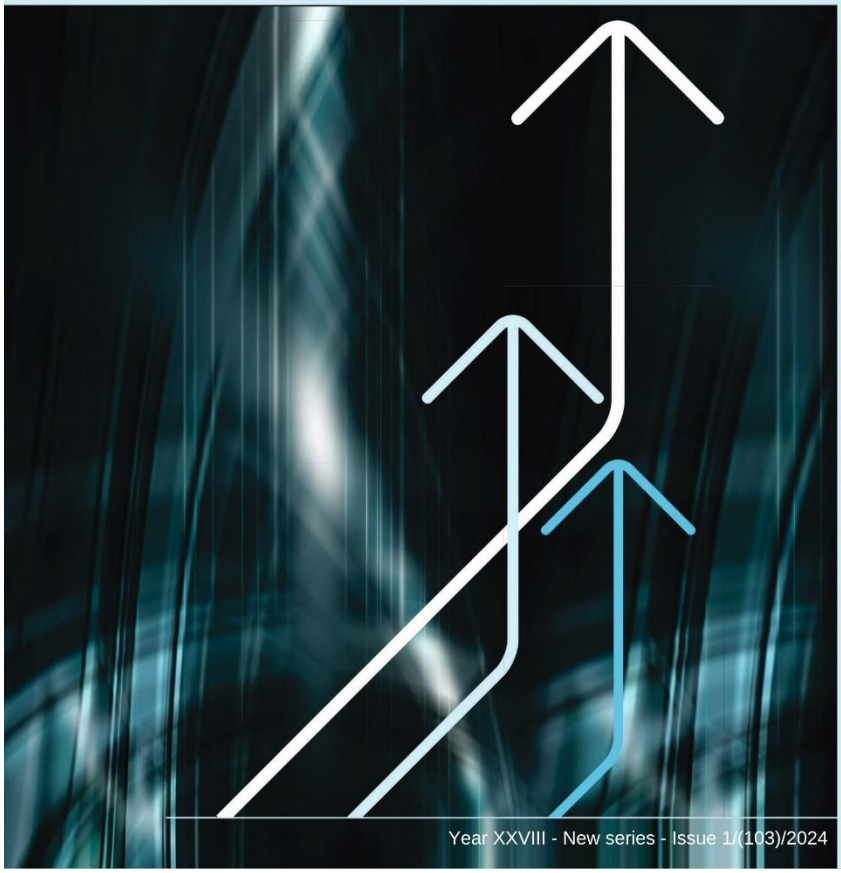
Romanian Academy
"Costin C. Kiriţescu" National Institute for Economic Research
"Victor Slăvescu" Centre for Financial and Monetary Research

Financial Studies



Year XXVIII - New series - Issue 1/(103)/2024

“VICTOR SLĂVESCU” CENTRE FOR FINANCIAL
AND MONETARY RESEARCH

FINANCIAL STUDIES

ROMANIAN ACADEMY
"COSTIN C. KIRIȚESCU" NATIONAL INSTITUTE FOR ECONOMIC RESEARCH
"VICTOR SLĂVESCU" CENTRE FOR FINANCIAL AND MONETARY RESEARCH

FINANCIAL STUDIES

Year XXVIII– New series – Issue 1 (103)/2024

ROMANIAN ACADEMY
"COSTIN C. KIRIŢESCU" NATIONAL INSTITUTE FOR ECONOMIC RESEARCH
"VICTOR SLĂVESCU" CENTRE FOR FINANCIAL AND MONETARY RESEARCH

Quarterly journal of financial and monetary studies

EDITORIAL BOARD

SCIENTIFIC BOARD

ISSN 2066 - 6071
ISSN-L 2066 - 6071

Contents

THE IMPACT OF ENERGY CONSUMPTION IN CRYPTO ASSETS ON CRYPTO ASSET PRICES AND CARBON EMISSIONS: CASE OF BITCOIN AND ETHEREUM[1]

