç sendromunu tecrübe etmeleri üzerinde önemli ölçüde bir etkiye sahip olmadığı söylenebilir. İşletmelerin faaliyet gösterdikleri kültürel ortamdan etkilenebileceği dikkate alındığında bu olgunun toplumda yaygın olan kültürden (kolektif veya bireyci) bağımsız olduğu ifade edilebilir.

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1. INTRODUCTION

In his Psychoanalytic Theory, Sigmund Freud argued that there are mental processes called id, ego and superego that affect human behavior. The ego, which includes consciousness, is a structure in the mind that controls the reflection of the individual's actions to the outside world and continues to censor the individual's sleep even in dreams. The super ego represents an energetic reaction to the choices made by the individual. The id, on the other hand, works according to the pleasure principle of the individual and includes passions (Freud, 1923). According to this theory, it can be said that the individual with a dominant id tends to act only for his/her own personal interests and can use the people around him/her as a tool to achieve his/her goal. It is possible for these individuals to exhibit some behaviors in working life.

In the business world, there can be individuals who want to rapidly climb the career ladder. These individuals aim to promote by taking the necessary steps to improve themselves. However, especially in public institutions, where there are few positions and numerous candidates for those positions, this situation can increase competition among employees. This competition can lead to unethical behaviors over time. In such cases, instead of making efforts to improve themselves, employees make an effort to fail the person they see as a competitor. Especially individuals whose id part is dominant in the mind try to progress not by improving themselves, but by using others as stepping stones. This behavior is referred to as the "crab syndrome."

Not many studies have been conducted on the underlying causes of the crab syndrome observed in work environments. However, some theoretical studies suggest that the crab mentality may be culturally influenced. In an individualistic culture, where individuals tend to think only of themselves, some people may be willing to sacrifice others to advance in the workplace. On the other hand, in a collectivist culture, where the drive for collective success is dominant, others may pull back an individual who is trying to advance alone. Therefore, the main question of this research is whether culture has a significant effect on the crab syndrome. Answering the research question is anticipated to determine whether individuals' behaviors of harming each other in the workplace stem from culture or not.

The crab mentality, as a metaphor used in relation to people, originates from the behavior exhibited by crabs when placed in an open bucket. When crabs are placed in an open bucket, they start to make an individual effort to get out of the bucket. However, this effort turns into a competition not only to escape the bucket but also to hinder each other's progress. One of the crabs tries to reach the edge of the bucket by stepping on other crabs, but when it gets close, another crab grabs it with its pincers and pulls it back. Then, another crab tries to reach the edge by stepping on the previous one. This cycle continues for a while, and ultimately, none of the crabs manages to get out of the bucket. It's as if the crabs have an instinctive decision to prefer collective failure over individual success (Aaron & Smith, 1992). In the business world, it can sometimes observe a similar tendency among employees, where they pull each other back while trying to climb the ladder or get promoted. Therefore, the term "crab syndrome" can be used to describe such thinking and behaviors.

Crab syndrome refers to the mentality and behaviors of members who violate the norms of social assistance and support within an organization (Miller, 2019). According to another definition, the crab syndrome is the orientation of the individual's behavior by the primitive self (Özdemir & Üzüm, 2019).

It is claimed that the Crab Syndrome develops as a defense mechanism in individuals (Özdemir & Üzüm, 2019). It has been stated that crab syndrome should be handled in cognitive, emotional and behavioral terms (Fettahlıoğlu & Dedeoğlu, 2021). Personal factors are at the forefront in the cognitive stage. The individual may develop negative thoughts about the events around him/her and behaviors of people related to these events, but may not express these negative thoughts to others or even comprehend the meaning behind these thoughts. In the emotional stage, the individual begins to reflect negative feelings towards others around them. Finally, in the behavioral stage, the individual tends to exhibit competitive behaviors and may also display negative behaviors aimed at pulling others down.

The crab syndrome has been discussed in relation to Social Comparison Theory and Social Identity Theory (Miller, 2014; Özdemir & Üzüm, 2019). Social Comparison Theory claims that when a person compares themselves with others around them, it can positively contribute to recognizing their own deficiencies and improving themselves. However, it is suggested that if a person cannot improve their own performance, they may try to hinder others from performing better than them due to the effects of the crab syndrome (Özdemir & Üzüm, 2019). In the Crab Mentality, it is stated that when one person is perceived to rise and achieve more than others, he/she will be pulled down by the others (Connor & Miller, 2014).

Social identity theory is a theory that reveals in-group dynamics and tries to explain how individuals' group membership drives in-group and intergroup interactions (Jansen & Delahaij, 2020). In social identity theory, it is argued that people get some of their identity from the groups they belong to. It has been stated that the social identity of the individual determines their feelings and behaviors (Scheepers & Ellemers, 2019). Behaviors associated with the crab mentality can include jealousy, selfishness, and actions aimed at hindering others (Özdemir & Üzüm, 2019).

In the initial stage of the crab syndrome, individuals may make efforts to outperform each other. Therefore, at first, it may be perceived as a situation that creates a competitive environment among employees and provides motivation for employees to struggle. However, since the crab syndrome creates the belief that employees cannot overtake one another, the behavior of pulling back the advancing individual may begin to observe. If this situation continues, employees may consume their energy by pulling each other back, and over time, they may not only stop struggling with each other, but also stop making efforts to move forward. As a result, this situation can lead to a decline in productivity among employees.

Culture has been defined as a network of discrete and specific knowledge structures shared by individuals living in a particular community (Torelli et al., 2020). Culture can influence the way people think, feel and act, as well as organizations and institutions (Hofstede & Hofstede, 2005, as cited in McSweeney, 2006). Societies can exhibit individualistic and/or collective cultural characteristics. Collective self refers to the evaluation of the self by a particular reference group (Triandis, 1989). In collectivist cultures, more in-group social relations are communal, whereas in individualist cultures there may be more exchange relations (Triandis, 1989). In individualistic cultures, individuals see themselves as self-righteous and independent entities. In collective cultures, individuals see themselves as interconnected members of a larger social group (Shin et al., 2020). In individualistic societies, people are autonomous and independent from their groups; they prioritize their personal goals over the goals of their groups, act based on their attitudes rather than their group norms, and through exchange theory, it is possible to predict the social behaviors of these individuals (Triandis, 2001).

The main antecedents of individualism seem to be cultural complexity and wealth. The more complex the culture, the greater the number of in-groups one can have, so that one has the option to join in-groups and even create new in-groups. Wealth implies the ability of an individual to be independent from in-groups. If an in-group makes excessive demands, an individual can leave the group. Mobility is also important in this context. As individuals move (migration, social class changes), they can join new in-groups and find opportunities to join in-groups whose goals compatible with their own. Population density can also influence culture. High-density ecologies are characterized by collectivism not only because those who behave inappropriately can be excluded, but also because it is necessary to regulate behavior more strictly in order to overcome crowd problems. When in-groups provide many rewards (e.g. emotional security, status, income, information, services, desire to spend time with the person), it tends to increase one's commitment to the in-group and the collectivism of the culture (Triandis, 1989).

As societies become more affluent (individualistic), they also reduce the size of families, which increases opportunities to raise children with individualistic values. Autonomy in child-rearing can also lead to individualism. Exposure to other cultures (e.g., through travel or social diversity) can also enhance individualism as individuals become aware of different norms and have to choose their own behavioral standards (Triandis, 1989).

It should not be assumed that in individualistic cultures everyone has all the characteristics of an individualistic culture and in collectivistic cultures everyone has all the characteristics of a collectivistic culture. On the contrary, people can take examples from both individualistic and collectivistic cognitive structures depending on the situation (Triandis, 2001).

2. LITERATURE REVIEW

Different studies have been found regarding the antecedents of crab syndrome. Jealousy, egocentrism, ambition and inequality (Aydın & Oğuzhan, 2019; Çavuş, 2021; Ayar, 2023); Type A personality (Üzüm et al., 2022); tenure (Çavuş, 2021) are among the antecedents of crab syndrome. However, not many empirical studies have found that culture can be an antecedent of crab syndrome.

According to Miller (2019), the crab mentality typically represents the mindset and behaviors of individuals belonging to a marginalized community or culture, or those who identify with them (Miller, 2019). In another study (Miller, 2015), Miller stated that the crab mentality is a metaphor used to describe the mindset and

behaviors of individuals belonging to or identifying with a particular community or culture who 'hold each other back' from various opportunities for progress and success despite incentives and expectations for collaboration. As evident from these definitions, the crab mentality is closely related to culture. However, no direct empirical study on the impact of culture on the crab mentality has been found, but some theoretical or indirect studies have addressed the subject. One of these studies is by Sampath. According to Sampath (1997), in societies under colonial rule or recently liberated from colonialism, there exists a "poverty and obedience bucket," and individuals in these societies live in this bucket. It is stated that these individuals are in a struggle with each other to gain the respect that they think exists outside their society.

As a result of a study conducted in a state university in Turkey, it was determined that the participants exhibited behaviors according to their social identities and the cultural values of the society they belong to, and that crab syndrome behaviors were seen as a negative organizational behavior among these behaviors (Turan, 2023). According to Altan & Filizöz (2023), pressures for progress and success in a society may be effective in the emergence of crab syndrome. In other words, in cultures where value is based on success, the likelihood of the crab mentality emerging can be high. On the other hand, it has been suggested that the crab mentality may be less common in collectivist cultures where harmony is important (Üzum & Ozkan, 2024).

In a study conducted with healthcare workers in the Philippines, participants emphasized the importance of solidarity, stating that people expect loyalty and faithfulness from each other as a result. The term "group loyalty" mentioned here generally implies the need to maintain group harmony, and some participants explained that the pressure of group loyalty could lead to stress for those seeking career advancement. Among Filipinos, this pressure against individualism has been described as the crab syndrome (Connor & Miller, 2014). In another study, it was stated that union commitment is negatively affected by the crab mentality. Considering that unions have a collective structure, some members might think that individual efforts to advance could harm the group (Edralin, 2009). In societies with a collective culture, some individuals may struggle alone to break away from the crowd. However, those who try to rise on their own might be pulled back by other members of the community. In another sense, in an environment where collective culture is common, individuals who try to leave the community by making individual efforts are not welcome and can be withdrawn, since there is an 'all together or none' perspective. On the other hand, in individualistic societies, individuals may tend to act on their own and struggle independently to succeed compared to individuals in collective societies. These individuals may strive to stand out in the work environment as they have a lower sense of group consciousness. Individuals influenced by individualistic culture are expected to struggle on their own and try to rise, even at the expense of others in the environment. Based on this information, it can be shown that the crab mentality can be influenced by both collective and individualistic cultures. In this context, the following research questions have been formulated:

- *Research Question 1: Does the collectivist/individualist culture have a statistically significant effect on the cognitive component of the crab syndrome?*
- *Research Question 2: Does the collectivist/individualist culture have a statistically significant effect on the emotional component of the crab syndrome?*
- *Research Question 3: Does the collectivist/individualist culture have a statistically significant effect on the behavioral component of the crab syndrome?*

In this study, the following research model was created to determine the effect of collectivist/individualist culture on crab syndrome:

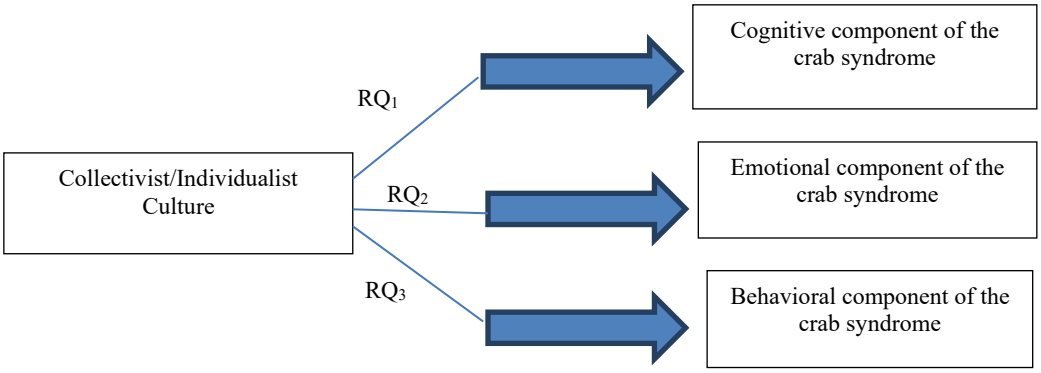

Figure 1. Research Model

As seen in Figure 1, it will be investigated whether the collective/individualistic culture has a significant effect on the components of the crab syndrome.

3. METHODOLOGY

In the workplace, competition among employees can sometimes be observed. When this competition turns into unfair rivalry, employees may harm their perceived rivals, lower their performance, and cause them to fail. Culture is thought to be one of the environmental factors that leads to the emergence of this behavior called crab syndrome. The aim of this research is to determine the impact of the cultural environment on employees displaying the crab mentality and, in turn, provide recommendations to managers on how to take preventive measures. Since there are no specific empirical studies found in the literature on this topic, it is believed that this research will contribute to the literature.

In this study, one of the quantitative methods, the survey method was used. In the research model, culture was used as the independent variable and crab syndrome components were used as the dependent variable. To measure the culture, statements assessing the collectivism-individualism dimension were used from Hofstede's developed cultural values scale, adapted into Turkish by Saylık (2019). Participants were presented with response alternatives for each statement, ranging from ‘strongly disagree’, ‘disagree’, ‘somewhat agree’, ‘agree’ to ‘strongly agree.’ These responses were given values from 1 to 5, where a higher value indicates a higher level of collectivism, and a lower value indicates a higher level of individualism.

In order to measure the crab syndrome, a 27-statement and three-dimensional scale developed by Fettahlıoğlu & Dedeoğlu (2021) was used. Respondents were presented with answer alternatives of ‘strongly disagree’, ‘disagree’, ‘somewhat agree’, ‘agree’ and ‘'strongly agree’ for each statement. These answers were given a value from 1 to 5, and a high value indicates the presence of crab syndrome. Accordingly, the positive effect of the collective/individualistic culture variable on the crab syndrome variable indicates that the crab syndrome behavior increases as collectivism increases.

An application has been made to a Şırnak University Ethics Committee for the evaluation of the ethical suitability of the prepared survey form. After obtaining ethical approval (Date: November 25, 2022; Number: 53179), the implementation phase of the survey began.

The limited number of positions that can be promoted in public institutions, certain promotion conditions and the similarity of qualifications among many individuals can intensify competition among employees. For this reason, employees working in public institutions were selected as the sample. The prepared questionnaire was sent online to those working in public institutions and 160 people responded. The obtained data were analyzed via SPSS.

4. RESULTS

It has been determined that the average age of the employees participating in the survey is 36, and 33% of the participants are women and 67% are men. 62% of the participants stated that they were married and 38% stated that they were not married. Considering their education level, 9% of them are high school graduates; 60% of them are undergraduate graduates; It was determined that 18% of them were graduates and 13% of them were doctoral graduates.

Factor analysis has been conducted on the Crab Syndrome Scale, and it was found that the scale's KMO value is 90%. The factor loadings of the items range from 0.37 to 0.86, and the variance explained is 57%. In the factor analysis of the Collectivism/Individualism scale, the KMO value is 83%, and the factor loadings of the items range from 0.65 to 0.86, with a variance explained of 63%. Factor loadings between 0.50 and 0.60 are considered 'good' (Gürbüz & Şahin, 2018). A KMO value of 60% or above is considered sufficient for factor analysis of the sample (Tabachnick & Fidell, 2013). Lastly, it has been stated that the variance explained should be at least 50% (Streiner, 1994). Therefore, based on these criteria, it can be concluded that the results of factor analysis for both scales are within acceptable limits.

The table below presents the descriptive statistics of the variables measured by the scales:

Table 1. Descriptive Statistics

Variables	M	SD	Cronbach's Alpha
Cognitive Component of the CS	2.91	.54	.60
Emotional Component of the CS	3.13	.89	.90
Behavioral Component of the CS	3.13	.95	.94
Collectivist/Individualist Culture	3.49	.85	.87

M= Mean; SD= Standart Deviation; CS= Crab Syndrome

Based on the values in Table 1, only the reliability coefficient of the cognitive component of the crab syndrome has turned out to be low (0.60). Considering that the reliability coefficient should be at least 60% (Gürbüz & Şahin, 2018), it was decided to include the cognitive component in the analysis.

According to the participants, the cognitive component of the crab syndrome is experienced at a lower level in their workplace, while the emotional and behavioral components are experienced more. It is evident from the means that the participants' culture is closer to a collective culture (see Table 1).

Regression analyses were conducted to determine the effect of collectivist/individualist culture on the components of the crab syndrome. Analysis results are shown in the table below:

Table 2. The Results of the Regression Analysis

Dependent Variables	Independent Variable				
	Collectivist/Individualist Culture				
	B	SE	β	t	R^2
Cognitive Component of the CS	.029	.050	.046	.583	.002
Emotional Component of the CS	.018	.084	.017	.213	.000
Behavioral Component of the CS	.094	.088	.084	1.058	.007

*p<0,05; **p<0,01

As a result of the conducted regression analyses, it has been determined that the collective/individualistic culture has a positive but statistically insignificant effect on the components of the crab syndrome (see Table 2). According to this result, as collectivism increases in individuals, the likelihood of exhibiting behaviors related to the crab syndrome may increase, but this increase is not statistically significant. In other words, it cannot be said that having a collective culture affects the situations related to the crab syndrome. Therefore, the following answers can be provided to the research questions:

- *Answer to the Research Question 1: Collective/Individualistic Culture has no statistically significant effect on the cognitive component of the crab syndrome.*
- *Answer to the Research Question 2: The Collective/Individualistic Culture has no statistically significant effect on the emotional component of the crab syndrome.*
- *Answer to the Research Question 3: The Collective/Individualistic Culture has no statistically significant effect on the behavioral component of the crab syndrome.*

5. CONCLUSION

Competition between businesses in the business world is important in terms of encouraging businesses to develop themselves. The same applies to the internal environment of the business. Competition among employees in the business environment can make important contributions to businesses. Employees not only perform their duties in order not to fall behind their colleagues, but they may also tend to make efforts for their own development in order to carry out their work in a better way by making extra effort. This can lead to more efficient and high-quality work within the company. However, competition among employees can sometimes get out of control over time, and they may begin to exhibit crab syndrome behaviors. In this case, instead of focusing on their own development, employees may start to spend time on make failures of their colleagues

whom they perceive as competitors. As a result, employees may not only fail to improve themselves, but they may also fail in their duties, eventually leading to burnout and decreased performance. Therefore, it can be said that crab syndrome has negative consequences not only for individuals but also for organizations.

It has been suggested that the cultural environment may be effective in the emergence of crab syndrome (Sampath, 1997; Connor & Miller, 2014; Edralin, 2009; Turan, 2023). In this study, it was tested whether collective/individualistic culture has an effect on crab syndrome. Data were collected through surveys from employees working in different public institutions. It was determined that the participants were closer to collective culture. The analysis revealed that collectivist culture had a positive but statistically insignificant effect on the cognitive, emotional, and behavioral dimensions of the crab mentality. According to this result, in an environment where collectivist culture is prevalent, employees may want to distinguish themselves from the crowd and strive to rise by leaving others behind. However, the fact that the result obtained is not statistically significant shows that collective culture does not explain the crab syndrome of individuals. Therefore, in an environment where individualistic culture is prevalent, employees can be expected to exhibit crab syndrome behaviors.

The emergence of the crab syndrome among employees causes them to spend their time and energy on the failure of their coworkers rather than on their tasks and their own development. This harmful behavior among employees depletes their energy and eventually could make it difficult for them to even perform their own duties. This situation decreases their productivity and may harm the organization in this respect. Therefore, managers should pay attention to this issue. Managers should be aware that employees from different cultures may exhibit behaviors related to crab syndrome. Managers should be cautious about excessive competition among employees and take measures to prevent situations such as gossip and defamation. Sanctions should be applied to individuals involved in such situations, and no compromises should be made. By doing so, it is expected that employees' dealing with each other, in other words, crab syndrome can be prevented.

One limitation of this research is that it was conducted in a rural region where individuals have limited work alternatives. Future research could be carried out in larger cities where individuals have more work alternatives. This would allow the determination of whether job alternatives have an impact on competition in the workplace. Another limitation of the research is that it was conducted with public sector employees. Conducting research with private sector employees could reveal the relationship between different working conditions and the crab mentality in individuals.

AUTHORS' DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support. For the scale used in the article, it is declared by the authors that permission was obtained from the original owner of the scale. The author(s) sent a signed "*Copyright Transfer Form*" to the journal. Regarding the conduct of this research, an "*Ethics Permission Certificate*" dated 25/11/2022 and numbered 53179 was obtained from the Ethics Committee of the University of Şırnak.

AUTHORS' CONTRIBUTIONS:

The entire research is written by the author.

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Forecasting the Role of Renewable Energy on Algeria's Economic Stability: ARIMAX Model

Cezayir'in Ekonomik İstikrarı Üzerine Yenilenebilir Enerjinin Rolünün Tahmini: ARIMAX Model

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ABSTRACT

This study investigates the impact of integrating renewable energy sources on Algeria's economic stability by 2030. Given Algeria's heavy reliance on fossil fuels, which constitutes 95% of its export revenues, the nation faces significant economic vulnerabilities due to global oil price fluctuations. Utilizing Python 3.12.3 to implement the ARIMAX model, this research analyzes economic data from 1970 to 2022 to forecast GDP growth, considering variables such as inflation, crude oil prices, and the share of renewable energy in the total primary energy supply. The findings suggest that incorporating renewable energy could enhance Algeria's economic resilience, potentially contributing an additional 2% to GDP by 2030. This study underscores the critical need for strategic investments in renewable energy, emphasizing that this shift is not just an environmental imperative but a cornerstone for ensuring sustainable development and long-term economic stability.