Meltem BİLİRER*

Feyyaz ZEREN, PhD**

Abstract

In this paper, it is aimed to evaluate the relationship between energy consumption in crypto assets and crypto asset prices. In this direction, the price, CO2 emission and energy consumption series of Bitcoin and Ethereum between March 17, 2021, and March 15, 2023, were examined weekly. In order to clarify the subject, Fourier Granger causality and Fourier ADL cointegration tests were applied to the series. In the findings, a bidirectional causality relationship was determined between Bitcoin price, Bitcoin energy consumption and Bitcoin CO2 emission series, and no causality relationship was detected between Ethereum price, Ethereum energy consumption and Ethereum CO2 emission series. On the cointegration side of the analyses, while there is a long-run nexus between Bitcoin Price and Bitcoin CO2 emission and Bitcoin energy consumption variables, it has been observed that there is no long-run nexus between the variables for Ethereum. At the end of the study, it was mentioned that it would be useful to examine the market values of these variables in future studies

---

[1] *This study is based on Meltem BİLİRER's master's thesis titled "Decentralized Finance Applications and Electricity Consumption, Carbon Dioxide Emission, Price Relationship of Crypto Assets After Merge: An Application on Selected Coins and Tokens" which was carried out under the supervision of Prof. Dr. Feyyaz ZEREN at Graduate Education Institute, Department of International Trade and Finance, Yalova University, Yalova, Türkiye.*

* *Student, Graduate School of Education, Department of International Trade and Finance, Yalova University, Yalova, Türkiye.*

** *Professor, Faculty of Economics and Administrative Science, Department of International Trade and Finance, Yalova University, Yalova, Türkiye*.

and that since the Merge event in Ethereum is an important development for crypto assets, it is possible to increase similar developments with the necessary incentives and policies in this direction.

Keywords: cryptocurrency, energy problem, merge, proof of stake, proof of work

JEL Classification: G15; Q43

1. Introduction

With the widespread use of the Internet, technological developments have taken place in all areas of our lives over time, and the impact of these developments on trade has been inevitable. And along with this, many attempts have been made to electronic money, which forms the basis of commercial transactions. Although the first attempts were not very successful, with Satoshi Nakamoto's announcement of the blockchain-based digital currency Bitcoin in 2008, rapid developments took place in this field and this process was followed by the emergence of various crypto assets (Charandabi and Kamyar, 2021; Yumuşaker, 2019).

Although crypto assets are not dependent on a central institution or any other authority, their values are determined according to the instant supply and demand in the market, and transactions are recorded in an encrypted form on a system called blockchain (Cengiz, 2018). Blockchain technology, which has become popular with Bitcoin and has the potential to facilitate human life in many areas, has a significant impact on the global carbon footprint due to its high energy consumption trend. Blockchain has been multiplied and diversified over time for different use cases. We can give an example of Ethereum, which leads this diversification, operates in a decentralised way and has smart contracts on it, unlike Bitcoin (Bada et al., 2021).

In addition to these, Nakamoto in his/her article describing the structure and working mechanism of blockchain technology, in other words, referred to the Proof of Work (PoW) mechanism, which represents the form of the Bitcoin production process. This mechanism, in which software developers, called miners, compete to solve heavy mathematical puzzles for which they will receive certain amounts of Bitcoin rewards in return for winning, requires a significant

amount of energy consumption due to its incentive structure (Öztürk et al., 2018; Zhang and Chan, 2020).

In order to solve the problem of high energy consumption brought about by the increase in the use of Bitcoin, researchers have started to look for alternatives to Proof of Work. One of the main alternatives offered to solve the current energy demand problem, which poses similar risks in Ethereum, another blockchain-based crypto asset, as in Bitcoin, has been Proof of Stake (PoS) (Siim, 2017). In the Proof of Stake mechanism, the authority to update the blockchain is given to randomly selected validators instead of existing competing miners in Proof of Work. There is a monetary reward here as well, but to earn this reward, validators do not need to be in a competitive situation as miners do in Proof of Work (Saleh, 2021).