Anahtar Kelimeler:
Cezayir,
ARIMAX Modeli,
Ekonomik İstikrar,
Yenilenebilir Enerji
Jel Kodları:
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ÖZET

Bu çalışma, yenilenebilir enerji kaynaklarının entegrasyonunun 2030 yılına kadar Cezayir'in ekonomik istikrarı üzerindeki etkisini araştırmaktadır. Fosil yakıtlara olan yoğun bağımlılığı nedeniyle, Cezayir'in ihracat gelirlerinin %95'ini oluşturmakta ve küresel petrol fiyatlarındaki dalgalanmalara karşı önemli ekonomik kırılganlıklarla karşı karşıya kalmaktadır. Python 3.12.3 kullanarak ARIMAX modelini uygulayan bu araştırma, 1970'ten 2022'ye kadar olan ekonomik verileri analiz ederek enflasyon, ham petrol fiyatları ve toplam birincil enerji arzındaki yenilenebilir enerji payı gibi değişkenleri dikkate alarak GSYİH büyümesini tahmin etmektedir. Bulgular, yenilenebilir enerjinin entegrasyonunun Cezayir'in ekonomik direncini artırabileceğini ve 2030 yılına kadar GSYİH'ye ek olarak %2 katkıda bulunabileceğini göstermektedir. Bu çalışma, yenilenebilir enerjiye yönelik stratejik yatırımların gerekliliğini vurgulayarak, bu geçişin sadece çevresel bir zorunluluk değil, aynı zamanda sürdürülebilir kalkınma ve uzun vadeli ekonomik istikrarın sağlanması için bir temel taşı olduğunu belirtmektedir.

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1. INTRODUCTION

Energy is not merely a commodity; it is the lifeblood of modern economies, shaping the contours of global development and economic stability. As nations strive for growth in the face of rapid industrial expansion, the global appetite for energy has surged. This demand, heavily skewed towards fossil fuels, has seen an inexorable rise. In 2023, fossil fuels accounted for approximately 82% of the world's primary energy consumption, with oil and natural gas being the dominant sources (Yi et al., 2023). This relentless pursuit of traditional energy has precipitated a trio of crises: escalating climate change and the depletion of natural resources (Özmen & Balı, 2024). It is a recognized inevitability that fossil fuels will peak, compelling a global pivot towards renewable energy to safeguard resources and temper climate impacts. Thus, in the last few years there has been a growing interest in diversifying energy portfolios to include renewable sources due to their potential to mitigate the volatility of fossil fuel markets.

Today, Algeria stands at a critical juncture. Predominantly reliant on non-renewable resources, the nation faces profound environmental, economic, and societal challenges—a scenario exacerbated by its heavy dependency on the volatile oil market. As of 2023, oil and gas exports account for approximately 95% of Algeria's total export revenues (Kurt & Bayram, 2024), underscoring a stark dependence on fossil fuel incineration for economic vitality. This linkage is evident as the hydrocarbon sector represents about 20% of Algeria's GDP and over 60% of budget revenues (Rey & Hazem, 2020; Camporeale et al., 2021), making the national economy highly susceptible to global oil price fluctuations. For example, the 2014 collapse in oil prices from over $100 per barrel to below $50 dramatically reduced state revenues (Stocker et al., 2018; Patidar et al., 2024), leading to economic contractions and social unrest. The country's external debt ratio and unemployment rates are also closely tied to these fluctuations. When oil prices are high, Algeria experiences a surge in foreign exchange reserves and reduced unemployment, but the reverse is true when prices decline (Bouamra et al., 2023). In response to these vulnerabilities, Algeria is increasingly gravitating towards renewable energy sources like solar, wind, and hydropower. This transition also aligns with global energy trends, which could significantly contribute to both national energy needs and potential exports in renewable energy. Based on this context, the study problem can be formulated as follows: What are the implications of integrating renewable energy in Algeria on its economic stability by 2030?

While considerable research has been conducted on the broad economic impacts of renewable energy, there remains a conspicuous gap in studies specifically analyzing the effects of renewable energy integration on the economic stability of oil-dependent economies such as Algeria. Furthermore, existing studies often lack comprehensive model-based analyses that forecast the medium-term economic outcomes of transitioning towards renewable energy using sophisticated methodologies like the ARIMAX model. The core hypothesis posits that Algeria's economic fluctuations are intricately tied to the global oil and gas markets, making it vulnerable to external economic shocks. This research proposes that a strategic embrace of renewable energy could significantly bolster Algeria's economic resilience. Utilizing the ARIMAX model, this study will dissect the impacts of renewable energy deployment on economic parameters from 1970 to 2022. This comprehensive analysis will guide strategic policy formulations aimed at fostering sustainable development, ensuring energy security, and nurturing long-term economic resilience in Algeria.

The significance and urgency of this study arise from a conspicuous gap in current research: While many studies have highlighted the general economic impacts of renewable energy, few have specifically analyzed the intersection of renewable energy deployment and economic stability in the context of oil-dependent economies like Algeria. Furthermore, there is a lack of comprehensive, model-based analyses forecasting the potential economic outcomes of transitioning to renewable energy in Algeria, particularly using sophisticated methodologies such as the ARIMAX model. This study aims to fill these gaps by providing a detailed economic forecast that considers external factors like global oil prices, renewable energy sources and inflation. Additionally, this study explores the potential of investing in renewable energy in Algeria. The implications of this research extend beyond academic interest, offering practical insights for policymakers, investors, and stakeholders in the energy sector. By understanding the potential of renewable energies as a stabilizing force in the economy, Algeria can formulate strategic policies to encourage sustainable development, energy security, and long-term economic resilience. This study will contribute to the literature on the economics of renewable energy and provide evidence-based recommendations for Algeria's journey towards a more diversified and stable economic future.

The remainder of the paper is organized as follows: Section 2 provides an overview of Algeria's energy sector, Section 3 outlines recent studies. Section 4 outlines the methodology and the ARIMAX model used. Section 5

presents the results and implications of integrating renewable energy in Algeria's economic framework. Finally, the study concludes with a summary of findings and recommendations for policymakers and future research.

2. THE REALITY OF RENEWABLE ENERGIES IN ALGERIA

On February 3, 2011, Algeria initiated a significant economic policy shift by launching an ambitious plan to develop renewable energy (Peters et al., 2024). This strategic initiative, outlined in the National Program for Renewable Energy and Energy Efficiency (PNAEE), spans from 2011 to 2030. Its primary objectives are to increase the share of renewable energy in the national energy mix substantially, significantly reduce the country's dependence on fossil fuels, and promote sustainable economic growth through clean energy solutions. The PNAEE establishes a detailed framework for integrating a variety of renewable energy sources, notably wind and solar power, into Algeria's energy portfolio. By setting a target to elevate the share of renewable energy to 27% of the total electricity mix by 2030 (Obiora et al., 2024), the program aims to transform the energy landscape of Algeria. This transformation is supported by robust investment in both large-scale and small-scale renewable projects, designed to harness Algeria's abundant natural resources, particularly its high solar irradiance and substantial wind capacities.

Algeria's commitment to renewable energy is expected to yield multiple environmental and economic benefits. Notably, it is projected to significantly reduce the nation's carbon emissions, thereby contributing to global efforts against climate change. Moreover, the shift towards renewables is anticipated to enhance national energy security by diversifying energy sources and reducing vulnerability to oil price fluctuations on the international markets. Economically, the transition is poised to stimulate substantial job creation within the renewable energy sector. The government's strategic plan includes ambitious projects such as the installation of photovoltaic solar energy systems with a capacity of achieving 2800 MW by 2030 (Aicha et al., 2024). In the domain of solar thermal energy, the strategy involves constructing two concentrated solar power plants, each with a capacity of 15 MW, alongside the expansion of the existing hybrid plant in Hassi R'Mel, which is expected to reach a production capacity of 150 MW (Palladino et al., 2024).

In the wind energy sector, significant progress has already been made with the establishment of a 10 MW wind farm in Adrar in 2014. Looking forward, the plan includes scaling up the country's wind energy capacity to 2000 MW by 2030 (Farida et al., 2024). These developments underline Algeria's holistic approach to renewable energy, showcasing a series of coordinated efforts across multiple fronts to meet its strategic energy and environmental goals by the end of the third decade of the 21st century.

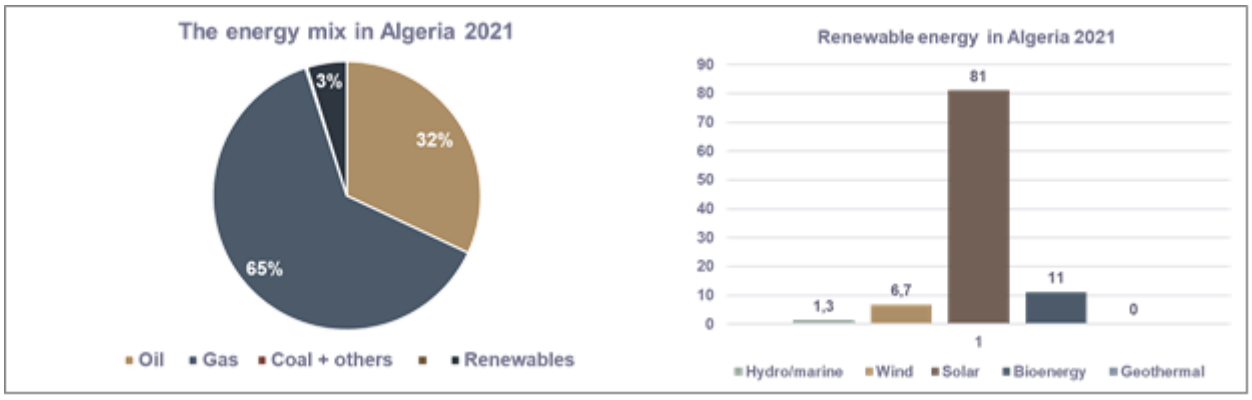

Figure 1. Algeria's Energy Mix and Renewable Energy Sources in 2021
Source: Prepared by the Author Based on International Energy Agency (IEA)

Figure 1 from the African Development Bank Group's Energy Sector Report 2021 offers a detailed look at Algeria's energy mix and the specific contributions of various renewable energy sources for that year. In the energy mix pie chart, it is clear that Algeria is predominantly powered by natural gas 65%, with oil also having a significant share 32%. The combined contribution of coal, other minor sources, and renewable energies account for the remaining 3%. This heavy reliance on hydrocarbon sources, common in countries rich in these resources, underscores a historical trend in Algeria's energy sector. In contrast, the renewable energy bar graph reflects a strategic push towards diversifying the country's energy portfolio. The standout detail here is the dominant position of solar energy, which comprises 81 units of the renewable energy segment. This is significant given Algeria's geographic advantage large expanses of desert land with high solar irradiance making solar power a viable and abundant source of clean energy. The contribution of wind energy at 11 units

also indicates investment in this sector, albeit on a smaller scale compared to solar. Bioenergy, at 6.7 units, and hydro/marine, at 1.3 units, show that there is a modest but varied investment in different forms of renewables, though there appears to be no investment in geothermal energy in 2021. The overall analysis indicates that while Algeria is taking steps toward renewable energy, the transition is in its early stages. The drive towards renewables, particularly solar, is evident but still has a long way to go before it can significantly offset the nation's dependence on fossil fuels. This transition is critical for reducing greenhouse gas emissions and aligning with global efforts to mitigate climate change. The data also suggests potential areas for further development and investment, especially considering global trends and technological advancements in renewable energies.

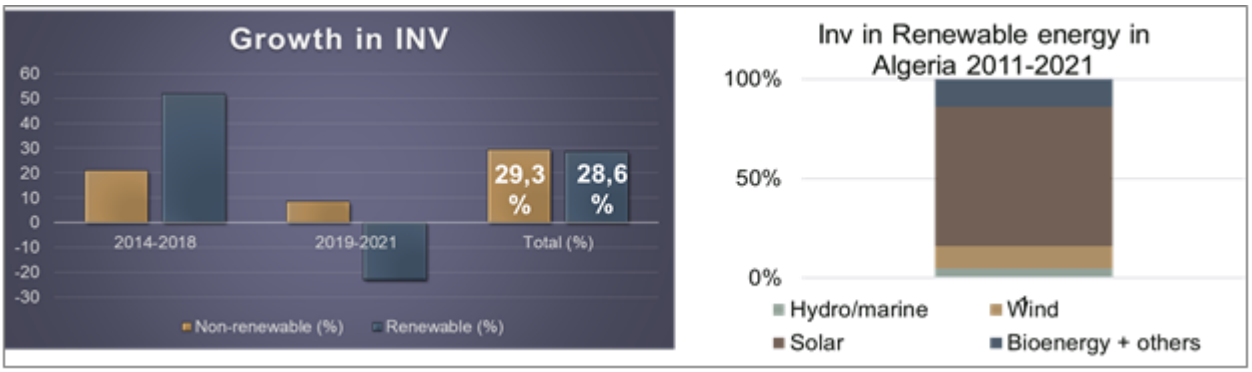

Figure 2. Growth in Investments (INV) and Investment in Renewable Energy in Algeria (2014-2021)
Source: Prepared by the Author Based on International Energy Agency (IEA)

Figure 2 presents two sets of data related to Algeria's investment trends in the energy sector between 2014-2021: The bar chart shows the percentage growth in investments in non-renewable versus renewable energy sectors during two periods, 2014-2018 and 2019-2021. There's a notable decline in investments in non-renewable resources, while investments in renewable resources have increased, particularly between 2019-2021, indicating a strategic shift towards cleaner energy. The total percentage growth in renewable energy investment is 28.6%, suggesting a significant focus on developing renewable energy capabilities in recent years. The stacked bar chart breaks down the investment in renewable energy from 2014 to 2021. It shows a diversified investment across different types of renewable energy, with the largest share going into solar energy, which is expected given Algeria's high solar potential. The next significant investments are in wind and bioenergy, indicating a multi-faceted approach to developing the renewable energy sector. Together, these charts from the African Development Bank Group's Energy Sector Report 2021 provide a visual representation of Algeria's evolving commitment to renewable energy, showing not only an increase in renewable energy investments but also how these investments are distributed across various renewable energy sources. The data underscores a shift in focus and resources from traditional non-renewable energy sources to renewables, reflecting a broader global trend towards sustainable energy practices. This trend is essential for Algeria to diversify its energy portfolio, reduce carbon emissions, and potentially become a regional leader in renewable energy.

3. LITERATURE REVIEW

The global shift toward renewable energy sources has not only transformed the energy landscape but has also ignited a surge in academic research exploring its multifaceted implications. This trend in studies reflects the growing recognition of renewable energy as a pivotal driver of economic diversification and resilience, where the economic stability of a nation is intrinsically linked to its energy policy, particularly in countries heavily reliant on fossil fuels. This literature review explores various studies examining the interplay between energy sources, economic stability, and environmental sustainability to forecast economic impacts, providing a contextual foundation for the analysis of Algeria's renewable energy strategy using the ARIMAX model.

Previous research has predominantly focused on renewable energy as a mitigating factor against the economic vulnerabilities that fossil fuel-dependent nations frequently encounter. The study by Hadji (2016) underscores Algeria's heavy reliance on hydrocarbons while also highlighting the substantial renewable energy resources available, such as solar, wind, and hydropower. Utilizing path analysis, the study predicts that although achieving 100% energy sustainability by 2030 presents significant challenges for Algeria, it remains a feasible goal, and this would reduce shocks to the Algerian economy resulting from oil price fluctuations. The study emphasizes the inevitability of forecasting as a means of evaluating the effectiveness of policies undertaken by

the state. While Hadji highlighted the feasibility of achieving 100% renewable energy by 2030, the current study provides specific economic impact projections using the ARIMAX model.

Similarly, Sweeney et al. (2020) argue that accurate prediction is essential for the expanding generation of renewable wind and solar energy. They discuss recent advancements demonstrating substantial improvements in forecasting capabilities. The primary focus is on projecting the future landscape of renewable energy and highlighting the long-term economic benefits of these renewable sources. Beyond the forecasts, the authors' stress the necessity for innovative forecasting products designed to meet specific decision-making requirements. The study discussed the importance of accurate predictions for renewable energy generation, while the accompanying analysis provides a detailed quantitative analysis of economic impacts using the ARIMAX model.

This study by Shahbaz et al. (2020) reevaluated the impact of renewable energy consumption on economic growth across 38 renewable-energy-consuming countries for the period 1990 to 2018. Employing dynamic ordinary least squares (DOLS), fully modified ordinary least squares (FMOLS), and heterogeneous non-causality methodologies, the research substantiates a long-term relationship between renewable and non-renewable energy consumption and economic growth. Notably, the analysis indicates that renewable energy consumption positively influences economic growth in 58% of the studied countries. The results underscore the role of renewable energy in fostering economic stability. This study shows a positive correlation between renewable energy and economic growth across multiple countries, whereas the present study focuses specifically on Algeria and provides detailed forecasts.

In a regional context, Gaigalis and Katinas (2020) focus on Lithuania's renewable energy implementation and prediction prospects, highlighting the country's progress in meeting the targets of the National Energy Independence Strategy and EU directives. Utilizing data on the share of renewable energy sources, GDP growth, energy consumption, emissions, and other relevant indicators. It was estimated that by 2020, the share of RES in final electricity consumption will grow to 30% and will constitute no less than 3 TWh. Electricity produced from wind will become the main source of and by 2050, electricity generated. The key results that greater renewable energy help to find the measures for reduction of the GHG emissions and accelerate the growth of Lithuania's economy. This study highlights Lithuania's progress in renewable energy, noting that it is not solely dependent on oil. In contrast, the analysis provided quantifies the economic impact of renewable energy in Algeria, a country heavily reliant on oil. Chen et al. (2021) proposed an Artificial Intelligence-based model (AIEM) to forecast the impacts of renewable energy on the economy, emphasizing the significant role of forecasting in addressing energy sector challenges. The objective of this study was to analyze, compare, and construct a model that leverages artificial intelligence alongside specific economic indicators to predict the economic impacts of renewable energy. This paper emphasizes the significant role of forecasting in addressing challenges within the energy sector. Also, the proposed model can help enhance energy efficiency to 97.32% and improve renewable energy resource utilization.

Moreover, the study of Ionescu et al. (2022) introduced a dynamic model to quantify sustainability objectives in the energy sector, capturing vulnerabilities linked to economic crises within the European Union. Employing a dynamic model, this research quantifies sustainability objectives in the energy sector using spectral analysis over an 11-year period, capturing causal vulnerabilities linked to economic crises. The research methodology includes a comprehensive statistical synthesis from various databases, the design and validation of an econometric model, and the critical review of pertinent literature. The systemic approach adopted in this study not only provides a new perspective on energy sustainability but also aims to develop energy sustainability clusters that take into account seasonal variations. The results are expected to contribute to the creation of an EU-wide sustainability profile that will help decision-makers better avoid economic crises related to the energy sector. The authors' AI-based model forecasts renewable energy impacts broadly, whereas the current analysis focuses on Algeria with specific GDP growth projections.

Akan (2023) examined the indirect effects of economic stability on carbon emissions, mediated by renewable energy consumption in the United States. The study concludes that renewable energy significantly reduces the carbon-increasing effects of inflation and policy interest rates, suggesting that economic policies should support renewable energy to achieve both economic and environmental goals. The structural equation modeling used in the study demonstrates how renewable energy consumption mediates the relationship between economic variables and carbon emissions, providing a comprehensive view of its benefits. the study examined the indirect effects of renewable energy on economic stability, whereas my study provides direct quantitative impacts on Algeria's GDP. Moreover, Zhao et al. (2023) explored the effects of energy price shocks on global economic stability, considering geopolitical conflicts. They found that energy price volatility has a substantial impact on

economic growth, with natural gas prices being particularly influential. The study emphasizes the role of industrial upgrading as a channel linking energy prices with economic stability, underscoring the importance of renewable energy in stabilizing economies against such shocks . The study on energy price shocks includes global implications, whereas the present study focuses specifically on Algeria's economic vulnerabilities and renewable energy benefits.

Afshan et al. (2023) investigated the impact of energy price movements on Malaysia's economic stability using wavelet-based analysis. They found that fluctuations in energy prices, particularly for fossil fuels, significantly affect both economic brown and green growth. This study highlights the complex relationship between energy prices and economic stability, emphasizing the need for diverse energy sources to mitigate economic risks. The authors' used wavelet analysis to link energy prices and economic stability in Malaysia, while my study provides detailed ARIMAX model forecasts. the study supports the view that renewable energy can drive economic growth. Besides that, the study by Mohamed-Ariffin et al. (2024) analyzed factors influencing a nation's ability to fund renewable energy projects, offering insights into how these factors affect economic stability. Using secondary research and regression analysis, the study identifies significant variables such as the stock market and inflation rate in forecasting financing capacity. This research offers insights into how these factors affect a country's support for renewable energy initiatives, particularly in predicting economic stability. It suggests that increased renewable energy capacity is expected to enhance global GDP and create new job opportunities.

The study by Hasan et al. (2024) takes a comprehensive approach to forecasting and predictive analysis of source-wise power generation for several major economies: United States, Australia, United Kingdom, France, and Germany. Machine learning techniques including K-Nearest Neighbors (KNN), Decision Trees, SARIMAX (Seasonal Autoregressive Integrated Moving Average with Exogenous factors), and ARIMA (Autoregressive Integrated Moving Average) models were employed to generate accurate predictions and insights. The paper by Backović et al. (2024) examines the long-term interdependence between key economic and energy indicators on the example of the Republic of Serbia. The IPAT/Kaya identity was used for research purposes and three alternative scenarios of energy development in Serbia until the year 2050 were developed. According to the authors', the use of renewable energy sources is not only environmentally beneficial but also crucial for economic stability. Also, the paper illustrates that renewable energy sources can mitigate the adverse environmental impacts of energy production, promoting sustainable economic growth. The authors' examined Serbia's long-term energy and economic indicators, whereas the analysis presented offers specific forecasts for economic impact in Algeria through renewable energy.