Initially based on the consensus mechanism Proof of Work (PoW), Ethereum left this mechanism, which causes intense energy consumption that requires competition between miners, and switched to the Proof of Stake (PoS) mechanism, which is more advantageous in terms of energy efficiency, in September 2022. After Merge, which expresses the structural updates in this transition period, the fact that those holding Ethereum on the chain in the last block before the Merge had the same number of assets in both the PoS chain and the PoW chain after the Merge gave rise to the expectation that there would be a sudden increase in the ETH liquidity of the Ethereum market (Heimbach et al., 2023).

In this study, the relationship between crypto-asset energy consumption and crypto-asset prices and carbon emissions will be examined, and changes in the market will be discussed after the transition of Ethereum crypto-asset to Proof-of-Stake protocol in line with the determination of the relationship between energy efficiency and asset price levels.

2. Literature review

In this part of the study, which aims to examine the relationship between energy consumption in crypto assets, crypto asset prices and carbon emissions by considering Ethereum's situation in the market after The Merge event, similar studies in the literature are mentioned in connection with the content of the research. Although there are not many similar studies in the literature on the relationship between energy consumption and the price of crypto-assets in terms of content,

it can be said that there are studies on Bitcoin and Ethereum in general, and most of them have been examined in the context of operating protocols.

Ampel (2023) investigated how the existing mechanism affects the cryptocurrency price and transaction volume in cryptocurrencies based on the consensus mechanism for transaction verification and network security. As a result of Ampel's (2023) analysis of Ethereum, which has changed its consensus protocol, it has been determined that Ethereum's mechanism change has a positive effect on the price but has a non-significant negative effect on transaction volumes. The study stated that the transition from Proof-of-Work to Proof-of-Stake is promising because it has positive effects both environmentally and in terms of increasing investment opportunities.

In their study, Zheng et al., (2023) aimed to examine the causality relationship between cryptocurrency transactions and electricity consumption. As a result of the analysis, it was observed that the series of cryptocurrency transactions and electricity consumption, which were exposed to daily shocks, gradually returned to average convergence. It has been determined that prices trend with hash rates.

DiFebo et al. (2021), in their study examining the relationship between the energy market and Bitcoin prices with the multivariate-quantile conditional autoregressive (MVMQ-CAViaR) model and the Granger causality test, it was determined that Bitcoin spillovers have a stronger effect on carbon markets and that the carbon market is not a granger cause to Bitcoin. In addition, it has been concluded that Bitcoin affects the carbon market in sub-tranes.

Felek et al. (2023) in their study examining the relationship between Bitcoin and carbon emissions between the periods 2017M1-2022M1, they applied Kapetanios et al. (2006)'s Nonlinear Co-integration analysis and Granger causality test to the series. As a result of their studies, it has been concluded that there is a nonlinear cointegration relationship between Bitcoin and CO2 in the long run and a one-way causality relationship from Bitcoin to carbon emissions.

Huynh et al. (2022), in their study, which is the first empirical article examining the relationship between Bitcoin's energy consumption and the Bitcoin market, they determined the existence of a relationship between Bitcoin energy consumption and returns and volumes by using quasi-variances and variance decompositions on daily data. According to the study, the effect of Bitcoin from trading volumes to energy consumption is higher than returns in the long run.

In addition, according to the results of the study, the decline in the Bitcoin market not only prevents energy consumption, but also triggers the interconnectedness of energy consumption from now on.

In this study, Afjal and Sajeev (2022) examined the return volatility spread of crypto assets with increasing annual energy consumption and the effect of Bitcoin, Ethereum and three other crypto assets on four energy markets (Nifty Energy Index, S&P 500 Energy Index, S&P/TSX Canadian Energy Index, Shanghai Stock Exchange Energy Index) using the Granger Causality Test and DCC MGARCH model and considering the period between 2016-2021; As a result of their findings, they determined that the general correlation, which changes over time, between energy markets and crypto asset units is low and weak.

Pagnottoni (2023) applied the method to investigate the topology of shock transmission networks across cryptoassets, energy prices, CO2 emissions, in this study, which presented a topological framework proposal for variance decomposition analysis of multivariate time series in time and frequency domains. The results of the research show that the topologies of long and short-term shock transmission networks are completely different, and superhighways and roads have changed significantly over time, but it has been stated that there are no direct strong links between cryptoassets and carbon markets after the Covid-19 outbreak.

In this study, in which De Vries (2023) examines crypto assets in the context of sustainability, it is emphasized that a special way of limiting the environmental effects of crypto assets, such as intense energy demand, is to avoid the Proof of Work (PoW) mechanism. In this study, which evaluates the transition of Ethereum, the second largest crypto asset in terms of market value, from the Proof-of-Work PoW mechanism to the Proof-of-Stake (PoS) mechanism with The Merge in September 2022, the opportunities and difficulties of replicating The Merge event in other crypto asset units are discussed. Accordingly, it has been stated that this initiative of Ethereum is an important example despite the existing difficulties, and it is not impossible to realize this initiative among other crypto assets in line with this example and with the right incentives. It was emphasized that the research needed for Bitcoin and other crypto assets to switch to PoS should be focused on, especially considering that the decreases in Bitcoin's energy demand are likely to be reflected globally.

Symitsi and Chalvatzis. (2018), in their study aiming to examine the interaction between Bitcoin and energy and technology companies with the VAR-GARCH model, determined that there are significant return spreads from energy and technology stocks to Bitcoin and that Bitcoin has long-term volatility effects on energy companies.

Corbet et al. (2021), in their study of Bitcoin and energy markets, discussed the underlying dynamics of Bitcoin's price fluctuations and crypto-asset mining and investigated their effects on utilities companies and basic energy markets. As a result of their research, it was stated that crypto-asset energy consumption has a continuous and significant effect on the performance of some companies in the energy sector, emphasizing the importance of considering and further evaluating the environmental effects of growth in crypto-assets in this direction.

Das and Dutta (2020) examined the relationship between miner revenues and energy consumption in Bitcoin, using the quantile regression method and the Markov regime change model, based on the question 'Is energy consumption the Achilles heel of miner income?'. As a result of their analysis, they determined a negative relationship between the variables and stated that the negative effect is important in cases where miner incomes are low and variable. Therefore, considering the increase in energy costs, they emphasized that cheap energy sources and efficient mining equipment are important in terms of sustainability.

Badea and Mungiu-Pupăzan (2021) aimed to provide an overview of the subject by examining the economic and environmental impact of Bitcoin through a systematic literature review. The research provided an opportunity to evaluate the level of knowledge regarding the environmental impact of the mining process in terms of energy consumption and CO2 emissions to identify potential solutions in terms of analysis of Bitcoin regulation and mitigation of the current negative impact. In their research findings, they observed that despite the negative environmental impact caused by Bitcoin, it continues to be used as a tool for various economic purposes, and the current regulatory trends in countries show that its use has begun to gain legitimacy, despite the criticisms against Bitcoin.

Yılmaz and Kaplan (2022) examined the effects of crypto-asset mining operations on environmental sustainability, including climate change and global warming. As a result of their research, they stated that the energy consumed by mining has important environmental

effects in the context of carbon emissions, global warming, climate change, and air pollution. In addition, in order to prevent these negative effects, the importance of innovative steps to be taken in this area, new legal regulations to be introduced, and the use of various evidence protocols and renewable energy sources that can be used specific to the system are emphasised in terms of crypto-asset markets and environmental sustainability.