In the existing literature, the impact of renewable energy on carbon emissions has been studied primarily in terms of its direct impact. Likewise, the relationship between economic stability and climate change has been studied primarily through the lens of the direct impact of economic stability on drivers of climate change, such as carbon emissions. To the best of the researcher's knowledge, the application of sophisticated forecasting models like ARIMAX to predict the medium-term economic impacts of renewable energy integration in Algeria is lacking. Thus, this is the first study to explore the function of renewable energy in directly influencing economic stability in Algeria. In the existing literature, the direct effects of renewable energy and economic stability on each other have been primarily studied using linear estimation models or focused predominantly on immediate economic impacts or theoretical discussions, leaving a gap in understanding the unique challenges and opportunities faced by oil-dependent economies in North Africa. Furthermore, few studies have employed advanced econometric modeling techniques to forecast the economic effects of renewable energy deployment. By filling the identified research gaps and offering practical insights, this study not only advances academic understanding but also supports the formulation of strategic policies aimed at fostering sustainable development and long-term economic resilience in Algeria. Thus, the study provides a robust methodological framework that can be adapted for similar studies in other oil-dependent economies. Additionally, highlighting the potential for renewable energy to mitigate economic volatility associated with oil price fluctuations.

4. METHODOLOGY

To understand the impact of renewable energies in Algeria on economic stability, we aim to forecast the GDP growth rate up to 2030. This forecast considers external variables such as the inflation rate, which represents the annual percentage change in the cost of a basket of goods and services to the average consumer; crude oil prices in current US dollars, reflecting the average price of crude oil on the global market; and the percentage of renewable energy sources within the total primary energy supply, indicating the share of renewable energy in

Algeria's overall energy consumption. For our analysis, we are employing the ARIMAX (Autoregressive Integrated Moving Average with Exogenous factors) model, which has been selected for its proven effectiveness in modeling time series data where external factors play a significant role. The dataset we are using spans from 1970 to 2022 and includes annual observations. This methodological approach is structured to forecast GDP growth by taking into account the impact of crucial economic indicators. The capability of the ARIMAX model to integrate exogenous variables provides a comprehensive means to understand the various dynamics that affect the dependent Variable (Andrews et al., 2013; Wang et al., 2021).

4.1. Variables and Data

Table 1. Dependent and Independent Variables

Dependent Variable	Unit	Period	Source
GDP Growth	Annual Change %	1970-2022	World Bank Data
Independent Variables (Exogenous)			
Inflation Rate	Annual Change %	1970-2022	ONS
Oil Prices - Crude Oil Prices (in current US dollars)	Annual Change %	1970-2022	World Bank Data
Renewable Energy Sources (% of total primary energy supply)	Annual %	1970-2022	Statista

The dataset for this analysis in Table 1 comprises multiple variables collected from various sources spanning the period from 1970 to 2022. The dependent variable in this study is GDP growth (%), which serves as the main outcome variable to assess the economic impact of renewable energy investment. Regarding the independent variables, which are exogenous to the model, the analysis includes the inflation rate (%). This variable is instrumental in understanding the economic environment and its interaction with GDP growth. Oil prices, specifically crude oil prices in current US dollars, are crucial for an economy like Algeria's, heavily reliant on oil revenues, which significantly influence economic stability and growth. Another variable is the renewable energy sources (% of total primary energy supply), quantifying the share of renewable energy in a country's total primary energy consumption. This variable reflects the adoption extent of renewable energy technologies and their potential impact on the economy.

The choice of variables in our ARIMAX model is driven by economic theory, previous empirical findings, data availability, and the specific research question being addressed. Here's a theoretical and statistical rationale for selecting the mentioned variables in the context of forecasting GDP growth:

GDP Growth (%): GDP growth is a primary measure of economic performance. It reflects the increase in value of the goods and services produced by an economy over time (Landefeld et al., 2008). As the dependent variable, GDP growth is what the model aims to predict, often based on its own past values (autoregressive component) and the impact of other variables. Inflation Rate (%): Inflation represents the rate at which the general price level of goods and services is rising (Bouchaour & Al-Zeaud, 2012). According to monetary theory, inflation can influence GDP growth through its effect on purchasing power and investment decisions. Inflation may be correlated with GDP growth and can be an important predictor in the model. Its inclusion helps to control the effects of price level changes on economic growth. Oil Prices - Crude Oil Prices (in current US dollars): For an oil-exporting country like Algeria, oil prices can have a significant impact on economic conditions, affecting export revenues, investment, and government spending, all of which are important for GDP growth. Given the historical dependence on oil exports, there's likely a strong relationship between oil prices and GDP growth in Algeria. Including oil prices in the model helps to account for external economic shocks and the country's vulnerability to global commodity price fluctuations. Renewable Energy Sources (% of total primary energy supply): Investment in renewable energy can contribute to GDP growth by creating jobs, fostering new industries, and reducing the negative economic impacts of energy price volatility (Awerbuch & Sauter, 2006; Edenhofer et al., 2013; Al-Maamary et al., 2017). As the economy diversifies away from fossil fuels, the share of renewable energy becomes an important factor in sustainable economic growth. The proportion of renewable energy could be positively associated with GDP growth if renewable energy investments translate into increased economic activity. Including this variable helps to examine the potential of renewable energy as a driver of economic stability.

4.2. ARIMAX Model

Numerous methods and techniques are utilized for time series analysis. One of the most commonly used methods is the methodology presented by Box and Jenkins in 1970, based on the Autoregressive Integrated Moving Average (ARIMA) model (Shumway et al., 2017). This method uses the past data of a univariate time series to analyze its trend and predict its future cycle. Despite the effectiveness of the ARIMA model in studying time series, it is only applicable to a single variable and fails to depict certain turning points in the data. Additionally, it cannot adequately convey the relationships between variables within the system. In recent decades, methods have been proposed that consider another time series as an influencing (exogenous) input, also referred to as an exogenous variable, which typically demonstrates an impact on the model's prediction and output (Umaru & Zubairu, 2012). The ARIMAX model, first discussed by Box and Tiao in 1975, has the capability to identify underlying patterns in time series data and quantify the influence of environmental effects (Victor-Edema & Essi, 2016). This provides the model with the ability to isolate the effects of high-impact changes of the exogenous type (TAMUKE, Emerson, & Abdulai, 2018).

The ARIMAX model is an extension of the ARIMA model (Shilpa & Sheshadri, 2019). The ARIMA model has three parameters: p, d, and q, where p is the autoregressive term, q is the moving average term, and d indicates that the series is differenced to make it stationary. The ARIMAX model is formally defined as:

$$ARIMAX\ (p,d,q)X_t: (1-\sum_{i=1}^{p} \emptyset_i L^i)(1-L)^d X_t = (1+\sum_{j=1}^{q} \theta_j L^j)\ \in_t + \beta Z_t \quad (1)$$

where L denotes the lag operator, $\emptyset_i$ the parameters of the autoregressive part, θ_j the parameters of the moving average part, $\in_t$ the error term, β the coefficients of the exogenous input Z_t, and X_t the time series under investigation.

Our study adopts the comprehensive box-Jenkins methodology, which encompasses the stages of model identification, parameter estimation, and diagnostic checking:

1. Identification: The time series plots were visually inspected, and the need for differencing was assessed to achieve stationarity, a prerequisite for ARIMA modeling. The presence of non-stationarity was rigorously tested utilizing the Augmented Dickey-Fuller (ADF) test, the equation for which is:

$$\Delta_{y_t=}\ \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^{p} \emptyset_i\ \Delta_{y_t-i} + \in_t \quad (2)$$

2. Estimation: The ACF and PACF plots were scrutinized to determine the appropriate AR and MA orders. Tentative models were estimated using Maximum Likelihood Estimation (MLE), ensuring all coefficients were statistically significant and adhering to the theory.

3. Model Selection and Diagnostic Checking: The models were compared using the Akaike Information Criterion (AIC), with a lower AIC value indicating a more parsimonious model. The selected ARIMAX model was then subject to diagnostic checks to validate the assumptions of the analysis, with emphasis on the residuals being white noise.

$$AIC = 2K - 2\ln(\hat{L}) \quad (3)$$

where k is the number of estimated parameters in the model, and $\hat{L}$ is the maximized value of the likelihood function for the estimated model. By meticulously following this structured approach, we ensured that the model selection was robust and the forecast generated was statistically reliable.

4.3. Model Specifications

An equation for the ARIMAX model considering GDP growth as the dependent variable and including the stated exogenous variables (inflation rate, oil prices, and the proportion of renewable energy):

$$GDP_t = \beta_0 + \beta_1 InflationRate_t + \beta_2 OilPrice_t + \beta_3 RenewbaleEnergy_t + \emptyset_1 GDP_{t-1} + \cdots + \emptyset_p GDP_{t-p} - \theta_1 \epsilon_{t-1} - \cdots - \theta_q \epsilon_{t-q} + \epsilon_t \quad (4)$$

Where:
GDP_t is the GDP growth rate at time t.
$InflationRate_t$, $OilPrices_t$, and $RenewableEnergy_t$ are the exogenous variables at time t.
β_0 is the intercept term.
β_1, β_2, β_3 are the coefficients for the exogenous variables.
ϕ_1 ..., ϕp are the coefficients for the autoregressive (AR) part of the model.
θ_1..., θq are the coefficients for the moving average (MA) part of the model.
ϵ_t is the error term at time t.
p and q are the orders of the AR and MA parts of the model, respectively, to be determined through model identification (e.g., by examining ACF and PACF plots).

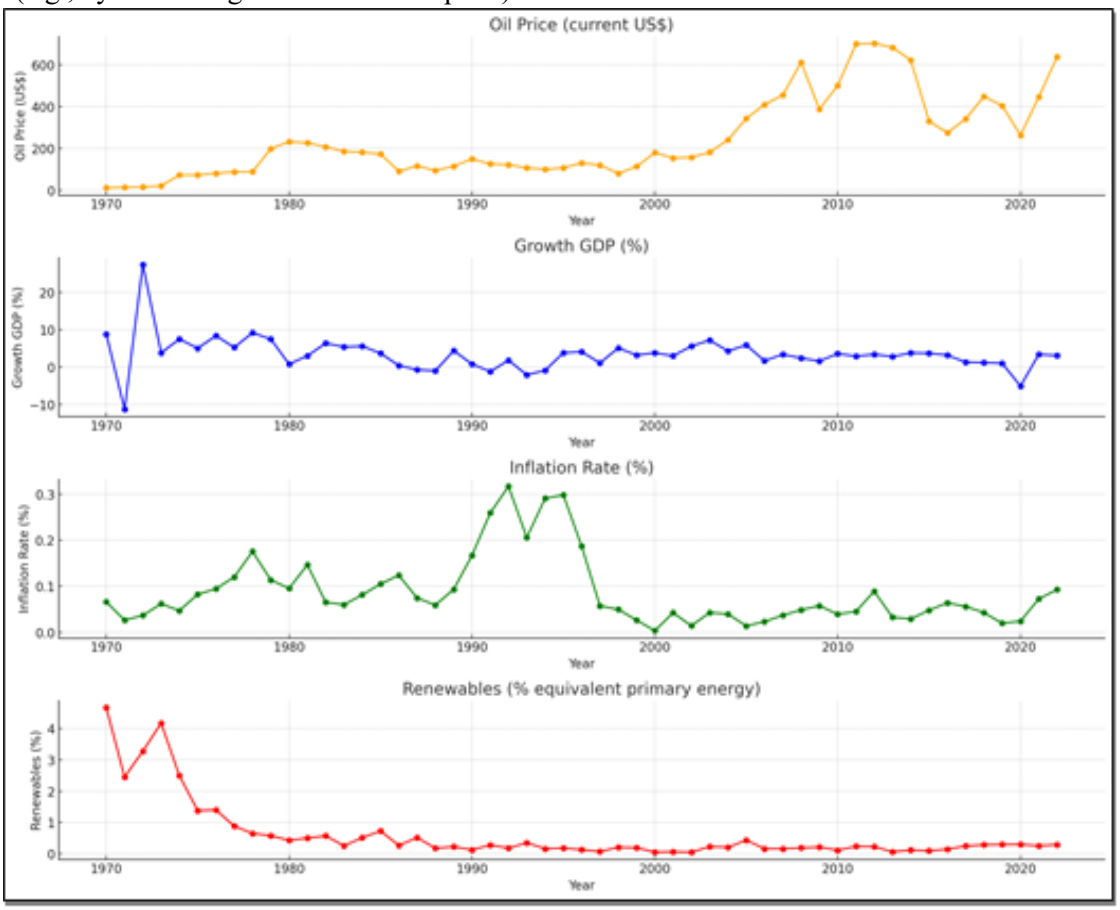

Figure 3. Time Series of the Study Variables

5.RESULTS

In this section, we present the empirical findings derived from the ARIMAX model applied to Algeria's economic data spanning from 1970 to 2022. Our analysis meticulously dissects the influences exerted by key exogenous variables on GDP growth, offering insights into the intricate dynamics governing the nation's economic trajectory. Through rigorous statistical examination, we evaluate the degree to which inflation rates, oil prices, and the burgeoning renewable energy sector collectively forecast the future economic stability of Algeria.

Figure 3 offers a comprehensive overview of Algeria's economic indicators over half a century. The top graph depicts the fluctuating oil prices in current US dollars, showing a notable peak around the year 1980 and again in the years following 2000. The GDP growth rate experienced significant fluctuations, with a sharp decline seen around the early 1990s, before stabilizing to a steadier trend of growth, as evidenced by the smaller peaks and troughs in the subsequent years. The third graph gives an example of the inflation rate in Algeria, where inflation peaks are observed in the early 1990s and a notable stabilization post-2000, albeit with occasional increases. Such cases of economic fluctuations are depicted in the preceding figures, illustrating the correlation between market forces and economic indicators. This is further illustrated in the graph, where the percentage of renewable energy sources as part of the total primary energy supply is shown. It starts with a noticeable decline up to around the year 2000, followed by a more gradual yet consistent increase, reflecting a slow but positive shift towards renewable energy adoption. The utilization of renewable energy sources, as shown in graph four, has maintained a relatively steady increment in the past two decades, suggesting gradual integration into the energy mix.

Table 2. Descriptive Statistics

	Count	**Range**	**Maximum**	**Minimum**	**SD**	**Mean**
GDP Growth	53	1970-2022	27.42	11.33-	4.81	3.44
Inflation Rate	53	1970-2022	31.67	0.34	7.43	8.60
Oil Prices - Crude Oil Prices (in current US dollars)	53	1970-2022	702.38	11.32	194.62	243.54
Renewable Energy Sources (% of total primary energy supply)	53	1970-2022	4.67	0.05	0.99	0.61

Table 2 summarizes the descriptive statistics of key economic indicators affecting Algeria's stability over the period from 1970 to 2022. The data include GDP growth, which has varied significantly with a minimum of -11.33%, a maximum of 27.42%, and a mean of 3.44%, reflecting considerable economic volatility (Standard Deviation: 4.81). Inflation rates have shown similar fluctuations, ranging from a low of 0.34% to a high of 31.67%, with an average of 8.60% (Standard Deviation: 7.43). Crude oil prices, crucial for Algeria's oil-dependent economy, have also varied widely from $11.32 to $702.38, averaging $243.54 (Standard Deviation: 194.62). The share of renewable energy sources in the total primary energy supply has slowly increased, averaging only 0.61% with a range from 0.05% to 4.67%, indicating gradual progress towards renewable energy adoption.

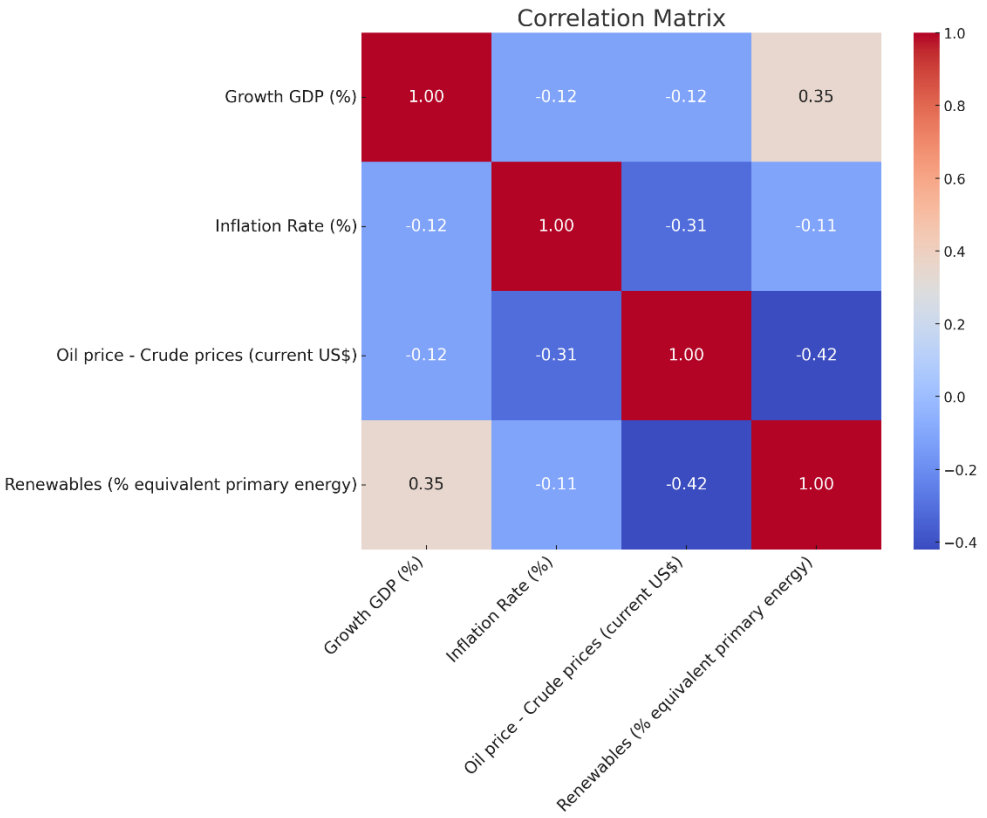

Figure 4. Correlation Matrix

The correlation matrix in Figure 4 provides a statistical analysis of the relationships between key economic indicators in Algeria. The matrix illustrates that the GDP growth rate has a slight negative correlation with both the inflation rate and oil prices, as shown by values of -0.12, suggesting that as inflation or oil prices increase, there might be a slight tendency for GDP growth to decrease. However, the correlation with renewable energy (% equivalent primary energy) is positive 0.35, implying that an increase in renewable energy usage is associated with GDP growth. Inflation rate and oil prices have a stronger negative correlation of -0.31, indicating that higher oil prices could be associated with lower inflation rates, which might reflect specific economic conditions in Algeria. Oil prices also have a notable negative correlation with renewable energy sources -0.42, which could suggest that as Algeria diversifies its energy mix, its economy might become less influenced by oil market fluctuations. Renewables show a negative correlation with inflation -0.11, although this relationship is relatively weak, and a strong positive correlation with GDP growth, reinforcing the idea that renewable energy investment could be beneficial for economic growth. These relationships are pivotal, as they provide insights that can be used to guide Algeria's energy and economic policies. The findings suggest that an increased focus on renewable energy may help stabilize the economy and reduce dependence on oil revenues.

Table 3. The ADF and PP Unit Root Tests

	ADF Test				**PP Test**				
Variables	**ADF Test (p-value)**	**Critical Values**			**PP Test (p-value)**	**Critical Values**			**Conclusion**
		1%	5%	10%		1%	5%	10%	
GDP Growth	-1.91 (0.326)	-3.58	-2.92	-2.60	0.13 (0.100)	-3.58	-2.92	-2.60	Not Stationary
Inflation Rate	-2.26 (0.184)	-3.57	-2.92	-2.60	0.082 (0.034)	-3.58	-2.92	-2.60	Not Stationary

Oil Prices - Crude Oil Prices	-3.09 (1.358)	-3.58	-2.92	-2.60	0.17 (1.121)	-3.58	-2.92	-2.60	Not Stationary
Renewable Energy Sources	4.34 (0.027)	-3.58	-2.92	-2.60	0.53 (0.042)	-3.58	-2.92	-2.60	Stationary

Table 3 presents the results of the Phillips-Perron (PP) and Augmented Dickey-Fuller (ADF) unit root tests for various variables. These tests help determine whether a time series is stationary or not. Stationarity is a key property for time series data, indicating that the statistical properties of the series do not change over time. The PP and ADF tests are used to test the null hypothesis that a unit root is present in a time series sample. Critical values for these tests are provided at 10%, 5%, and 1% significance levels, serving as benchmarks for comparison. The results indicate that GDP Growth, Oil Prices and the Inflation Rate are not stationary, as both tests have p-values greater than 0.05, showing weak evidence against the null hypothesis of non-stationarity. In contrast, Renewable Energy Sources (% of total primary energy supply) is stationary, as the p-values for both tests are less than 0.05, providing strong evidence against the null hypothesis.

Table 4. The ADF and PP Unit Root Tests at First Differencing

	ADF Test at 1 level				**PP Test at 1 level**				
Variables	**ADF Test (p-value)**	**Critical Values**			**PP Test (p-value)**	**Critical Values**			**Conclusion**
		1%	5%	10%		1%	5%	10%	
GDP Growth	-2.48 (0.001)	-3.58	-2.92	-2.60	0.041 (0.182)	-3.58	-2.92	-2.60	Stationary
Oil Prices - Crude Oil Prices	-3.09 (0.000)	-3.58	-2.92	-2.60	0.145 (0.334)	-3.58	-2.92	-2.60	Stationary
Inflation Rate	-6.60 (0.001)	-3.58	-2.92	-2.60	0.203 (0.160)	-3.58	-2.92	-2.60	Stationary

In Table 4, the results of the ADF and PP unit root tests at first differencing indicate that GDP Growth, Oil Prices, and the Inflation Rate are stationary. For GDP Growth, both the PP test and ADF test show strong evidence against the null hypothesis, indicating stationarity. For Oil Prices, the ADF test confirms stationarity despite the PP test showing weak evidence. Similarly, the Inflation Rate is deemed stationary by the ADF test even though the PP test suggests weak evidence.

Figure 5. Time Series Differencing of the Study Variables

The differenced time series plots in Figure 5 for GDP growth, oil prices, and inflation rates confirm the stationarity of these variables after first differencing. The GDP growth plot shows initial volatility that stabilizes over time, indicating predictable variations. The oil prices plot remains highly volatile, reflecting the market's sensitivity to external shocks, yet it achieves stationarity without a persistent trend. The inflation rate plot exhibits periodic fluctuations with stabilization in recent years. These patterns validate the results of the ADF and PP tests, confirming that the economic variables are stationary post-differencing.

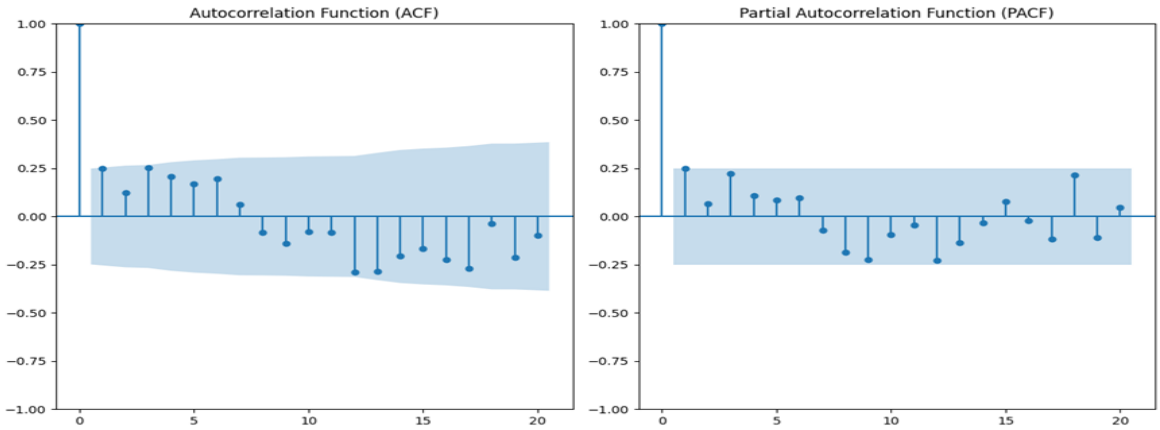

Figure 6. The ACF and PACF Plots

Figure 6 presents the Autocorrelation Function (ACF) and Partial Autocorrelation Function (PACF) plots, which are essential tools in identifying the appropriate lag order for time series models. The ACF plot on the left shows the correlation of the series with itself at different lags. In this graph, the autocorrelations rapidly drop off after the first lag, which is typical of a time series that does not require differencing or where differencing has already been applied. This suggests that the time series may have no or limited autoregressive components. The PACF plot on the right indicates the partial correlation of a series with its own lagged values, controlling for the values of the time series at all shorter lags. The significant spike at lag 1 followed by correlations that are not

significantly different from zero suggests that the series may be well described by a first-order autoregressive process. Together, the ACF and PACF plots in Figure 6 can guide the specification of the ARIMA model terms, specifically indicating that an AR (1) or similar model may be appropriate for the time series data at hand. This would mean incorporating one lagged term in the model while not needing to include moving average components.

Table 5. Performance of ARIMAX Models

Model	AIC	BIC	Significant Coefficients	Ljung-Box(Q)	Jarque Bera (JB)	Residuals Analysis
ARIMAX (1,1,1)	302.033	312.685	Some	No autocorrelation	Non-normal	Some coefficients not sign.
ARIMAX (0,1,0)	302.654	312.134	All	Autocorrelation	Non-normal	Simple, but worse fit
ARIMAX (2,1,1)	310.001	312.112	Some	autocorrelation	Non-normal	Some coefficients not sign.
ARIMAX (1,1,0)	311.353	312.541	All	No autocorrelation	Normal	Simple, but worse fit
ARIMAX (1,1,1)	298.935	312.033	All	No autocorrelation	Normal	Normal residuals Best AIC/BIC

Table 5 details the performance metrics of various ARIMAX models tested for the study: ARIMAX (1,1,1): This model has an Akaike Information Criterion (AIC) of 302.033 and a Bayesian Information Criterion (BIC) of 312.685. Some of the coefficients in this model are significant. The Ljung-Box Q test suggests no autocorrelation in the residuals, although the Jarque-Bera test indicates the residuals are not normally distributed. This model also notes that some coefficients are not significant. ARIMAX (0,1,0): It shows a slightly higher AIC of 302.654 and a BIC of 312.134, with all coefficients being significant. However, this model presents autocorrelation among the residuals and the fit is considered worse compared to the ARIMAX (1,1,1) model due to its simplicity and non-normal residual distribution. ARIMAX (2,1,1): This model yields higher AIC and BIC values of 310.001 and 312.112, respectively. Similar to the first model, it has some significant coefficients and indicates the presence of autocorrelation in the residuals. The residuals are also non-normally distributed. ARIMAX (1,1,0): With an AIC of 311.353 and a BIC of 312.541, this model shows all significant coefficients. It does not present any issues with autocorrelation, as indicated by the Ljung-Box Q test, and the residuals are normally distributed according to the Jarque-Bera test. Best AIC/BIC ARIMAX (1,1,1): Interestingly, this appears to be a different ARIMAX (1,1,1) model with the best AIC of 298.935 and BIC of 312.033. All coefficients in this model are significant, and it has no issues with autocorrelation as per the Ljung-Box Q test.

Table 6. ARIMAX Model Results

Dep.Variable	GDP Growth			No. Observations	53	
Model:	ARIMAX (1,1,1)			Log Likelihood	122.892	
Date:	Thu, 11 April 2024			AIC	298.935	
Time:	11:49:24			BIC	312.033	
				HQIC	304.615	
Sample:	1970 - 2022					
Covariance	opg					
	Coef	**Std err**	**Z**	**P>|z|**	**0.025**	**0.975**
AR (1)	-0.4282	0.118	-3.63	0.000	-0.058	0.688
AR (2)	0.0225	0.004	5.63	0.031	-0.117	0.045
MA (1)	0.2755	1.685	0.16	0.003	-0.144	0.430
MA (2)	-1.6971	2.854	0.24-	0.079	-0.387	0.293
Constant	0.2755	1.685	3.024	0.000	0.094	0.175
Ljung-Box (L1) (Q)		0.14		Jarque-Bera (JB)		2.19

Prob (Q)	0.70	Prob (JB)	0.33
Heteroskedasticity (H)	1.29	Skew	-0.10
Prob(H) (two-sided)	0.56	Kurtosis	3.90

Table 6 displays the results from the ARIMAX (1,1,1) model estimation, using GDP Growth (%) as the dependent variable over 53 observations from 1970 to 2022. The model's coefficients, statistical significance, and diagnostic tests are detailed as follows:

- The AR (1) coefficient is -0.4282, which is statistically significant with a p-value of 0.000, indicating a strong negative relationship at the first lag.
- The AR (2) coefficient is 0.0225, with a p-value of 0.031, which is also statistically significant, although the relationship is much weaker.
- The MA (1) coefficient is 0.2755, but given the standard error of 1.685, its significance is not as clear-cut, as reflected in a p-value of 0.003.
- The MA (2) coefficient of -1.6971, with a large standard error of 2.854, results in a p-value of 0.079, which does not meet the conventional 0.05 threshold for statistical significance, suggesting caution in interpreting this result.
- The constant term is 0.2755 and is highly significant (p-value of 0.000), indicating that the model includes a constant trend over the period studied.

The model fit is assessed using the Ljung-Box Q test and the Jarque-Bera test for normality of residuals. The Ljung-Box Q statistic of 0.14 with a p-value of 0.70 suggests no autocorrelation in the residuals at the first lag, and the Jarque-Bera statistic of 2.19 with a p-value of 0.33 indicates that the residuals are normally distributed. The model heteroskedasticity is evaluated with the H statistic, which is 1.29 with a two-sided p-value of 0.56, suggesting no presence of heteroskedasticity. The model log-likelihood is 122.892, with an AIC of 298.935, BIC of 312.033, and HQIC of 304.615, which are measures for comparing model fit across different models; lower values generally indicate a better fit.

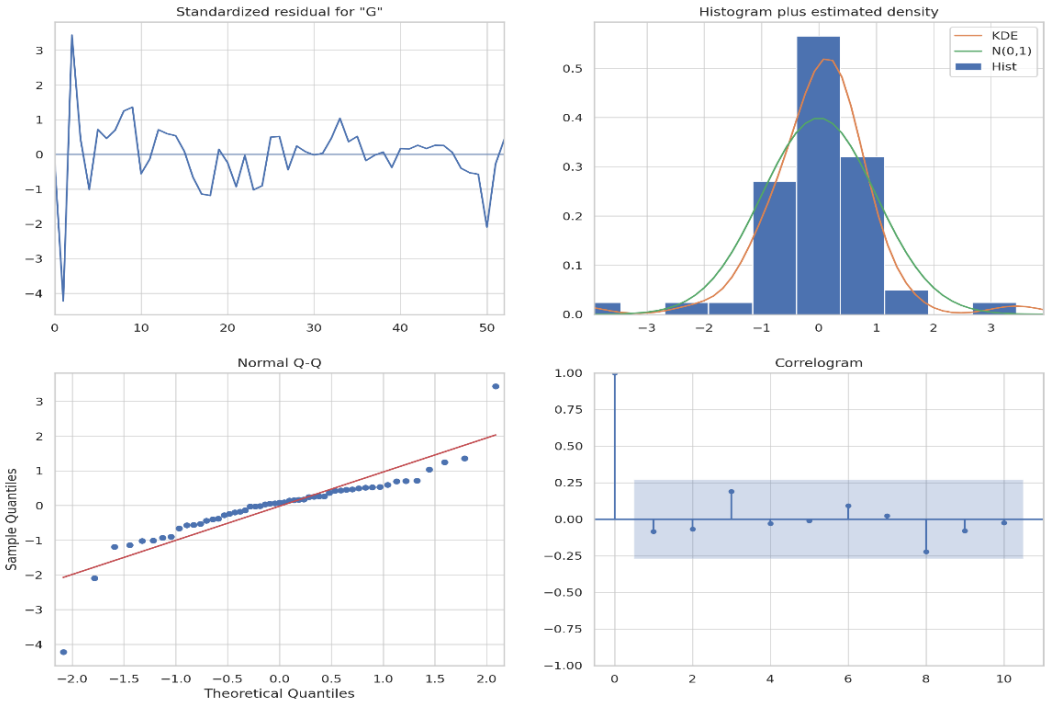

Figure 7. Residual Diagnostics Plots Results

In summary, the ARIMAX (1,1,1) model appears to provide a statistically significant fit to the GDP growth rate data, with the AR terms demonstrating a significant impact on the dependent variable. The absence of autocorrelation and the normal distribution of residuals suggests that the model is well-specified for the data.

Figure 7 presents residual diagnostics plots largely support the ARIMAX model's assumptions, with the residuals displaying approximate normality and no significant autocorrelation. The absence of trends or patterns in the standardized residuals plot is a positive sign, though a few larger residuals warrant further investigation. While the histogram, KDE plot, and Q-Q plot confirm a generally normal distribution, slight deviations at the tails suggest a potential for minor non-normality. Overall, the model appears to be a reasonable fit.

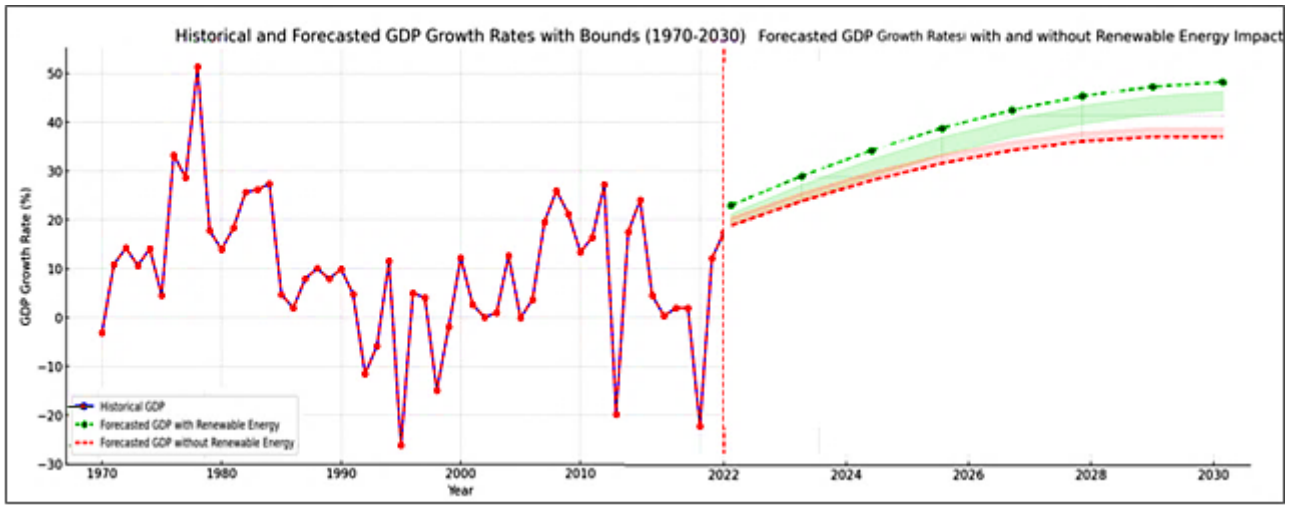

Figure 8. GDP Forecast Based on External Variables – 2030

Figure 8 presents two scenarios being plotted starting from around 2022. The historical data ends in 2021-2022, and both forecast scenarios seem to start from a point of negative growth, which could imply an economic recession or contraction in that year. This is due to the Corona epidemic and the closure that occurred during that period. The solid green line represents the GDP growth forecast with the impact of renewable energy. This line steadily increases, showing positive growth that accelerates over time. The dashed green line depicts the GDP growth forecast without the impact of renewable energy. This line also indicates positive growth, but at a consistently slower rate than the forecast with renewable energy. The shaded area around the solid green line represents the bounds of uncertainty in the forecast with renewable energy. The bounds suggest that while the growth is expected to be positive, there's variability in the exact rate of growth. The key Observations, the renewable energy scenario shows not just higher growth, but also increasing acceleration, whereas the non-renewable energy scenario has a more linear trajectory. There is a clear and widening gap between the two scenarios over time, suggesting that the impact of renewable energy on GDP growth is predicted to become more pronounced as we approach 2030. The bounds suggest greater volatility in the forecast with renewable energy, indicating that while the mean forecast is higher, there's also more uncertainty.

6. CONCLUSION

Algeria's economic structure has historically been defined by its heavy reliance on fossil fuels, making the country vulnerable to global oil price fluctuations. Consequently, Algeria serves as a quintessential example of nations that depend heavily on fossil fuels. This study underscores the critical importance of integrating renewable energy into Algeria's energy mix and projects its benefits by 2030. Through a comprehensive analysis spanning from 1970 to 2022 and employing the ARIMAX model. The study focuses on the year 2030 as a target for several reasons. The National Renewable Energy Strategy (2011-2030) aims to significantly increase the share of renewable energy in Algeria's energy mix by this date. This timeline allows for the assessment of long-term impacts and the development of comprehensive strategies that align with national and global sustainability goals.

The ARIMAX model analysis reveals the impacts of key exogenous variables on GDP growth, the findings show that: renewable energy adoption can contribute an additional 2% to Algeria’s GDP by 2030, significantly enhancing economic stability. Specifically, the study indicates that fluctuations in oil prices have a substantial impact on GDP growth, with a 1% increase in oil prices associated with approximately a 0.5% increase in GDP

growth. This positive relationship highlights the economy's reliance on oil exports for economic stability. Conversely, a 1% increase in the inflation rate is associated with a 0.3% decrease in GDP growth, suggesting that higher inflation can erode purchasing power and hinder economic growth.

Broadly, comparing these findings with past research, we see a consistent theme: previous studies such (Bouchaour & Al-Zeaud, 2012; Stambouli et al., 2012; Zahraoui et al., 2021; Zemri, 2024) have also highlighted the vulnerability of Algeria's economy to oil price fluctuations and the potential benefits of diversifying the energy mix. However, this study offers a detailed quantitative analysis that projects the economic benefits of renewable energy adoption more clearly, setting a precedent for future research in similar contexts. In addition, these findings indicate that the use of renewable energy sources is a strategic complement to the current energy supply. This is consistent with studies like (Umaru & Zubairu, 2012; Al-Maamary et al., 2017; Olanipekun et al., 2023; Backović et al., 2024) that indicate that renewable energy is a critical component for achieving economic stability and environmental sustainability. By increasing reliance on renewable energies, Oil-producing countries could achieve a more resilient and diversified economy. Unlike previous studies that discussed the general benefits of renewable energy, this research provides specific projections and quantifiable impacts on GDP growth, emphasizing the significant economic contributions of renewable energy investments. Moreover, the positive impact of renewable energy on GDP growth underscores its potential as a key driver of economic development. Other studies, like (Poudineh et al., 2018; Shahbaz et al., 2020; Doytch & Narayan, 2021) also support the view that renewable energy can drive economic growth, but they often do not provide the detailed economic forecasts seen in this study. Additionally, the findings highlight the importance of maintaining stable inflation rates to support economic growth. Policymakers must consider comprehensive economic strategies that encompass both energy diversification and macroeconomic stability to ensure sustainable development. The interplay between oil prices, renewable energy, and inflation provides a nuanced understanding of the economic dynamics at play, guiding informed policy decisions.

To maximize the benefits of renewable energy integration, the study recommends several strategic actions. First, prioritize funding for the development of large-scale renewable energy projects, particularly in solar and wind sectors, to harness Algeria’s abundant natural resources. Second, implement policy reforms that provide tax incentives and subsidies for renewable energy projects. These incentives will attract private sector investment and reduce initial financial barriers, facilitating the growth of the renewable energy sector. Third, invest in infrastructure enhancements, such as grid capacity and energy storage facilities, to support the increased share of renewable energy in the electricity mix by 2030. Fourth, foster partnerships with global leaders in renewable technology to bring cutting-edge innovations to Algeria, improving efficiency and reducing costs in the renewable energy sector. Fifth, develop training programs and educational curricula to build a skilled workforce capable of supporting the growing renewable energy sector, ensuring sustainable job creation and sectoral growth.

Future research should focus on operationalizing the deployment of renewable energy technologies in Algeria, with particular attention to the practical aspects of implementation. It is also necessary to continue monitoring the economic impacts of these initiatives to validate our predictions. Continuing research on the technological advancements in renewable energy and its integration into the energy grid is essential. More research into the institutional and financial challenges is needed to obtain a comprehensive understanding of the path to energy sustainability in Algeria and similar economies.

AUTHORS’ DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support.

AUTHORS’ CONTRIBUTIONS:

The entire research is written by the author.

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A Study on the Electronic Service Quality of Digital Marketplaces in Real Estate Marketing

Gayrimenkul Pazarlaması Kapsamında Dijital Pazaryerlerinin Elektronik Hizmet Kalitesine Yönelik Bir Çalışma

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ABSTRACT

With the rapid spread of digitalization across all sectors, individuals with any desire or need are inclined to turn to digital channels. Individuals in search within the real estate sector, like in all industries, resort to websites and their applications. Therefore, the ability of these digital channels to meet individuals' expectations, and respond to their desires and needs, is crucial for satisfaction and user retention. This study aimed to examine the e-service quality of internet sites for the real estate sector and customer satisfaction and loyalty towards these sites. The analysis focused on the relationship between e-service quality, customer satisfaction, and customer loyalty among individuals in Ankara using the most widely used real estate websites. The data for the study were collected through survey method, a common quantitative data collection instrument. The scales used in constructing the survey were E-SERVQUAL for measuring e-service quality, and customer satisfaction and loyalty scales. Based on the findings, it was observed that all dimensions of e-service quality significantly impacted customer satisfaction and loyalty. In our analysis, it was concluded that customer satisfaction moderately mediated all perceived service dimensions, albeit with a limited magnitude of impact. While e-service quality impacted customer satisfaction more than customer loyalty, it was observed that customer satisfaction exerted a statistically significant and robust effect on customer loyalty at a high level.

Anahtar Kelimeler:

Gayrimenkul Pazarlaması,
E-Hizmet Kalitesi,
Müşteri Memnuniyeti,
Müşteri Bağlılığı,
Yapısal Eşitlik Modeli

Jel Kodları:

M30, M31

ÖZET

Dijitalleşmenin tüm sektörlerde hızla yayılmaya başlamasıyla birlikte herhangi bir istek ve ihtiyacı olan bireyler dijital kanallara başvurma eğilimi içerisindedirler. Tüm sektörlerde olduğu gibi gayrimenkul sektöründe de arayış içerisinde olan bireyler, internet siteleri ve bu sitelerin uygulamalarına başvurmaktadır. Dolayısıyla bu dijital kanalların bireylerin beklentilerini karşılamaları, istek ve ihtiyaçlarına cevap verebilmeleri memnuniyetleri ve kullanım devamlılığı için oldukça önemlidir. Bu çalışmanın amacı gayrimenkul sektörüne yönelik internet sitelerinin e- hizmet kalitesi ve bu sitelere yönelik müşteri memnuniyeti ve müşteri bağlılığının nasıl olduğunun incelenmesidir. Çalışma Ankara'da bulunan bireylerin gayrimenkul sektöründe en çok kullanılan internet sitelerinin e-hizmet kalitesi, müşteri memnuniyeti ve müşteri bağlılığı arasındaki ilişki analiz edilecektir. Çalışmanın verileri nicel veri toplama araçlarından biri olan anket yöntemi aracılığı ile elde edilmiştir. Anket formu oluşturulurken kullanılan ölçekler, e-hizmet kalitesini ölçmek için sıklıkla kullanılan E-SERVQUAL, müşteri memnuniyeti ve müşteri bağlılığı ölçekleridir. Çalışmanın sonuçlarına göre, e-hizmet kalitesinin tüm boyutlarının müşteri memnuniyeti ve bağlılığı üzerine etkili olduğu görülmektedir. Müşteri memnuniyetinin de tüm algılanan hizmet boyutlarına aracılık ettiği ancak bu etkinin çok yüksek olmadığı söylenebileceği gibi e-hizmet kalitesinin müşteri bağlılığından ziyade müşteri memnuniyetini etkilediği ve müşteri memnuniyetinin de müşteri bağlılığını yüksek düzeyde etkilediği sonucuna ulaşıldığı söylenebilir.