When the existing studies in the literature are examined within the scope of the subject of this study, it can be said that the studies were made especially on Bitcoin and Ethereum. It can be said that the reason for this is that Bitcoin works with the Proof-of-Work protocol, while Ethereum starts with the Proof-of-Work protocol like Bitcoin and then moves to the Proof-of-Stake protocol by eliminating the mining process that causes intense energy consumption in the Proof-of-Work. In this context, it has been suggested that in order to avoid this environmental risk caused by crypto-asset investments in general, it would be beneficial to focus on the transition of other crypto assets to the Proof-of-Stake protocol or whether different protocol types can be developed that do not technically cause intense energy consumption.

3. Data and method

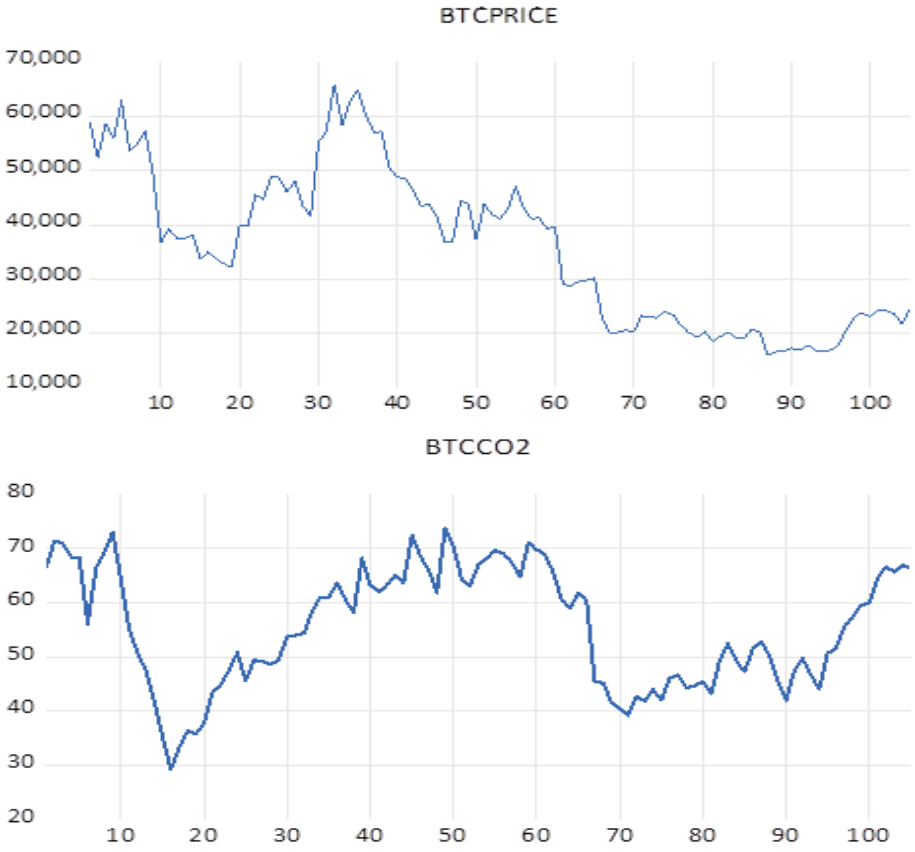
3.1. Data

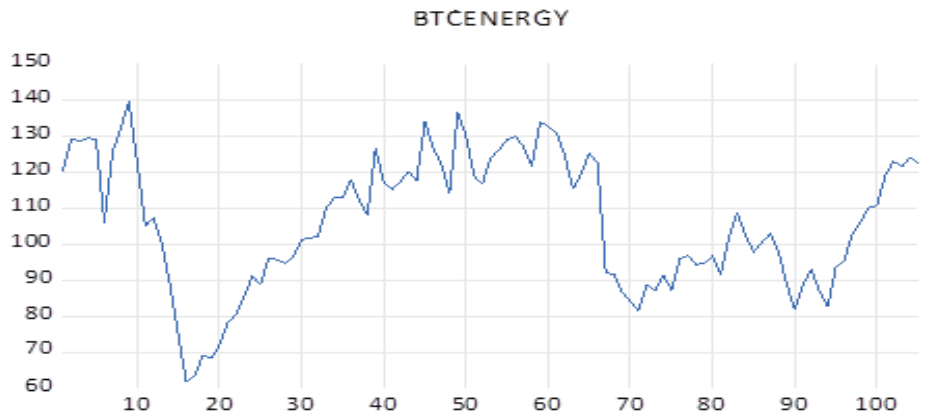