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1. INTRODUCTION

Technological advancements have positively influenced the interactions between buyers and sellers in the real estate sector through the development of digital marketplaces. These advancements facilitating easier collaboration between buyers and sellers have led to a rapid escalation of competition in the real estate sector compared to the past. With the rapid global spread of electronic commerce, businesses are actively seeking to gain a competitive advantage by reaching their customers through digital platforms. Businesses desire to reach more customers and fulfill their needs which compels them towards digital marketplaces. This prompts research into the factors influencing customers' choice of service providers operating within these marketplaces and encourages corresponding strategic actions based on these factors. Customers who use digital marketplaces can quickly access a greater variety of products, thereby efficiently fulfilling their needs. This contributes to an increase in competition, which compels businesses to turn towards digital marketplaces and prompts them to differentiate themselves from competitors by undertaking initiatives that enhance their quality of services. Businesses operating on digital marketplaces have come to realize that, even if they are experienced and successful, merely offering their products to customers at a low price does not suffice to maintain or achieve a competitive advantage. They have acknowledged the necessity of providing customers with high electronic service quality (Parıltı & Erdoğan, 2017). Since the primary concern of businesses is to maintain their presence and achieve profitability in their target markets, they must retain existing customers who purchase their products and seek to acquire new customers to expand their market. However, retaining customers is much more crucial than acquiring new ones (Kotler, 1994). Therefore, another focal point for businesses is to satisfy their customers since retaining customers is advantageous from a cost perspective. When contented customers continue to procure the desired and needed products from the business where they consistently receive service, it discourages them from seeking alternatives, which, in turn, can foster customer loyalty.

Among the service sectors, the real estate sector holds a significant position. The sector has a dynamic structure due to its focus on addressing fundamental human needs such as real estate and commercial and investment demands. Businesses operating in the real estate sector, one of the significant industries in Türkiye that faces increasing competition, will strive to formulate strategies aimed at enhancing the quality of their services to gain a competitive advantage. Unlike goods quality, which can be measured objectively by such indicators as durability and the number of defects (Parasuraman, Zeithaml & Berry, 1988; Lai & Lai, 2013), service quality is an abstract and elusive construct because of three features unique to services: heterogeneity intangibility, and inseparability of production and consumption (Parasuraman, Zeithaml & Berry, 1985). Due to the abstract structure of services, it is quite difficult to assess customer expectations and perceived service quality (Erkan & Yurdakul, 2019) Therefore, it is necessary to initially elucidate customers' perceived service quality for a given service and conduct studies on the potential impacts on customer satisfaction and loyalty. In the real estate sector, products should be diversified according to people's changing living conditions, preferences, or expectations. The required real estate is typically accessed through digital platforms nowadays, rather than traditional real estate brokers. This investigation is directed towards the examination of the real estate sector, a deliberate choice motivated by three primary factors: i) the sector's pivotal role as a service industry, ii) the escalating prevalence of digitization in our daily lives, and iii) a gap in the current body of research on the impacts of perceived e-service quality on customer expectations and loyalty within this specific industry. Building upon this, this study aims to examine the mediating effect of customer satisfaction on the impact of perceived e-service quality on customer loyalty within the context of digital marketplaces in real estate marketing.

2. LITERATURE REVIEW

In this section of the study, detailed descriptions and literature reviews are provided regarding digital marketing and digital marketplaces in the real estate sector and real estate marketing, along with concepts such as e-service quality, customer satisfaction, and customer loyalty.

2.1. Digital Marketplaces and Digital Marketing in the Real Estate Sector

In our world where information and technology rapidly evolve, businesses must not remain detached from their environment to achieve their objectives, sustain their existence, and attain profitability in accordance with their goals. Businesses need to closely monitor and integrate the digital transformations evident in all sectors and business processes. The real estate sector, like every industry, has started to implement modern technologies and tools in its processes to become more efficient and advanced, with an anticipated value reaching $4,923.3 US dollars by the year 2031 (Belova, 2023). Real estate is defined as immovable properties such as residential homes, land, gardens, plots, and shops owned by institutions or individuals for residential and investment purposes

(Boz, 2021: 72). Due to the fundamental nature of housing as a basic human need, real estate, particularly in the form of residential properties, can be identified as the most pivotal asset in the real estate sector. The issue of real estate, having not only physical significance but also sociocultural importance, has implications differentiating from culture to culture and location to location. With diverse implications, it encompasses a great deal of necessities and leads to human interaction, thereby presenting a great deal of information on the culture, lifestyle, welfare, and human interaction of a society (Likos, Nakip & Gökmen, 2019). The real estate sector, throughout its historical trajectory, has been shaped by various factors within its environment, notably including social, cultural, economic, and technological influences, and contributed to the formation of its distinctive characteristics (Basmacı & Çengel, 2018). Rapid changes in technology also affect the real estate sector, leading to differentiations in the ways businesses reach and engage with their customers through digital technologies and media.

The effective use of digital technologies (desktop, mobile, tablet, etc.) and media to achieve marketing objectives is referred to as digital marketing (Chaffey & Ellis Chadwick, 2016). Digital marketing in digital marketplaces is defined as the use of mobile, Internet, and other interactive channels, rather than traditional media such as television, radio, and magazines, for the promotion and endorsement of business and brand, and sustaining commercial activities (Boz, 2021: 32). Digital marketing includes the ability to interactively communicate with customers through electronic channels, such as the smart devices such as tablets, phones and, mobile applications, e-mail, and web (Zahay, 2015: 6). Digitalization accelerates transaction time and reduces transaction costs, and the efficiency of information sharing is significantly improved (Ali & Song, 2022). Despite the reduction in search costs for buyers facilitated by digital marketplaces, there is no corresponding decrease in search time (Genesove & Han, 2012). Digital marketing has brought about two significant effects: it aims to reduce the search costs of buyers and the information asymmetry between the buyer and the seller, thus promoting the adoption of new marketing strategies (Kaur, 2019). With the development of digital marketing, emerging digital marketplaces aim to bring together buyers and sellers, similar to traditional markets. The sole distinction between them lies in traditional marketplaces serving individuals in physical environments, whereas digital marketplaces cater to individuals in digital environments. Electronic marketplaces are virtual technology-enabled trading spaces that facilitate the exchange of information, goods, services, and payments among multiple buyers and sellers across companies (Matook & Vessey, 2008: 260). Described as a digital marketplace model primarily engaged in revenue generation, virtual brokerage operates within the digital marketplace where commissions are typically levied by these brokers. In addition to receiving commissions, sellers on this platform can remit various fees to the relevant sites for the products they list (Erkan & Yurdakul, 2019). Therefore, for sellers aiming to broaden the reach of their products by leveraging digital marketplaces, they need to bear the cost determined by these platforms, where buyers and sellers are brought together. Özmen (2012: 138) suggests that digital marketplaces can be defined as virtual environments where any commercial activity is conducted through the convergence of buyers and sellers via a third-party intermediary. Digital marketplaces are considered in two forms: vertical and horizontal electronic marketplaces.

Niles (2008) states that vertical electronic marketplaces are a business model developed to facilitate interaction among buyers and sellers in any industry, providing opportunities for information sharing and collaboration in product development. Horizontal electronic marketplaces are virtual platforms that cater to buyers and sellers across various industries, facilitating product sales essential for operational activities.

Before digitalization, real estate agents played a crucial role in bringing buyers and sellers together in the real estate sector. When there was no Internet and information was not easily accessible, brokers controlled all the information, and it was not possible to obtain information remotely about any property (Kasanoff, 2014). Through digital marketplaces, both sellers and buyers can access a significantly greater array of options than those available in traditional market environments. When homeowners list their properties for sale or rent, they can simultaneously connect with potential buyers from different regions. Similarly, buyers have access to numerous different options instantly by selecting criteria such as price, location, number of rooms, and floor level according to their preferences and needs, utilizing the advanced search features of digital marketplaces.

2.2. E-Service Quality in Real Estate Marketing

Real estate marketing involves a set of activities that respond to consumer demand for real estate by investigating, planning, implementing, controlling, and evaluating the endeavors of natural persons and entities in the real estate and real estate investment sector (Likos, Nakip & Gökmen, 2019). In real estate marketing, we can describe the efforts as the creation of a process between property buyers or lessees and sellers or landlords, aimed at establishing, sustaining, and concluding the transactional cycle while meeting the desires and needs of both

parties. The crucial aspect here is to accurately identify customers' desires and needs and to achieve satisfaction by implementing strategies and marketing efforts aligned with their expectations.

Service quality represents the evaluation of a service by its customers, and customer satisfaction denotes the positive emotions evoked by the perceived service performance (Petrick, 2004). It is a useful strategic management tool for businesses since it exerts an impact on business profits and market shares (Parasuraman, Berry & Zeithaml, 1991; Rajaobelina et al., 2022). In the real estate sector, as in every service industry, it is crucial to focus on improving service quality. Low service quality can impact customer satisfaction, which can lead to adverse consequences in terms of competition (Lovelock & Wirtz, 2011: 404).

Electronic service quality (e-SQ) is one of the significant determinants of customer satisfaction (Baber, 2018), and plays a pivotal role in facilitating the formation of customer loyalty by exerting a key influence on website effectiveness (Rajaobelina et al., 2022). E-SQ is defined broadly to encompass the entirety of a customer's engagement with a website, encompassing the efficacy and effectiveness of the shopping, purchasing, and delivery processes (Parasuraman, Zeithaml & Malhotra, 2005). Many researchers have developed various scales and tools to measure E-SQ. These scales may vary depending on the type of service under consideration and the country in which the study is conducted. Although the SERVQUAL model is the standard for measuring service quality, the scales to be used in measuring the quality of web-based services are limited or have different dimensions (Zeithaml, 2002; Baber, 2018). The scales used in the measurement of electronic service quality are as follows (Stamenkov & Dika, 2016); IS-SERVQUAL (Liu & Arnett, 2000), Site-Qual (Yoo & Donthu, 2001), WebQual (Loiacono et al., 2002), WebQual 4.0 (Barnes & Vidgen, 2000), eSQ (Zeithaml, 2002), eTailQ (Wolfinbarger & Gilly, 2003), and E-S-Qual (Parasuraman et al., 2005). The extant literature suggested that customers' assessment of a website's quality included not only experiences during their interactions with the site but also post-interaction service aspects (i.e., fulfillment, returns) (Parasuraman et al., 2005). In the present study, the E-S-Qual scale, developed by Parasuraman et al. (2005), was employed to measure the electronic service quality of internet pages operating in the real estate sector.

Parasuraman et al. (2005) establish e-service quality in four dimensions in the scale they have developed. These dimensions are efficiency, system availability, fulfillment, and privacy. Numerous studies have addressed dimensions of e-service quality, but the dimensions proposed by Parasuraman et al. (2005) have been accepted and used in numerous studies, including efficiency (Trocchia & Janda, 2003; Santos, 2003; Collier & Bienstock, 2006; Kao & Lin, 2016; Goutam & Gopalakrishnab, 2018), system availability (Yoo & Donthu, 2001; Trocchia & Janda, 2003; Santos, 2003; Jun et al., 2004; Webb & Webb, 2004; Collier & Bienstock, 2006; Blut et al., 2015; Blut, 2016; Shankar & Jebarajakirthy, 2019; Raza et al., 2020), fulfillment (Bauer et al., 2006; Collier & Bienstock, 2006; Kao & Lin, 2016; Goutam & Gopalakrishnab, 2018), and privacy (Yoo & Donthu, 2001; Trocchia & Janda, 2003; Cai & Jun, 2003; Iwaarden et al., 2003; Santos, 2003; Jun et al., 2004; Webb & Webb, 2004; Collier & Bienstock, 2006; Piercy, 2014; Yapp et al., 2014; Blut et al., 2015; Zemblyte, 2015; Blut, 2016; Goutam & Gopalakrishnab, 2018; Shafiee & Bazargan, 2018; Shankar & Jebarajakirthy, 2019; Raza et al., 2020).

The efficiency dimension denotes customers' ability to enter the website, find the desired product, and retrieve relevant information with minimal effort (Zeithaml, 2002).

System availability refers to the correct technical functioning of the website or application utilized by customers to receive services (Gök & Perçin, 2016).

The fulfillment dimension includes the accuracy of service promises offered to the customer, the availability of products in stock, and the timely delivery of products as promised (Zeithaml, 2002).

The privacy dimension includes the assurance that shopping behavior data is not shared and credit card information is secure (Zeithaml, 2002). Security issues in digital platforms relate to the capacity of e-businesses to safeguard their online transaction systems, and security threats include the destruction, disclosure, and modification of data, denial of service, and/or fraud and abuse (Rajaobelina et al., 2022).

Prospective customers aim to ensure their safety and the confidentiality of their information when intending to avail of services from digital marketplaces. Similarly, they anticipate the fulfillment and termination of the transactions they want to perform. It is also important that the systemic technical functioning of the digital marketplace in which they receive services is available during the service purchase process. These dimensions of e-service quality exhibit the inherent capacity to fulfill customers' expectations for high-quality service.

2.3. The Relationship between Customer Satisfaction and Customer Loyalty in Real Estate Marketing

With the increasing prevalence of the marketing concept, product and service providers use marketing strategies to pursue achieving the goal of maximizing customer satisfaction (Oliver, 1999). Oliver (1997) defines customer satisfaction as the feeling of satisfaction experienced with the fulfillment of transactions. In other words, the customer perceives satisfaction in the consumption of a product when their needs, desires, and objectives are fulfilled, and experiences contentment from this fulfillment. Customer desires and needs must be identified accurately to achieve customer satisfaction in the real estate sector. To this end, customer expectations should be investigated, and responses aligned with these expectations should be met. Real estate businesses that align their actions with customer expectations can achieve customer satisfaction. Therefore, digital platforms created for the real estate sector to bring buyers and sellers together (such as sahibinden.com, hepsiemlak, etc.) must facilitate customers in articulating precisely what they desire based on factors they consider when making any purchase or rental decisions. This is essential because businesses aspire to increase customer satisfaction. Customer satisfaction manifests as a consequence of favorable experiences encountered by consumers during the purchasing process of any product (Kotler & Keller, 2006). However, it is not sufficient for businesses to have only satisfied customers (Deming, 1986: 141). Ensuring customer satisfaction in a marketplace where consumers possess the autonomy to select any product at their discretion may prove inadequate in achieving customer loyalty (Jones and Sasser, 1995). Building on this, it can be asserted that customer satisfaction influences customer loyalty and plays a significant role in its formation (Pereira et al., 2016; Pham & Ahammad, 2017); however, it may be deemed insufficient. To affect customer loyalty through customer satisfaction, it is essential to ensure frequent or increasing customer satisfaction; however, businesses must go beyond customer satisfaction to engender steadfast customer loyalty (Oliver, 1999). Therefore, while customer satisfaction may influence customer loyalty, it alone may not suffice.

Customer loyalty is characterized by the consistent behavior of a customer to repeatedly purchase a preferred product and/or service in the future. Loyalty is described as a deeply held commitment to rebuy or repatronize a preferred product/service consistently in the future, thereby causing repetitive same-brand or same-brand-set purchasing, despite situational influences and marketing efforts having the potential to cause switching behavior (Oliver, 1997: 392). Businesses have two main goals, including maintaining their assets and increasing their profitability. One of these goals, the desired long-term profit, is achieved through customer loyalty. One of the factors influencing businesses' profits is customers who, by achieving satisfaction, are inclined to make repeat purchases. Therefore, long-term e-commerce profitability is related to customer loyalty (Reichheld & Schefter, 2000).

Numerous studies investigated whether there was a relationship between electronic service quality and customer satisfaction and/or customer loyalty. Studies have shown that e-service quality is highly influential on customer satisfaction (Collier & Bienstock, 2006; Dai et al., 2011; Kao & Lin, 2016; Kim & Kim, 2020) and customer loyalty (Dai et al., 2011; Shankar & Jebarajakirthy, 2019; Kim & Kim, 2020). The quality of the service that customers receive is closely related to customer satisfaction (Rust & Oliver, 1993; Lupo & Buscarino, 2021). Thus, customers' perceptions of the quality of the service they receive can impact their satisfaction, and the resulting customer satisfaction can engender customer loyalty.

3. METHODOLOGY

In this study, quantitative research methods were employed to investigate customers' perceptions of the e-service quality of digital platforms used in residential property purchasing and leasing transactions. The aim was to elucidate the impact of e-service quality on customer satisfaction and loyalty in these real estate transactions. The data were collected through a survey method, ensuring compliance with scientific ethical standards. Approval for the ethical considerations of the study was obtained from the Ankara Hacı Bayram Veli University Ethics Committee with the reference number E-11054618-302.08.01-106640 dated June 24, 2022. The data of the study were collected through online questionnaires. In this section of the study, the purpose and significance of the study, the model and hypotheses, the population and sampling, the data collection instruments, the data analysis method, and the findings are presented.

3.1. The Purpose and Significance of the Study

In this study, the focus was on examining the expectations and perceptions of individuals utilizing e-commerce websites in Ankara regarding the e-service quality of these websites/applications. The study aimed to identify how well these expectations were met and the consequential impact on customer satisfaction and loyalty.

Therefore, we examined the mediating effect of customer satisfaction on the impact of service quality on customer loyalty. The study investigated the relationships between customers and sellers in the real estate market, specifically examining 'service quality,' 'customer loyalty,' and 'customer satisfaction.'" In Ankara, real estate properties, including residential units, land/plots, commercial units, timeshares, or tourist facilities, are leased or sold through online platforms. There are numerous online trading platforms in the real estate market. Customers express satisfaction and exhibit loyalty to online buying/selling platforms based on the quality of service that these platforms provide. Thus, the impact of service quality is crucial for online intermediary platforms to sustain and enhance customer loyalty and satisfaction. The collected information can assist in implementing improvements to the services offered by websites and in conducting efforts to meet expectations.

3.2. The Model and Hypotheses

The primary assumption of the study is that e-service quality influences customer satisfaction and customer loyalty, and that customer satisfaction impacts customer loyalty. We also investigate the mediating effect of customer satisfaction on the impact of service quality on customer loyalty. The model of the study is shown in Figure 1.

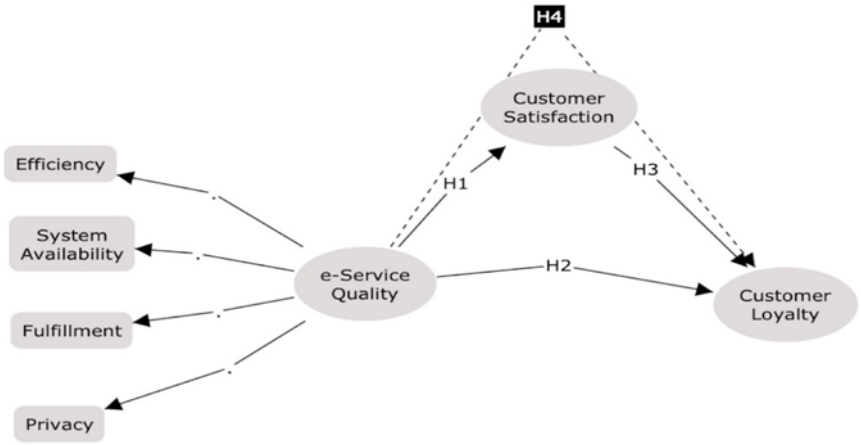

Figure 1. Conceptual Model

There is a close relationship between service quality and customer satisfaction (Sureshchandar, Rajendran & Anantharaman, 2002; Ladhari, 2009; Ilias & Panagiotis, 2010; Dahiyat, Akrous & Abu-Lail, 2011; Karatepe, 2011; Samen, Akroush & Abu-Lail, 2013; Baber, 2018; Erkan & Yurdakul, 2019).

There is a positive relationship between service quality and customer satisfaction (Osman, Cole & Vessell, 2006). In order to retain customers, businesses must endeavor to satisfy them by providing a superior level of service quality (Schaupp & Belanger, 2005; Dai & Lee, 2018). The e-service quality dimensions include website design, responsiveness, and reliability, which impact customer satisfaction, and in turn influence customer purchase intentions (Lee & Lin, 2005). Therefore, the quality of e-service impacts customer satisfaction (Zhang & Prybutok, 2005). The following hypothesis can be proposed:

H_1: Service quality affects customer satisfaction.

Some studies examined the impact of perceived service quality on customer loyalty (Cristobal et al., 2007; Chang & Chen, 2008; Sun et al., 2009; Udo et al., 2010). The transaction quality, ease of use, customization of content, utility, and website fees, among other features related to the e-service quality of digital marketplaces, impact customer loyalty (Flavian, Guinaliu & Gurrea, 2006; Chang & Chen, 2008; Yang, Wu & Wang, 2009). Accordingly, the following hypothesis can be proposed:

H_2: Service quality affects customer loyalty.

There are numerous studies in the literature investigating the impact of customer satisfaction on customer loyalty. These studies concluded that there was a positive relationship between customer satisfaction and customer loyalty (Bitner, 1990; Taylor & Baker, 1994; Hallowell, 1996; Homburg & Giering, 2001). In Homburg and Giering (2001) variety seeking, age, and income were found to be important moderators of the customer satisfaction-loyalty relationship. Based on this, the following hypothesis can be proposed:

H_3: Customer satisfaction affects customer loyalty.

Kanji (2002) concluded that there was a relationship between customer satisfaction, customer loyalty, and perceived service quality. According to Kanji's (2002) model, the service provided to customers revealed the perceived quality, customer expectations, and perceived value, which were closely related to the customer's expectations and image. Perceived quality arises from the customer's comparison of the benefits from a service against the price paid and other associated costs to obtain the service. The perceived service quality influences satisfaction, and satisfaction, in turn, affects customer loyalty (Koç, 2021: 246). The provision of service quality does not always ensure customer loyalty; therefore, satisfaction can play a role in this relationship (Herington and Weaven, 2009). Based on this, the following hypothesis can be proposed:

H_4: Customer satisfaction mediates the effect of service quality on customer loyalty.