In this study, in order to examine the relationship between the energy consumption of crypto assets and the prices of crypto assets and CO2 emissions, the price, CO2 emission, energy consumption series of Bitcoin and Ethereum for the period 17 March 2021 – 15 March 2023 were examined, and the data of the series were discussed on a weekly basis.

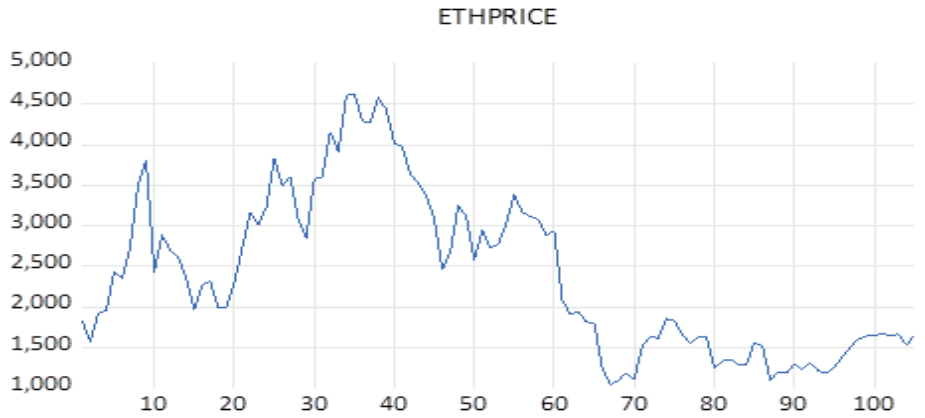
In the study, Bitcoin's energy consumption data from March 17, 2021 to March 1, 2023 is from Cambridge University of Cambridge Alternative Finance Center (CCAF), 8 and 15 March data from Crypto Carbon Ratings Institute (CCRI); March 17, 2021 – March 15, 2023 historical price data taken from investing.com. Ethereum 17 March 2021 – 15 March 2023 energy consumption data from Crypto Carbon Ratings Institute (CCRI), historical price data from investing.com. CO2 emissions data for both cryptoassets are from the Crypto Carbon Ratings Institute (CCRI). The time series charts for these series are presented below.