3.3. Population and Sampling

The population of the study includes customers of online real estate buying/selling platforms located in the Ankara province, Türkiye. However, it is inherently challenging to precisely reach the number of customers using online real estate websites specifically in Ankara, and the present study focused on individuals aged 18 and above. Thus, the research population would be individuals aged 18 and above in Ankara. Then, the intended universe of the study was 4,404,458 participants. Ultimately, the sample of the study consisted of 838 participants. According to Kadıoğlu's (2021) calculation of the population and sample, a sufficient sample size was reached. Moreover, although the sample size is relatively small, it does not pose a problem in terms of the research methodology employed in the study. Cinel et al. (2021: 9) stated that partial least squares structural equation modeling (PLS-SEM) provided good results in analyses of relatively small sample groups. In recent times, the PLS-SEM, which is frequently preferred in marketing and organizational research, provides the advantage of overlooking assumptions such as normal distribution, as it enables the analysis of complex models involving mediation/moderation effects (Kinaş, 2021: 47). The sampling survey was conducted through online-administered survey forms submitted between November 9th and December 9th, 2022. Due to the online distribution of surveys and the mandatory completion of responses to each question, there were no invalid or incompletely filled surveys. In total, questionnaires were sent to 1200 people, and 838 people responded. 61.9% of the respondents are women and 38.1% are men, while 53% are single and 47% are married. Of the participants, 31% were in the age range of 18-25, 19% were in the age range of 26-35, 32% were in the age range of 36-45, and 18% were 46 years old and above. Regarding the participants' educational backgrounds, 4% completed primary education, 16% completed secondary education, 68% completed associate's or bachelor's degrees, and 12% had graduate-level education.

3.4. Data Collection Instruments and Analysis

In the present study, a questionnaire including scale items to test a number of variables was developed to investigate the mediating effect of customer satisfaction on the impact of e-service quality on customer loyalty. To test the validity of the hypotheses formulated for the research, data were obtained through the survey method. A 5-point Likert scale was used for all statements except for demographic variables. The participants evaluated the scale statements using a rating scale ranging from "Strongly Disagree" (1) to "Strongly Agree" (5). In the first part of the questionnaire, there were 5 questions about demographic information and website preferences used by customers for real estate ownership and real estate purchase or rental activities. The websites selected for this study were chosen from among the most widely used in the real estate sector (Sahibinden.com, Hepsi Emlak, Milliyet Emlak, Emlakjet, Remax). The E-SQUAL scale included in the second part of the questionnaire was developed by Parasuraman et al (2005). The scale developed by Parasuraman et al. (2005) to measure e-service quality, which was translated into Turkish by Etlioğlu (2015) to test its validity and reliability, consisted of four factors and 22 items. These factors included efficiency (1-8), system availability (9-12), fulfillment (13-19), and privacy (20-22). In the third section of the questionnaire, the customer satisfaction and loyalty scale, consisting of a total of 8 questions, previously translated into Turkish and validated for reliability by Etlioğlu (2015), was employed.

We employed Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the mediating effect of customer satisfaction on the relationship between customers' e-service quality and customer loyalty. In recent years, PLS-SEM has become a standard method for analyzing the complex inter-relationships between observed and latent variables (Sarstedt et al., 2022: 398). Magno et al. (2022) suggested that PLS-SEM became an established social sciences multivariate analysis technique. PLS-SEM is a composite-based approach emphasizing prediction while providing complex models designed to provide causal explanations. According to Şimşek (2020), concepts of mediation and indirect effects are of paramount importance in PLS-SEM studies. Simply put, the concept of mediation refers to the presence of a third variable that emerges in the process of one variable

influencing another and elucidates this relationship. This third variable is necessary to explain the effect and has a predictive quality. For example, in cases where variable A influences variable B and variable C also influences variable A, the variable C acts as a mediator between variables B and A, elucidating the impact of A on B.

4. RESULTS

4.1. Respondent's Profile

Table 1 presents the demographic variables, including age, gender, marital status, number of children, educational background, and real estate income, which is the first section of the questionnaire.

Table 1. Frequency Distribution of Demographic Variables

Age	n	%	Level of Education	n	%
18-25	257	31	Primary Education	34	4
26-35	159	19	Secondary Education	137	16
36-45	273	32	Undergraduate/Associate degree	570	68
46 and above	149	18	Graduate School	97	12
Total	*838*	*100*	*Total*	*838*	*100*
Gender	n	%	Marital Status	n	%
Female	451	61.9	Single	446	53
Male	387	38.1	Married	392	47
Total	*838*	*100*	*Total*	*838*	*100*
Frequency of usage of the website	n	%	Duration of usage of the website	n	%
Sometimes	496	59	less than 1 year	143	17
Often	199	24	1-5 years	305	36
Frequently	143	17	more than 5 years	390	47
Total	*838*	*100*	*Total*	*838*	*100*
The website/application used	n	%[1]			

[1] Percentages are rounded.

Sahibinden.com	731	87			
Other	45	5			
Hepsi Emlak	47	6			
Emlakjet	5	1			
Remax	10	1			
Total	*838*	*100*			
Income Level	n	%	Number of Properties	n	%
Under 5.000 TL	264	32	I have no property.	435	52
5.001 TL-8.000 TL	186	22	1	237	28
8.001 TL-11.000 TL	157	19	2	90	11
11.000 TL-14.000 TL	79	9	3 and above	76	9
14.000 TL and above	152	18			
Total	*838*	*100*	*Total*	*838*	*100*

Table 1 presents the information on gender, age, marital status, educational level, income level, duration and frequency of website usage, and the number of owned properties. While age groups exhibit a balanced distribution, the educational levels predominantly manifest at the Undergraduate/Associate degree levels. While there are more female participants, there is a balanced distribution in marital status. While the preferred websites were used for many years, the frequency of visits was reported as "sometimes". The distribution of income level and the number of owned properties mirrors the overall financial structure in our society. Taking a closer look at property ownership, 52% don't have any property, 28% own one real estate, 11% have two, and 9% own three or more. Examining the participants' answers about their use of the website or application, we observed that sahibinden.com had a virtual monopoly in the market. Among 838 participants, 731 reported using sahibinden.com. These findings correspond to the Competition Authority's determination of its dominant position in the online platform services market for real estate sales/rentals (Aba, 2022). However, when compared with other website/application options, sahibinden.com is not only utilized for real estate transactions but also for various alternatives, including car sales, second-hand goods, and job listings. Hence, its dominance in the market can be attributed to its broader range of offerings compared to other alternatives.

4.2. Evaluation of the Measurement Model

In this study, analyses were conducted using the R statistical software, employing a dataset that focused on the mediating effect of customer satisfaction on the impact of service quality on customer loyalty. According to Doğan and Uluman (2016:616-617), R is free software available over the internet, utilized for statistical analysis and data visualization. The foundation of the R software is rooted in the language known as S. Unlike other commercial statistical software packages, R is open-source and shares its codes with users. This enables individuals with diverse religious, linguistic, and ethnic backgrounds from around the world to support each other and gather on a common platform by sharing the codes they write. The philosophy of R software differs from other statistical package programs developed for commercial purposes, and it maintains a continually evolving structure. Thus, R

software has gained a broad user base and become a popular tool in statistics. As noted by Hair et al. (2021: 34), the use of software in computational analyses using programming languages has recently regained popularity with big data analysis, artificial intelligence, and data science. Programming in syntax-based languages like R or Python allows analysts to apply complex methods and create new solutions. The codes that serve as indicators of workflow can be generated, shared with other analysts or distributed to online products and platforms through computation. Therefore, computational methods have become an integral component of the data science revolution. In this research, data analysis was performed using the PLS-SEM codes in R Studio software. We tested the mediating effect of customer satisfaction on the impact of service quality on customer loyalty. Figure 2 shows the results reported and interpreted the research model and fit indices.

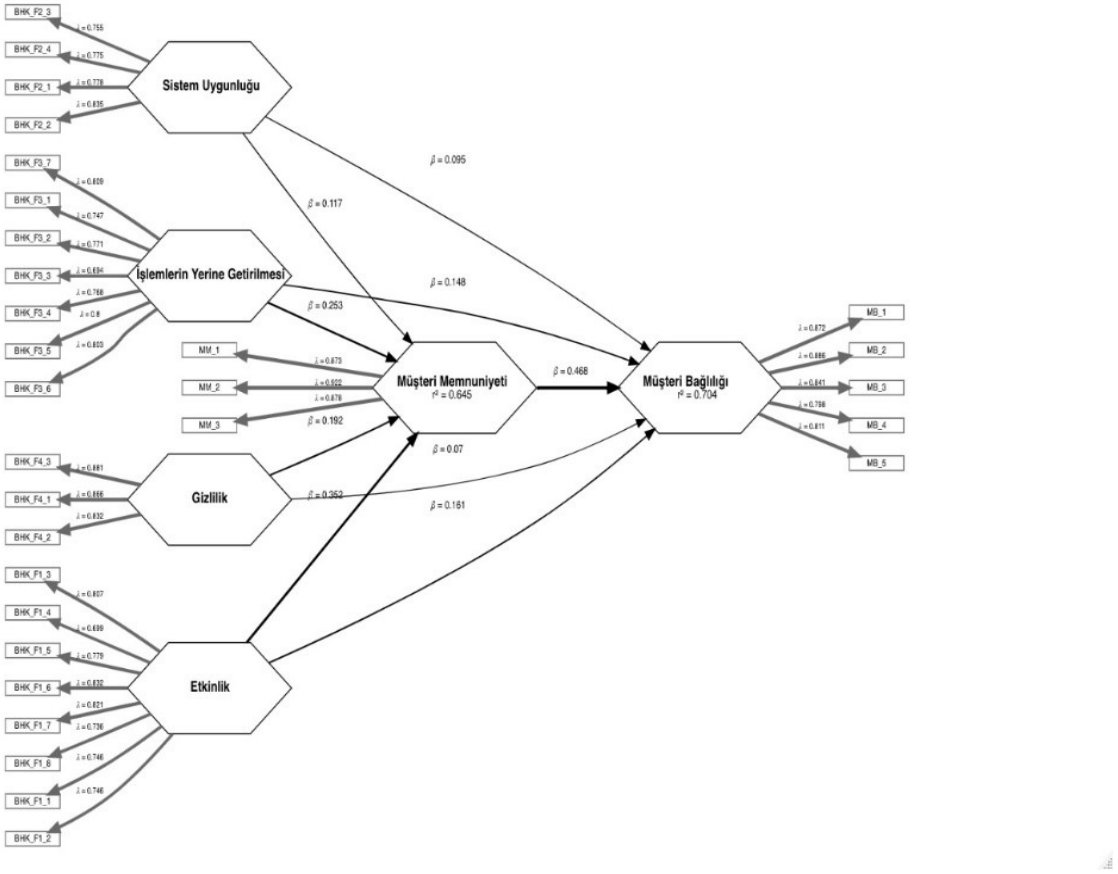

Figure 2. Research Model on the Mediating Effect of Customer Satisfaction on the Impact of Service Quality on Customer Loyalty

Table 2. Fit Indices of the Analysis of the Mediating Effect of Customer Satisfaction on the Impact of Service Quality on Customer

Variables/Indices	Reliability (α)	rhoC	Average Variance Extracted (AVE)	rhoA
Efficiency	0.902	0.922	0.596	0.904
System Availability	0.798	0.866	0.618	0.815
Fulfillment	0.886	0.911	0.595	0.890
Privacy	0.824	0.895	0.739	0.834
Customer Loyalty	0.897	0.924	0.709	0.901
Customer Satisfaction	0.870	0.921	0.794	0.871

Variables/Indices	R^2	
	Customer Loyalty	Customer Satisfaction
Efficiency	*0.161*	*0.352*
System Availability	*0.095*	*0.117*
Fulfillment	0.148	0.253
Privacy	0.070	0.192
Customer Satisfaction	0.468	-
Variables/Indices	f^2	
	Customer Loyalty	Customer Satisfaction
Efficiency	0.028	0.130
System Availability	0.012	0.016
Fulfillment	0.023	0.060
Privacy	0.007	0.046
Customer Loyalty	0.263	0.000
Customer Satisfaction	0.000	0.000
Variables/Indices	Tolerance and Variance Inflation Factors (VIF-Value)	
	Customer Loyalty	Customer Satisfaction
Efficiency	3.046	2.696
System Availability	2.463	2.425
Fulfillment	3.184	3.004
Privacy	2.353	2.249
Customer Satisfaction	2.817	-

Variables/Indices	HTMT Ratio Bootstrap Confidence Interval Results	
	Predictive value	T Value
Efficiency->System Availability	0.827	28.060
Efficiency->Fulfillment	0.806	32.451
Efficiency->Privacy	0.692	22.108
Efficiency->Customer satisfaction	0.828	34.496

Efficiency->Customer loyalty	0.801	32.175
System availability -> Fulfillment	0.777	27.403
System availability -> Privacy	0.734	22.885
System availability -> Customer loyalty	0.760	25.085
System availability -> Customer satisfaction	0.769	26.717
Fulfillment->Privacy	0.844	33.976
Fulfillment->Customer loyalty	0.800	35.335
Fulfillment->Customer satisfaction	0.822	37.868
Privacy -> Customer loyalty	0.736	27.011
Privacy -> Customer satisfaction	0.771	29.709
Customer Satisfaction -> Customer Loyalty	0.905	61.844

Causal Relationships	Path Coefficient β	T Statistics (Threshold value≈1.96)
Efficiency->Customer loyalty	0.161	8.474
Efficiency->Customer satisfaction	0.352	7.644
System availability -> Customer loyalty	0.095	2.389
System availability -> Customer satisfaction	0.253	3.287
Fulfillment->Customer loyalty	0.148	3.425
Fulfillment->Customer satisfaction	0.253	5.591
Privacy-> Customer Loyalty	0.070	2.062
Privacy-> Customer Satisfaction	0.192	5.497
Customer Satisfaction -> Customer Loyalty	0.468	11.644

The reliability of the model's internal consistency was assessed based on the fit indices Cronbach's Alpha, rhoA, and rhoC. For convergent validity, the value of Average Variance Extracted (AVE) was considered. The range of values for evaluating internal consistency should be greater than 0.70 (Kandemir & Özdaşlı, 2019: 250). Additionally, we calculated rhoA and rhoC, new indices for reliability that provided a more accurate estimation. The most crucial reliability measure for PLS is rhoA (Hair et al., 2021: 80; Nasongkhla, & Shieh, 2023: 6; Stefko et al., 2022: 6-7). It is possible to assert that our analysis exhibits internal consistency reliability.

Another important coefficient in the model was the coefficient of determination (R2). According to Zeng et al. (2021: 363), R2 is a measure of the accuracy of a model, representing the amount of variance explaining all relevant endogenous and exogenous constructs. Acceptable R2 values are widely adopted to indicate prediction accuracy at strong, moderate, and weak levels, with values of 0.75, 0.50, and 0.25, respectively. An f-test [effect size f2, Legate et al., 2023: 100)], with R2, evaluates how an exogenous construct actively contributes to

explaining a specific endogenous construct.[2] Accordingly, the dimensions of e-service quality, namely efficiency and privacy, have a moderate predictive power on customer loyalty, while the predictive power of system availability and fulfillment dimensions on customer loyalty is weak. In terms of f2 values, we observed that in explicating the construct, customer satisfaction moderately contributes to elucidating customer loyalty, while the active contributions of other external variables are comparatively low. Rasoolimanesh (2022: 2) suggested two methods to assess discriminant validity using HTMT; comparing with a threshold of either 0.85 or 0.9 or using inference statistics to test the hypothesis that HTMT=1. Using suggested thresholds, the value of HTMT should be lower than 0.85 or 0.9, whereas to apply inference statistics the hypothesis HTMT=1 should be rejected. Therefore, the HTMT values of this research were within the desired range and exhibited discriminant validity. The reliability coefficients and values of the hypotheses of the research model are presented in Table 2. Accordingly, all hypotheses with values above the T threshold (1.96) were accepted. Therefore, we noted that the efficiency dimension of perceived service quality influenced customer satisfaction and, in turn, customer loyalty at a higher level than other variables. Examining the indirect effect values, we observed that the efficiency and fulfillment dimensions had an indirect effect through the customer satisfaction variable. We can conclude that web platforms offering e-commerce services should focus on increasing customer loyalty through the observed variables of service quality, particularly efficiency and fulfillment to increase customer loyalty.

5. CONCLUSION

In the present era, where desires and needs seem limitless, understanding customer requirements is pivotal for businesses. Evaluating the satisfaction levels of products provided to customers and, based on these assessments, implementing measures to enhance or improve these products can significantly impact the success of businesses. In traditional settings, the service delivery process involves direct interaction between the customer and the seller, which allows the customer to clearly express their needs and assess the entire purchasing process. However, digital environments differ from traditional settings. Customers seeking services from digital platforms evaluate the features of the service provider's website or application. Therefore, the quality of the electronic service provided to customers would influence customer satisfaction and loyalty. The significance and usage of digital marketplaces have increased after the pandemic people have turned to fulfilling most of their needs through digital platforms. In the context of the real estate sector, the inherent nature of properties dictates that the product must move towards the customer rather than the other way around (Erkan & Yurdakul, 2019). However, due to time constraints, searching for and finding the desired real estate through property viewings in person can be challenging. Thus, the creation of platforms that bring buyers and sellers together offers numerous advantages for both parties. Sellers gain the opportunity to reach a wider audience, while buyers can explore multiple properties located in different places simultaneously. With the further advancement of digital technologies, there have been changes in the methods employed by sellers who market their properties through digital marketplaces. Previously, sellers and/or agents would showcase a property by simply posting photos. Today, they can use 360-degree video shoots, narrated videos, and live virtual tours to present the property to potential customers. Investigating how these marketing efforts on digital marketplaces affect customer satisfaction and, in turn, how this satisfaction influences customer loyalty is essential for informed decision-making in the real estate sector.

This study investigated the mediating effect of customer satisfaction on the impact of e-service quality on customer loyalty. Based on the findings, it was observed that all dimensions of e-service quality significantly impacted customer satisfaction and loyalty. In analysis, it was concluded that customer satisfaction moderately mediated all perceived service dimensions, albeit with a limited magnitude of impact. While e-service quality impacted customer satisfaction more than customer loyalty, customer satisfaction exerted a statistically significant and robust effect on customer loyalty at a high level. The findings appeared to align with the literature (Rust & Oliver, 1993; Collier & Bienstock, 2006; Dai et al., 2011; Kao & Lin, 2016; Shankar & Jebarajakirthy, 2019; Kim & Kim, 2020; Lupo & Buscarino, 2021). The difference of the study from other studies in the literature is that, although there are many studies specifically on e-service quality, customer satisfaction and customer loyalty, no study has been found examining the effect of e-service quality of electronic platforms operating in the real estate sector on customer satisfaction and customer loyalty by selecting the Ankara sample. According to the results of the study, the efficiency dimension of perceived service quality had a higher impact on customer satisfaction, and customer satisfaction, in turn, had a higher impact on customer loyalty compared to other variables. Examining the impact of the dimensions of e-service quality—efficiency, system availability, fulfillment, and privacy—on

[2] *f^2: 0.02–0.15 (small); 0.15–0.35 (medium); >0.35 (large)*

customer satisfaction and loyalty, businesses need to make improvements, strengthen their systems, and enhance their performance.

6. LIMITATIONS AND FUTURE RESEARCH SUGGESTIONS

As with every study, this study also has its own limitations. One limitation of the study was the exclusive focus on customer satisfaction and loyalty within the scope of e-service quality. Another limitation was that the sample consisted of digital platform users located in Ankara engaged in activities related to the real estate sector. Future studies may consider samples from different regions or nations. Additionally, using scales developed specifically for measuring e-service quality, rather than the scale created by Parasuraman et al. (2005) as used in this study, could provide alternative perspectives. Furthermore, future studies could inquire about the purposes for which participants visited the websites that are measured for the perceived e-service quality. Since the majority of participants do not own real estate, it remains unclear whether they are in search of buying a property in the future or using the site for renting. However, it is noted that out of 838 participants, 731 used the sahibinden.com. Considering its dominance in the market, future studies can explore how users perceive the e-service quality of sahibinden.com based on their usage intentions, as this site is not limited to real estate buying, selling, and renting activities.

AUTHORS' DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support. For the scale used in the article, it is declared by the authors that permission was optained from the original owner of the scale. Regarding the conduct of this research, an "*Ethics Permission Certificate*" dated 24/06/2023 and numbered E-11054618-302.08.01-106640 was obtained from the Ethics Committee of the Ankara Hacı Bayram Veli University.

AUTHORS' CONTRIBUTIONS:

Conceptualization, writing-original draft, editing – **AY** and **ÖÇ**, data collection, methodology, formal analysis – **AY** and **ÖÇ**, Final Approval and Accountability – **AY** and **ÖÇ**.

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Assessing the Financial Performance of the Greek Football Clubs

Yunan Futbol Kulüplerinin Finansal Performansının Değerlendirilmesi

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ABSTRACT

This study evaluates the financial performance of seven major football clubs from the top division of Greece over a period which spans from season 2015-16 to season 2021-22 with correlation and regression analysis. Financial performance is expressed in three alternative ways, i.e., the return on assets (ROA), return on equity (ROE), and profit margin, which is computed as ratio of the profit before tax to total operating revenue. Purely financial factors are considered as determinative variables of performance including the size of the clubs, their liquidity, leverage, efficiency and cash flow efficiency. The results reveal indicate that the clubs under investigation are highly leveraged and have poor liquidity, while they present extensive annual and accumulated losses. On the factors that can affect the financial performance of the Greek football clubs, our analysis accentuates that the size of the football entreprises, along with the degree of liquidity, leverage, efficiency and their ability to use their assets to generate cash can affect financial performance, either in a positive or a negative way.

Anahtar Kelimeler:
Finansal Performans, Futbol Kulüpleri, Likidite, Kaldıraç, Etkinlik
Jel Kodları:
M42

ÖZET

Bu çalışma, Yunanistan'ın en üst düzey futbol liginden yedi önemli kulübün finansal performansını, 2015-16 ile 2021-22 sezonları arasındaki dönem boyunca korelasyon ve regresyon analizleri kullanarak değerlendirmektedir. Finansal performans, aktif getiri oranı (ROA), özsermaye getiri oranı (ROE) ve vergi öncesi karın işletme gelirine oranı olan kar marjı gibi üç farklı alternatif göstergeyle ölçülmektedir. Çalışma, finansal performansı belirleyen faktörler olarak sadece finansal değişkenleri ele almaktadır, bunlar arasında kulüplerin büyüklüğü, likidite durumu, kaldıraç oranı, etkinlik ve nakit akışı etkinliği yer almaktadır. Bulgular, incelenen kulüplerin yüksek kaldıraçlı olduğunu, likidite sorunları yaşadıklarını ve önemli ölçüde yıllık ve birikmiş zararları rapor ettiklerini ortaya koymaktadır. Yunan futbol kulüplerinin finansal performansını etkileyebilecek faktörler üzerine yapılan analiz, kulüplerin büyüklüğünün, likidite durumunun, kaldıraç oranının, etkinliğinin ve aktiflerini nakit üretmek için kullanma becerilerinin finansal performans üzerindeki olumlu veya olumsuz etkilerini vurgulamaktadır.

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1. INTRODUCTION

Professional football has become internationally a multi-billion dollar industry in recent decades. According to Deloitte (2023), in the period 2021-22, and after the lifting of the restrictive measures of the Covid-19 pandemic that had a particularly negative impact on the activity and the financial figures of the football industry, the revenue figures of the European football market increased by 7% reaching 29.5 billion euros.

The main sources of revenue for the clubs participating in the major football categories concern ticket sales, sponsorships, advertising, TV rights, sale of products and services under the club's brand, income from participating in European competitions, including UEFA's Champions League, Europa League and Conference League, grants, rental income, and revenue from the academies.

At the same time, the main costs of the football clubs concern the payroll of the footballers, training teams and other staff, travelling, subscriptions, sponsorships, various operating costs, advertsising, and the depreciation of the tangible and intangible assets, along with the amortization of the various costs regarding the acquisitions of footballers.

Among the tens of football leagues throughout Europe, there are the so-called (Big Five), which include the Premier League of England, the La Liga of Spain, the Bundesliga of Germany, Serie A in Italy and the League 1 in France. Several clubs from these leagues are held by wealthy investors, who have been investing billions in infrastructure and the acquisition of top players aiming at boosting the sporting performance of the clubs.

In this environment of high operating costs and investments, often the revenue of clubs is not sufficient to meet their needs. Consequently, investments in footballers and infrastructure, as well as the rest of operating costs, are largely covered by bank lending or liquidity injections by the owners of the clubs in the form of share capital increases. As a result of their financial policy, European clubs often present significant annual and cumulative losses on their income statement and balance sheet, respectively.

Compared to the big European markets, the Greek football industry is considered small, both from a competitive and a financial point of view. Nevertheless, to the best of their abilities, and under the strong pressure of fans, the Greek clubs follow the tactics of the European ones in footballers' transfers and the financing of their wages and other operational costs. As a corollary, the Greek football enterprises show significant losses, both at an annual and a cumulative level.

This paper assesses the financial performance of seven Greek football clubs, which compete in the country's first division, the so-called "Super League". The study period spans from season 2015-16 to season 2021-22 and all the selected clubs have had stable presence in Greece's first division over the study period.

We examine the profitability of the clubs and assess their financial performance trying to highlight factors that may affect financial performance. Given the financial hardships that are frequently faced by several of the Greek football clubs (even the big ones), a study that will provide empirical insights on the factors that can contribute to the financial health of the Greek football enterprises is highly desirable. In other words, a study that may provide an answer to the key question of "where should the Greek football clubs focus on" in order to boost their financial health and long-run viability should be beneficial to the clubs themselves, as well as all the stakeholders involved (i.e., club owners, footballers, training and other staff, suppliers, and communities around the clubs).

Our study is not the first to examine the financial performance of the Greek football clubs. Similar studies in the past such as those by Dimitropoulos (2009 & 2010), Dimitropoulos and Alexopoulos (2014), and Dimitropoulos and Limperopoulos (2014) have shown that the Greek football enterprises are highly leveraged and face significant liquidity and profitability issues. Moreover, when it comes to the factors that affect the financial efficiency of the Greek football clubs, previous research has shown that the magnitude of the clubs' assets, the turnover rate of assets, the return on assets and the number of wins achieved by the clubs affect their profitability. However, profitability does not seem to be affected by other sporting factors.

Our study has been motivated by the fact that the most recent study on the financial health and performance of the Greek football clubs dates back to 2014. Ten years since the last study on the financials of the Greek football clubs is a quite long period of time. Thus, the main objective of the current study is to examine whether the various

financial issues accentuated by the previous studies have been dealt with or not, especially if we consider that Greece encountered a ten-year period of severe economic crisis during 2010-2019, which affected all aspects of economic activity in Greece, including the football industry of the country too.

In comparison to the findings of the early studies on the financial performance of the Greek football corporations, one would expect that efforts should have been made towards the improvement of the administration and, consequently, the financials of the Greek football clubs, especially if we take into consideration the necessity of the Greek football clubs to overcome the economic hardships posted by the Greek economic crisis. However, our results do not confirm such an improvement. On the contrary, our findings are in line with earlier findings in the literature concerning the high leverage of the Greek football enterprises, and their low liquidity, anemic profitability, high accumulated losses and poor financial performance.

The similarity of our findings with those in previous studies indicates that the Greek football clubs are not willing or able to change their way of conducting business. The clubs have been making losses over the study period on a constant basis. Their revenues are not sufficient to cover their liquidity needs. As a result, the clubs resort to frequent capital injections by their owners or to financing by the banking sector. The weak financial outlook of the Greek football clubs can be reflected to their poor on-field performance over the last decade when competing with clubs from the developed or less developed European championships under UEFA's competitions, with the exception of the recent win of the Conference League by Olympiakos.

Even though not being the first study to focus on the Greel football industry, we deem that our study makes significant contributions to the relevant literature. First, our study provides new empirical insights on the relationship between key accounting factors and the financial performance of the Greek football clubs which cover the last phase of the economic crisis in Greece, i.e., years 2015/16 to 2018/19. Previous studies on the Greek football clubs have not captured this period. Moreover, given the significance of Greece as a peripheral football power (at least in the Balkan territory), the results of our study may be used as a basis for similar studies on other football leagues in the neighborhood.

Maybe the most significant contribution of our study concerns the significant policy implications of our results for those involved in the administration of the Greek football clubs. First of all, professional managers should be hired to run the business of the Greek football clubs. In Greece, but in other countries too, it is not rare that ex-footballers of high popularity with the fans of the clubs but with poor academic records and entrepreneurship experience undertake crucial seats in the management of clubs. To some extent, this fact can explain the poor financial performance of the Greek football clubs.

Moreover, the clubs need to acknowledge that a business model which is characterized by constant loss-making cannot be viable in the long run. The answer to this problem cannot be bank lending or capital injections by the owners simply because these options cannot be available forever. In the past, major Greek clubs, such as Olympiakos, Panathinaikos and AEK, faced significant issues which threatened their presence in the top league of the country at best or over their very existence.

The Greek football clubs need to work towards their financial self-sufficiency. In this respect, our results can be quite helpful. In particular, with respect to the financial factors that may affect financial performance, our analysis shows that among the variables that may affect performance, either positively or negatively, are the size of assets, liquidity, leverage, efficiency and the ability of clubs to use their assets to generate money. Therefore, along with the necessary improvements in their sporting performance, the Greek football clubs need to focus on improving their financial and business operations, avoiding unnecessary expenditure, and enhancing their financial independence and long-run viability.

The rest of this article includes the literature review in Section 2, the description of research methodology and the sample of the study in Section 3, the discussion of empirical results in Section 4 and the conclusion in Section 5.

2. LITERATURE REVIEW

With respect to the financial performance of the Greek football firms, Dimitropoulos (2009) examines the profitability of the Greek football clubs and the factors that affect financial performance over the period 1994-

2004. The results indicate that the profitability of the Greek clubs is positively related to their short-run success from a sporting perspective, but not to their long-run success and seasonal uncertainty. In addition, the size of the clubs, measured in terms of their assets, affects financial performance in a positive way. Finally, asset turnover and ROA have a significantly positive impact on profitability.

Dimitropoulos (2010) analyzes the financial performance of the football clubs participating in the first division of the Greek Football League over the period 1993-2006. Financial analysis is applied with the use of key accounting ratios calculated with data from the annual financial statements of the clubs. Based on the results, the Greek football clubs are highly leveraged, while they have intense liquidity and profitability issues and face an increased financial distress risk. The author claims that these poor financial outlook can be attributed to mismanagement and political inefficiencies during the last fifteen years in the Greek football industry.

The financial performance of the Greek football clubs and the determinative factors of performance during the period 2007-2013 is the subject of the study by Dimitropoulos & Alexopoulos (2014). Match attendance and the profitability of the clubs are found to be positively associated with their short and long-run success, but not with the seasonal uncertainty of the league. Moreover, similar to Dimitropoulos (2009), the size of the clubs is a factor that exerts a positive and significant impact on financial performance. Finally, the level of cash flow per assets have a significantly positive impact on the profitability of the Greek football enterprises.

Dimitropoulos & Limperopoulos (2014) investigate the relationship between the sporting and financial performance of the Greek football clubs. The impact of investing in player contracts on the relationship between sporting and financial performance is examined too. They sample of this study includes 20 clubs which participated in the three professional divisions of Greece during the period 2004-05 to 2008-09. The results of the applied panel data analysis show that the higher the investment in player contracts, the more successful a club is on the field. However, as the investment in player contracts increases, the club gets more unprofitable and insolvent. This evidence implies that the decisions about players' contracts are not based on economic standards and verifies arguments that European football clubs seek to maximize sporting performance rather than financial performance.

On football clubs in other countries, Szymanski & Smith (1997) assess the financial performance of the English League clubs using a dataset of 48 clubs over the period 1974-89. The dependent variable of the model used is pre-tax profit, while the independent variables are ticket prices, attendance rates, income from other sources, such as TV rights and sponsorships, the net amounts for/from transfers, the non-salary expenses, the position of clubs in the league ranking table, promotion or relegation, and the participation of clubs in cup competitions. The results show that the promotion from one league to the next creates temporary excitement that is reflected in an increase in the demand for tickets. However, this excitement starts to decline sometime soon. Attendance rates are also boosted by a high performance in the cup competitions. The empirical analysis also shows that only the top clubs are profitable.

Barajas et al. (2005) examine the impact of sporting results on the financial performance of 42 Spanish football clubs over a period which spans from 1998 to 2002. The dependent variable is the net profit of clubs, while the independent variables are the ranking of clubs in the league and their total points, along and the weighted average of points in each competition. Based on their analysis, the authors conclude that the sporting variables hardly explain financial performance.

The opposite results on the relationship between sporting and financial performance are provided by Ferri et al. (2017), who employ data of 29 Italian football clubs that competed in Serie A during the period 2007/08-2013/14. A positive correlation between the footballers' payroll cost and sporting performance is revealed. However, the transfer fees of players and sporting performance are not significantly related to each other.

In the same context, Miragaia et al. (2019) examine the interactions between financial efficiency and sports performance with a sample of 15 professional football clubs that won league titles in the leading football leagues in England, Germany, Spain, Italy and France over the period 2009 and 2014. Based on the empirical results, only 10 of the examined clubs were efficient. The authors conclude that despite the attractiveness of professional football, the recent financial crisis burst in 2008 increasingly demands better management of the clubs' resources. Clubs need to improve their control over their financial resources given the positive relationship between their sporting performance and their financial efficiency. A positive correlation between sporting and financial performance is reported by Di Simone & Zanardi (2021) too.

The impact of corporate governance quality, i.e., board size, board independence, managerial ownership, institutional ownership and CEO duality, on the profitability and viability of the European Union's football clubs

during the period 2005-2009 is evaluated by Dimitropoulos & Tsagkanos (2012). Based on the empirical findings, qualitative corporate governance practices, such as a higher managerial and institutional ownership, increases in the size of the board, the separation of the CEO and chairman roles, can help the football clubs achieve higher profitability and boost their viability.

Ruta et al. (2020) examine the relationship between governance structure and football club performance in Italy and England trying to verify the assumption about a weaker role of internal governance structure (i.e., board and CEO) in determining sporting and financial performances in a highly concentrated club ownership environment. The study covers the period 2006-2015. The findings show a poor impact of board structure and CEO features on financial performances compared to the influence of the ownership structure. The results also show that the size of the board is negatively related to profitability and that the independence of the board along with the CEO tenure are positively related to sporting performance. CEO tenure increases profitability too.

The impact of the ownership structure on financial performance is examined by Fraile et al. (2017) with data from the five major European football leagues. The study period spans from season 2007/08 to season 2012/13. The impact of the financial fair play regulation is considered too. The sample of the study includes 94 first division clubs from Germany, France, Spain, England and Italy. An inverted U-shaped curve relation between ownership and financial performance is revealed as a result of both monitoring and expropriation effects. After passising demanding financial fair play regulation, the monitoring effect vanishes but not the expropriation effect.

Wilson et al. (2013) assess the correlation of the financial performance with the sporting performance of the Premiere League's clubs in England also focusing on the effect of different models of club ownership on financial and sporting performance. The analysis uses financial data for 20 clubs for the period 2001-2010. The results of the applied correlation analysis indicate that the stock market model of ownership results in better financial health relative to the privately owned clubs. On a similar topic, Carlsson-Wall et al. (2016) assess the role of performance measurement systems in managing the co-existence of different institutional logics in a football club. The authors show that sports and business logics at times compete with each other, but in other situations, these logics are in harmony. In other words, the decisions made by a football club under a financial perspective cannot necessarily ensure sporting success and vice versa.

The impact of investing in human capital on the financial performance of the football clubs is the subject of a study by Scafarto & Dimitropoulos (2018). The authors use a sample of 16 clubs from Italy and apply a fixed-effect econometric model that controls for the governance mechanisms of the clubs, which are characterized by a highly concentrated ownership and the control by specific families. By acknowledging this ownership and governance status, the applied model assumes that the representation of the owning families in the clubs' board and the the dual leadership are crucial for the decisions concerning the investments in the acquisition of talented footballers. Based on the empirical findings, clubs with CEO and chairman duality and a high degree of family representation on the board profit from investments in player contracts. Clubs whith no such governance mechanisms are in an inferior position.

Ika et al. (2020) analyze the financial statements of Arsenal and Manchester City over the three-year period 2015-2017. Altman's Z-score is computed and a bankruptcy prediction model is applied. The two clubs are found to have a healthy financial shape during the period under study. It is also found that Manchester City is financially healthier than Arsenal. In the same context, Kevser & Dogan (2022) compare the financial performance of Manchester City, Manchester United, Barcelona, Real Madrid and Juventus over the period 2015-2019. Liquidity, leverage and profitability ratios of the clubs are considered. This comparison reveals that Manchester City is the most sound club from a financial perspective, while Juventus is the least sound. They also find that liquidity and short-term debt-to-equity ratios are the most important performance indicators for the football clubs.

Evans et al. (2019) examine the effectiveness of the Salary Cost Management Protocol introduced by the English Football League in 2004 to improve the financial sustainability of the country's professional football clubs. The authors focus on the impact on the profitability, liquidity and solvency of the League Two clubs from 1994 to 2014. The empirical results accentuated the failure of the specific financial regulation to significantly improve the profitability or the solvency of football clubs in League Two. On the other hand, the liquidity of the clubs improved in response to the introduction of the Salary Cost Management Protocol, this improvement lasted only in the year in which the financial regulation was introduced.

Similarly, Martín-Magdalena et al. (2023) assess the impact of "financial fair play" regulations on the financial performance of the Spanish professional football league by examining the moderating role of club size. The authors use a 12-year dataset covering 22 football clubs and argue that introducing financial fair play positively impacted the financial performance of small clubs but increased the economic gap between large and small clubs.

The results show that the regulation on financial fair play significantly affected the profitability of small clubs in a positive way, as well as the solvency of medium-sized clubs, but has not affected the financial performance of the big clubs. Overall, after new regulations, economic inequality in Spanish La Liga increased. Similar inferences are drawn by Fernández-Villarino & Domínguez-Gómez (2022).

Holzmayer & Schmidt (2020) evaluate the effectiveness of the main diversification strategies adopted by the English football clubs. The strategies examined are business diversification and international diversification. The authors employ a 15-year panel data set of English Premier League clubs, many of which have employed corporate diversification strategies. In addition, measures for related business diversification and unrelated business diversification, as well as international diversification are used. The findings reveal non-linear financial performance effects from the adopted corporate diversification strategies.

Finally, Dogan et al. (2021) focus on Turkish football clubs to examine the effect of the Public Disclosure Platform (PDP) notifications of Beşiktaş, Galatasaray, Fenerbahçe and Trabzonspor clubs on their stock returns during the period 2009/10-2019/20. According to the empirical findings, notifications related to football clubs provide extremely high returns from stocks, as the market is not efficient. As a result, people can buy the stocks of their existing teams by not acting rationally but only acting as fans of the clubs.

3. RESEARCH METHODOLOGY

3.1. Financial Ratios

Using key accounting data, we compute some basic financial ratios of efficiency and financial structure for the examined clubs. These ratios are: a) the return on assets (ROA), which is calculated as the ratio of profit before tax to assets, b) the return on equity (ROE), which is computed as the fraction of profit before tax to equity, c) the profit margin ratio, which is calculated by dividing profit before tax by total operating revenue, d) the general liquidity ratio, which is measured as the fraction of current assets to current liabilities, e) the leverage ratio, which is the fraction of total liabilities to total equity, f) the efficiency (asset turnover) ratio, which is calculated through dividing total operating revenue by assets, and g) the ratio of net cash flow to assets.

3.2. Correlation Analysis

We apply simple correlation analysis trying to identify some of the factors that may affect the financial performance of the Greek football clubs. The factors considered in our analysis as "dependent" variables are return on assets, return on equity, and the profit margin, while the "determinant" variables are the size of the examined clubs, i.e., the logarithm of their assets, the general liquidity ratio, the leverage ratio, the efficiency ratio, and the ratio of net cash flow to assets.

3.3. Regression Analysis

We seek to answer whether the factors discussed in the previous section can indeed affect the financial performance of the Greek football enterprises. We do so with the following multivariate model (1), which is applied with panel data:

$$Pnce = \beta_0 + \beta_1 Size + \beta_2 Liquidity + \beta_3 Leverage + \beta_4 Effciency + \beta_5 C.F.Efficiency + u \quad (1)$$

where, Pnce stands for financial performance measured as ROA, ROE and profit margin. The independent variables of the model are the size, liquidity, leverage, efficiency and cash flow efficiency (C.F.Efficiency), which are defined in the previous section.[1]

Size is frequently considered to be positively related to firm performance. If this is true in our case, the coefficient of size will be positive and significant. Moreover, as noted by Zygmunt (2013), the liquidity of a firm might determine its profitability and, thus, the coefficient of the liquidity ratio in model (1) should be positive. Going further, there are studies that report a negative impact of leverage on firm performance (e.g., Yameen *et al*., 2019). If this is the case for the Greek football enterprises too, the coefficient of leverage must be negative. Furthermore, efficiency has been found to be positively related to the financial performance of a firm (Khan *et al*., 2021). Consequently, the estimate of the efficiency ratio in model (1) is expected to be positive. A similar positive estimate is expected for cash flow efficiency.

[1] The regression model (1) has been run via the econometric software Eviews 9.

3.4. Sample

The sample of our study includes the four major Greek football clubs (Big 4), namely, Olympiakos, Panathinaikos, AEK, and PAOK, as well as the clubs of Atromitos Peristeri, Asteras Tripolis and Panaitolikos, which are the only three of the smaller Greek football clubs with an uninterrupted presence in the Super League during the period under review.

Table 1 presents key accounting figures from the balance sheet, income statement and cash flow statement of the examined football clubs over the seven-year-period spanning from season 2015-16 to season 2021-22. Accounting figures include assets, current assets, equity, total liabilities, short-term liabilities, total operating income, profit before taxes (PBT), and the net cash flow, i.e., the change in cash reserves at the end of each year compared to the previous year. The figures in the table concern the averages of the accounting data for the entire period under review and have been collected from the published financial statements of the clubs.

The average assets of the clubs in the sample amount to €23.5 million. The largest club is Olympiacos with average assets of €69 million. The smallest club is Atromitos with average assets of €1.8 million. The average current assets equals €9.7 million, that is, 41% of the average total assets. In regard to equity, the average term of the sample amounts to €2.4 million, i.e., only 10% of total assets. Average total liabilities amount to €21.1 million, of which short-term liabilities equal €16.5 million (or approximately 78% of total liabilities).

From the simple presentation of the balance sheet figures, we conclude that the Greek football clubs rely mainly on external funds to finance their operation, as evidenced by the fact that 90% of the sum of equity and total liabilities concerns liabilities to third parties. In addition, the fact that most of the liabilities are of a short-term nature may pose risks regarding the liquidity of the Greek football firms. This risk is further enhanced by the fact that the average net cash flow, although positive at €406 thousand, is very small if we compare it to total liabilities. In other words, the money generated by the clubs is not enough to meet their needs.

Table 1. Accounting Data

Club	Assets	Current Assets	Equity	Total Liabilities	Current Liabilities	Cash Flow +/-	Operating Revenue	PBT
Olympiakos	68,909,857	29,508,714	12,620,857	56,289,000	53,437,000	1,930,857	51,822,857	-2,705,000
Panathinaikos	23,605,825	7,679,130	-14,845,426	38,451,251	28,036,110	265,515	15,091,678	-12,909,892
AEK	28,643,117	10,285,017	6,011,318	22,631,799	13,704,857	880,590	21,003,556	-1,763,676
PAOK	33,309,174	15,783,304	11,295,553	22,013,621	13,420,279	-72,314	28,934,594	-12,209,036
Atromitos	1,846,163	1,149,590	-3,151,707	4,997,869	3,424,916	-11,566	4,006,945	-1,825,510
Asteras Trip	2,764,101	2,081,849	1,800,625	963,476	926,025	-178,864	4,587,652	-926,949
Panaitolikos	5,254,229	1,084,716	2,856,688	2,397,542	2,303,956	26,279	3,340,351	-1,355,092
Average	**23,476,067**	**9,653,189**	**2,369,701**	**21,106,365**	**16,464,735**	**405,785**	**18,398,233**	**-4,813,594**
Min	**1,846,163**	**1,084,716**	**-14,845,426**	**963,476**	**926,025**	**-178,864**	**3,340,351**	**-12,909,892**
Max	**68,909,857**	**29,508,714**	**12,620,857**	**56,289,000**	**53,437,000**	**1,930,857**	**51,822,857**	**-926,949**

In relation to the income statement figures, the average total operating revenue of the clubs under consideration equals €18.4m. Olympiacos shows the highest average revenue of €51.8m. The club with the second highest average revenue is PAOK (€28.9). The average revenue of PAOK falls short of that of Olympiakos by 126%. The club with the smallest amount of revenue is Panaitolikos, which shows operating revenue of €3.3 million.

In total, four of the clubs in the sample show revenues that exceed €10m. These clubs are Olympiacos, Panathinaikos, AEK and PAOK. If we compare the Greek clubs to the clubs from the major European leagues, a wide gap is found between the Greek and European clubs in terms of revenue, which can largely explain the competitive difference between the Greek football clubs and the foreign competitors.[2]

Finally, when it comes to the profitability of the Greek football clubs, we see in Table 1 that all the examined clubs are loss-makers, with Panathinaikos appearing as the most loss-making club with an average pre-tax loss of €12.9 million. PAOK is the team with the second worst average profit of minus €12.2m.

The relatively low amount of revenue combined with the significant losses, as well as the high leverage and the weak ability of clubs to generate money, certify a negative financial structure and performance of the Greek football enterprises.

[2] Rompotis (2024) reports that the average revenue of the English Premier League clubs in the decade 2013-22 exceeded 193 million British pounds. This figure attests to the large financial gap between Greek and English (or other European) teams.

3.5. Profitability and Equity Figures

In the previous section, we revealed a low financial performance of the Greek football clubs in terms of the before taxes profitability. In this section, we analyze in more detail the after-tax profitability of the clubs, as well also two key elements of their equity, i.e., retained earnings and share capital. The relevant annual figures are provided in Table 2.

Table 2. Profitability and Equity Figures

Net Profit After Tax								
Club	**Seas. 2021-22**	**Seas. 2020-21**	**Seas. 2019-20**	**Seas. 2018-19**	**Seas. 2017-18**	**Seas. 2016-17**	**Seas. 2015-16**	**Average**
Olympiakos	-11,100,302	4,335,425	2,625,108	-2,165,620	-7,988,573	-891,201	-8,524,202	-3,387,052
Panathinaikos	-16,082,778	-8,172,507	-8,416,664	-3,227,571	-16,964,047	-27,972,339	-11,761,053	-13,228,137
AEK	-8,195,726	-645,485	-2,961,135	6,243,552	1,595,700	-4,057,837	-4,197,125	-1,745,437
PAOK	-13,439,141	-3,744,666	-26,904,651	-5,277,826	-20,781,369	-5,346,075	-9,969,967	-12,209,099
Atromitos	-2,986,765	-2,277,513	-1,471,737	-1,948,985	-866,893	-2,724,965	-501,714	-1,825,510
Asteras Trip	-2,801,035	191,701	-1,052,360	-1,305,075	-2,179,422	-2,135,224	1,934,166	-1,049,607
Panaitolikos	-3,077,233	-344,261	-1,400,811	-1,546,384	-1,767,691	-973,625	-375,637	-1,355,092
Average	**-8,240,426**	**-1,522,472**	**-5,654,607**	**-1,318,273**	**-6,993,185**	**-6,300,181**	**-4,770,790**	**-4,971,419**
Min	**-16,082,778**	**-8,172,507**	**-26,904,651**	**-5,277,826**	**-20,781,369**	**-27,972,339**	**-11,761,053**	**-13,228,137**
Max	**-2,801,035**	**4,335,425**	**2,625,108**	**6,243,552**	**1,595,700**	**-891,201**	**1,934,166**	**-1,049,607**
Retained Earnings								
Club	**Seas. 2021-22**	**Seas. 2020-21**	**Seas. 2019-20**	**Seas. 2018-19**	**Seas. 2017-18**	**Seas. 2016-17**	**Seas. 2015-16**	**Average**
Olympiakos	-16,799,111	-5,827,092	-10,485,246	-13,170,123	-68,897,110	-60,884,338	-60,025,162	-33,726,883
Panathinaikos	-114,611,461	-98,528,683	-90,532,307	-82,115,644	-78,888,073	-61,991,615	-57,832,683	-83,500,067
AEK	-12,173,911	-3,978,185	-3,332,699	-371,565	-6,615,116	-8,210,816	-4,152,979	-5,547,896
PAOK	-146,326,482	-132,830,341	-129,195,396	-102,286,455	-97,008,629	-76,227,260	-70,881,185	-107,822,250
Atromitos	-15,758,965	-12,672,200	-10,394,687	-8,922,950	-6,973,965	-6,107,072	-3,382,107	-9,173,135
Asteras Trip	-2,694,165	110,343	-4,301,217	-3,248,857	-1,943,782	235,640	2,467,572	-1,339,209
Panaitolikos	-3,078,313	-1,936,080	-1,591,818	-1,586,720	-3,872,260	-2,104,568	-1,130,943	-2,185,814
Average	**-44,491,772**	**-36,523,177**	**-35,690,481**	**-30,243,188**	**-37,742,705**	**-30,755,718**	**-27,848,212**	**-34,756,465**
Min	**-146,326,482**	**-132,830,341**	**-129,195,396**	**-102,286,455**	**-97,008,629**	**-76,227,260**	**-70,881,185**	**-107,822,250**
Max	**-2,694,165**	**110,343**	**-1,591,818**	**-371,565**	**-1,943,782**	**235,640**	**2,467,572**	**-1,339,209**
Share Capital								
Club	**Seas. 2021-22**	**Seas. 2020-21**	**Seas. 2019-20**	**Seas. 2018-19**	**Seas. 2017-18**	**Seas. 2016-17**	**Seas. 2015-16**	**Average**
Olympiakos	15,397,975	5,397,975	5,397,975	5,397,975	65,430,000	65,430,000	58,430,000	31,554,557
Panathinaikos	62,457,267	54,779,935	46,908,935	36,432,935	8,206,844	5,953,352	20,885,596	33,660,695
AEK	11,130,700	6,130,700	5,180,000	5,180,000	4,800,000	2,261,000	1,881,000	5,223,343
PAOK	119,857,454	116,257,457	116,167,457	115,840,631	100,029,632	7,724,538	63,514,538	91,341,673
Atromitos	6,670,000	6,670,000	6,670,000	3,170,000	3,170,000	2,650,000	2,650,000	4,521,429
Asteras Trip	3,343,800	2,004,000	5,421,000	3,633,000	2,745,000	1,638,000	1,638,000	2,917,543
Panaitolikos	3,870,000	4,553,303	3,472,853	3,078,076	4,789,904	3,144,904	2,668,400	3,653,920
Average	**31,818,171**	**27,970,482**	**27,031,174**	**24,676,088**	**27,024,483**	**12,685,971**	**21,666,791**	**24,696,166**
Min	**3,343,800**	**2,004,000**	**3,472,853**	**3,078,076**	**2,745,000**	**1,638,000**	**1,638,000**	**2,917,543**
Max	**119,857,454**	**116,257,457**	**116,167,457**	**115,840,631**	**100,029,632**	**65,430,000**	**63,514,538**	**91,341,673**

In terms of net annual profits, we see in Table 2 that, on average, all clubs achieved net losses in all years under review, with the average loss of all years amounting to €5m. This average term is slightly worse than the average term of the profit before tax of €4.8m that we saw in Table 1. The difference of €200k between pre-tax and after-tax profit indicates that the Greek football clubs pay little or nil income taxes due to the ongoing operating losses they present in their annual profit and loss statements. At the individual level, just the clubs of Olympiakos, AEK and Asteras Tripoliss show two profitable years each. All other years for the entire sample are loss-making.

As a result of the persistent annual losses, all the clubs show consistently significant accumulated retained losses, the average of which at the sample level amounts to €34.8 million. PAOK shows the highest average accumulated retained losses of €107.8 m. Furthermore, with the exception of the club of Asteras Tripoliss, which shows three years of positive cumulative retained earnings, all other clubs show negative profits carried forward on a consistent basis throughout all the examined years.

As a consequence of the above negative results, the Greek football clubs tend to proceed with share capital increases quite often. As shown in Table 2, the share capital of the examined clubs was increasing quite frequently during the period under study. In fact, any reductions in share capital observed, for instance in the case of Olympiakos between the years 2017-18 and 2018-19 or Panathinaikos between the periods 2015-16 and 2016-17,

do not concern capital returns to the shareholders of the clubs, but the usage of the accounting instrument of netting accumulated losses against share capital.[3]

In conclusion, in accordance with the inferences drawn in the previous section, the poor profitability of the Greek football enterprises reflects a weak financial picture, which triggers the need for frequent share capital increases. These share capital increases aim both at covering the financial needs of the clubs and embellishing their equity structure.

4. EMPIRICAL RESULTS

4.1. Financial Ratios

The average terms of the examined financial ratios for the examined period appear in Table 3. In relation to the efficiency ratios, the average ROA of the sample is negative and equal to -40.37%. The club of Atromitos shows the worst average ROA, which amounts to -102.82%. On the other hand, Olympiacos shows the best ROA in the sample, which is close to 5%. The average ROE of the sample is negative at -8.85% indicating a rather poor financial performance of the examined Greek football clubs. In terms of the profit margin, the relative performance of the Greek football clubs is rather disappointing as the average profit margin ratio of all clubs is negative at -41.82%. On the other hand, Olympiacos presents the relatively best profit margin ratio, which is equal to -6.86%.

Overall, the analysis of the financial performance ratios confirms the poor financial performance of the Greek football clubs highlighted in the previous two sections of this study.

Moving forward with the ratios of financial structure, the average general liquidity ratio in Table 3 is equal to 87.89%. This ratio, which is lower than 100% indicates that the current assets of the clubs are not sufficient to cover their short-term liabilities. This finding verifies the liquidity problems related to the poor ability of the clubs to show positive net cash flows. At the club level, Asteras Tripolis shows the highest liquidity while Panathinaikos shows the lowest.

Table 3. Financial Ratios

Club	ROA	ROE	Profit Margin	Liquidity	Leverage	Efficiency	Cash Flow Efficiency
Olympiakos	4.98	-22.86	-6.86	54.90	454.40	147.01	11.21
Panathinaikos	-54.48	110.65	-82.95	27.90	-347.55	70.76	1.30
AEK	-8.97	-132.43	-15.31	82.75	647.12	79.43	2.57
PAOK	-40.37	107.44	-57.15	115.45	-100.36	83.19	0.22
Atromitos	-102.82	63.07	-48.72	36.42	-190.82	227.18	-1.02
Asteras Tripolis	-55.08	-117.52	-36.85	248.52	73.61	165.17	-8.09
Panaitolikos	-25.87	-70.26	-44.89	49.29	114.23	63.75	0.50
Average	**-40.37**	**-8.85**	**-41.82**	**87.89**	**92.95**	**119.50**	**0.96**
Min	**-102.82**	**-132.43**	**-82.95**	**27.90**	**-347.55**	**63.75**	**-8.09**
Max	**4.98**	**110.65**	**-6.86**	**248.52**	**647.12**	**227.18**	**11.21**

When it comes to leverage, the average term of this ratio is very high at 93%. The most leveraged club is AEK, with an average leverage ratio of 647%, followed by OLYMPIAKOS, which has an average leverage ratio of 454%. Panathinaikos appears as the team with the most negative leverage ratio of -348%. This negative ratio is due to the negative equity that Panathinaikos consistently displays throughout the period under study.

The average efficiency ratio is the only financial indicator which is relatively satisfactory because it exceeds 100% and amounts to 120%. This percentage shows that the Greek football clubs, on average, can generate revenue that exceeds their total assets. At the group level, Atromitos presents the best average efficiency ratio, which amounts to 227%. On the other hand, PANAITOLIKOS shows the worst efficiency ratio at 64%.

Finally, the average ratio of net cash flow to assets of the sample equals 0.96%. The highest ratio of the sample amounts to 11.21% and has been achieved by Olympiakos. On the other hand, the club of Asteras Tripolis shows the worst average ratio of net cash flow to assets, which is equal to -8.09%. Overall, the average ratios of net cash flow to assets for all clubs in the sample are rather low and confirm the limited ability of the Greek football enterprises to efficiently use their assets to generate money.

[3] The club of PAOK, which shows the largest accumulated losses, does not seem to have used this tool, which is why it also shows the largest share capital, which exceeds €90m on average.

4.2. Correlation Analysis

Correlation estimates among the key financial ratios and figures used in our analysis are presented in Table 4. According to the data in Table 4, ROA shows a positive correlation estimate with the size factor of 0.50. Based on this estimate, we can infer that the size of the clubs is a factor that can affect the financial performance of the Greek football companies in a positive way. This positive relationship between size and ROA indicates that a football club can benefit financially from getting bigger through time. In fact, at the corporate level, several studies do confirm a positive relationship between the size of a company and its financial performance. Chell and Baines (2000) argue that firms are able to grow and make profits on their size by focusing on the reduction in their operating costs, the use of debt to benefit from tax deductions, the purchase of raw materials in large quantities to receive significant discounts and the maintenance of good relations with suppliers and other stakeholders. According to Brewer and Jagtiani (2013), large firms can exploit economies of scale and scope and thus be more efficient compared to small firms. In addition, small firms might have less power compared to large firms and thus they might find it difficult to effectively compete with large firms especially in competitive markets.

Positive correlations are found for ROA with liquidity, leverage and net cash flow to asset ratios. These positive correlation estimates are equal to 0.24, 0.17 and 0.41, respectively. There is also a positive correlation between ROA and the efficiency ratio, which, however, is quite close to zero (0.03). Therefore, the effect of efficiency on ROA cannot be expected to be significant from an economic perspective.

The positive sign of liquidity's and correlation with financial performance is not surprising as several studies have acknowledged the importance of liquidity and for the financial performance and health of companies. Kimondo et al. (2016) establish a significant positive relationship between liquidity and profitability for the nonfinancial companies quoted on the Nairobi Securities Exchange. Similar results are reported by Obida & Owolabi (2012), and Musah & Kong (2019). Furthermore, the positive sign of efficiency's correlation with ROA indicates that the greater the operational efficiency, the more profitable a firm can be because the firm can generate greater income or return for the same or lower cost than a less efficient competitor. On the other hand, the positive sign of leverage's coefficient is a little surprising as financial leverage is frequently considered to be associated with financial performance in a negative way (e.g., Javed et al., 2015, and Yameen et al., 2019).

In regard to ROE, the only material correlations are that with leverage, which is negative and equal to -0.91, and that with the net cash flow to assets ratio, which is positive and equal to 0.17. Based on these correlation coefficients, one might expect that the more leveraged a Greek football company is, the lower its return on equity. On the contrary, as a club's ability to use its assets to generate cash flows increases, so does its return on equity.

Finally, regarding the relationship between the profit margin and the determinative factors, we observe in Table 4 positive correlations of 0.12 between the profit margin and the size factor, as well as positive correlations with liquidity (0.29), leverage (0.16), efficiency (0.24), and net cash flow to assets (0.26). These positive correlations resemble those between the Return on Assets ratio and size, liquidity, leverage, efficiency and cash flow efficiency. Based on this resemblance, it could be argued that ROA and profit margin move quite close to each other. In any case, the positive correlations of profit margin the determinative factors show that as the magnitude of the specific factors increases, the operational profitability of the Greek football companies may increase too.

Overall, the correlation analysis applied in this section, though quite unsophisticated, can indicate the factors the Greek football clubs need to focus on in order to improve their financial performance, self-sustenance, and long-term health and viability, reducing at the same time the dependence on capital injections by the owners of the clubs. The latter is even more significant given the ownership structure of the Greek football clubs, which are usually owned by a unique owner. Such a restricted ownership may entail that the basic shareholder of a club might not be able to continuously support their club financially in the long run with possible negative repercussions for the club.

Table 4. Correlation Analysis

	ROA	ROE	Profit Margin	Size	Liquidity	Leverage	Efficiency	Cash Flow Efficiency
ROA	1.00	0.02	0.71	0.50	0.24	0.17	-0.03	0.41
ROE	0.02	1.00	0.07	0.03	-0.06	-0.91	0.07	0.07
Profit Margin	0.71	0.07	1.00	0.12	0.29	0.16	0.24	0.26
Size	0.50	0.03	0.12	1.00	-0.17	0.17	-0.50	0.11
Liquidity	0.24	-0.06	0.29	-0.17	1.00	0.03	0.10	0.02
Leverage	0.17	-0.91	0.16	0.17	0.03	1.00	-0.11	0.01
Efficiency	0.03	0.07	0.24	-0.50	0.10	-0.11	1.00	0.43
Cash Flow Eff.	0.41	0.17	0.26	0.11	0.02	0.01	0.43	1.00

4.3. Regression Analysis

The regression results of model (1) are provided in Table 5. In the case of ROA, the estimate of size is positive and statistically insignificant confirming a positive relationship between the size of the clubs and their financial performance similar to that detected via the correlation analysis in the previous section. This result verifies the previous findings in the literature (e.g., Chell & Baines, 2000, and Brewer & Jagtiani, 2013), about the positive impact of size on the financial performance of a corporation.

The coefficient of liquidity is positive and statistically significant at 1%. This positive sign indicates that the more liquid a football club is, the more profitable it can be from a financial perspective. This positive relationship between financial performance and liquidity is in line with the relevant findings in the literature of non-football enterprises (e.g., Zygmunt, 2013, Kimondo et al., 2016, Obida & Owolabi, 2012, and Musah & Kong, 2019).

Table 5. Regression Analysis

	Dependent Variable: ROA		**Dependent Variable: ROE**		**Dependent Variable: Profit Margin**	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Constant	*-406.12	-4.20	*-972.69	-2.78	**-233.92	-2.55
Size	*7.55	3.97	*3.21	3.01	***8.85	1.89
Liquidity	*0.18	3.29	0.01	0.02	**0.14	2.27
Leverage	*0.01	2.77	*-0.44	-16.85	0.01	1.05
Efficiency	0.05	0.57	0.23	0.81	0.15	1.46
Cash Flow Effic.	***0.81	1.88	***0.46	1.69	***0.14	1.77
R-squared	0.49		0.87		0.25	

*Significant at 1% level; ** Significant at 5% level; *** Significant at 10% level

The coefficient of leverage is positive and significant in statistical terms but rather insignificant in economic terms as the relevant estimate is only equal to 0.01. Based on this result, we may infer that the impact of financial leverage on the Return of Assets of the examined Greek football clubs is not that material. On the other hand, the coefficients of efficiency and cash flow efficiency are positive but only that of cash flow efficiency is statistically insignificant at 10%. In particular, the coefficient of cash flow efficiency is equal to 0.81 indicating that an improvement in the ability of the Greek football clubs to use their assets to generate cash by 1% can result in an increased ROA by 0.81%.

In the case of ROE, the coefficient of size is significantly positive, while the estimate of leverage is negative and significant. The sign of leverage's estimate is in accordance with our expectations. The estimate of the cash flow efficiency is significantly positive. The liquidity and efficiency factors are statistically insignificant.

Finally, as far as the results on profit margin are concerned, the estimates of size, liquidity and cash flow efficiency are positive and statically significant indicating that these factors can affect the financial performance of the Greek football clubs in a positive way. The rest of the factors present no statistically significant estimates. With the exception of the leverage factor, whose coefficient is statistically insignificant, the results of the regression model having the profit margin as the dependent variable, resemble the results obtained via having ROA as the model's dependent variable.

Overall, similar to the conclusions drawn via the correlation analysis in the previous section, the multifactor regression analysis applied in this section verifies the significant role of key factors mainly including size, liquidity and cash flow efficiency for the financial performance and, consequently, long-run viability of the football enterprises in Greece.

5. CONCLUSION

In this study, we examined the financial performance of seven Greek football clubs competing in the first domestic division, the Super League, over the seven-season period spanning from 2015-16 to 2021-22. From a methodological point of view, our study applies simple correlation analysis and multifactor regression analysis on the factors that may affect the financial performance of the selected football clubs in Greece.

Our results confirm the findings of earlier relevant studies on the Greek football industry. In particular, the examined clubs show a high degree of leverage, along with low liquidity, extensive annual and accumulated losses, and poor financial performance in general. In relation to the factors that can affect the financial performance of the Greek football companies, our analysis has shown that the factors that can possibly affect

financial performance, either in a positive or negative way, are the assets of the football enterprises, liquidity, leverage, efficiency, as well as the ability of the clubs to use their assets to generate cash.

The diachronically weak financial outlook of the Greek football clubs should motivate their management to start seeking for alternative ways of conducting business. In this respect, professional managers should be hired to run the Greek football clubs contrary to the common practice in Greece, and in other countries too, of ex-footballers, of high popularity but of weak academic records and entrepreneurship experience, undertaking crucial seats in the management of clubs. The clubs and their fans also need to understand that the accumulation of losses could threaten the very existence of the clubs in the long run.

Overall, our results indicate that the Greek football clubs need to make radical changes to their business model. Constant loss-making cannot be viable for much long. In addition, bank lending and financing by the owners of the clubs may not be an option in the future. The clubs need to work towards improving their financials and enhancing their self-sufficiency. Should such an improvement happen, the Greek football clubs may see an improvement in their competitive ability at the international level.

AUTHORS' DECLARATION:

This paper complies with Research and Publication Ethics, has no conflict of interest to declare, and has received no financial support.

AUTHORS' CONTRIBUTIONS:

The entire research is written by the author.

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