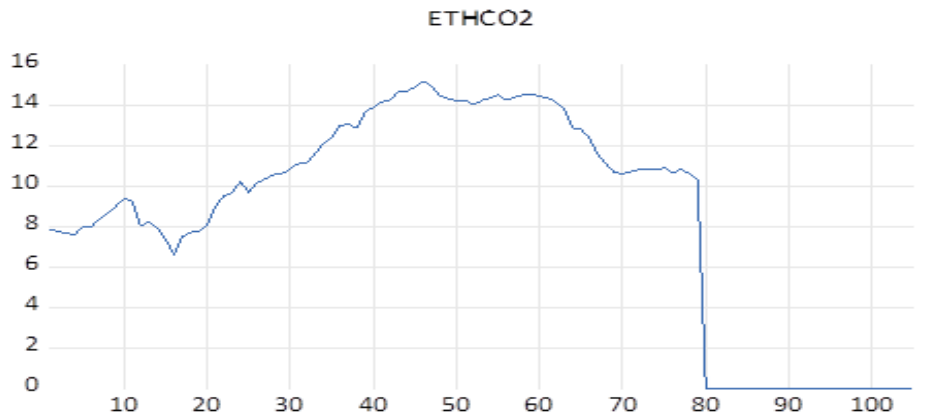
Graphs 1-6

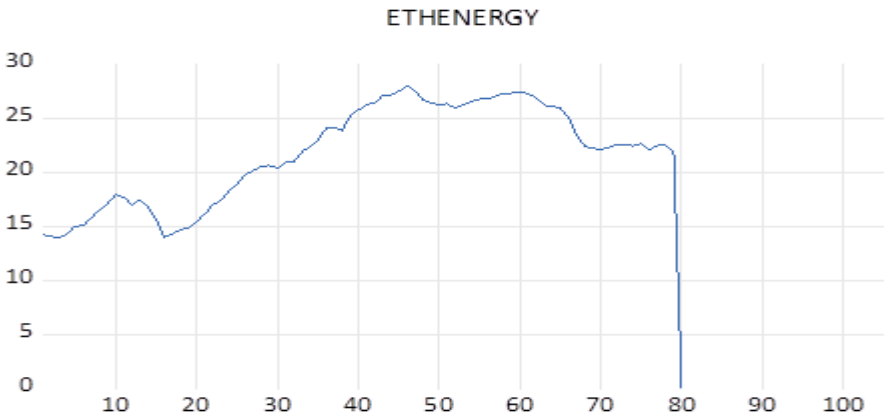
Time Series Charts of Variables




BTCENERGY
150
140
130
120
110
100
90
80
70
60
10
20
30
40
50
60
70
80
90
100


ETHPRICE
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
10
20
30
40
50
60
70
80
90
100


ETHCO2
16
14
12
10
8
6
4
2
0
10
20
30
40
50
60
70
80
90
100



Source: authors'

When the graphs are examined, it is understood that Bitcoin price, energy consumption, and CO2 emission variables show a similar course. On the other hand, with the effect of the merge, there was a serious break in Ethereum's CO2 emission and energy consumption data on September 21, 2022. It is clear from the graphs that this situation is not fully reflected in Ethereum prices. The aim of this study is to confirm these interpretations with empirical analysis.

3.2. Methodology and Empirical Findings

3.2.1. Fourier ADF Unit Root Test

The Dickey-Fuller Unit Root Test was first developed in 1979 by D. A. Dickey and W. A. Fuller (İzolluoğlu, 2019). Unit root tests are divided into linear and nonlinear unit root tests. If the trends of the series of variables considered in a study are linear over time, the stationarity condition of these series is determined by linear unit root tests. However, if the trend in the time series of the variables is not linear, the stationarity condition is determined by nonlinear unit root tests (Yücesan, 2021). This test, which is used to test the stationarity of the time series, is the basis of the unit root tests developed by making additions over time. In this study, the Fourier Augmented Dickey-Fuller Unit Root Test (FADF) developed by Walter Enders and Junsoo Lee in 2012 was used. The FADF test is seen as an alternative to the Perron (1990), Zivot and Andrews (1992), and Bai and Perron (2003) tests since it also includes asymmetric relationships in the analysis. The biggest advantage of this test, which also takes into account the structural breaks in the existing variables by adding some

trigonometric terms to the equation of the ADF unit root test, is that it is not necessary to predetermine the number and form of the existing break points in the series (İzolluoğlu, 2019; Mike and Alper, 2020; İnal et al., 2023).

The Fourier ADF Unit Root Test model is as follows:

$$y_t = y_0 + y_1 \sin\left(\frac{2\pi kt}{T}\right) + y_2 \cos\left(\frac{2\pi kt}{T}\right) + v_1 \quad (1)$$

The terms shown on the present equation and the values they represent are as follows: t=trend, T=sample size, π=3.1416, frequency is an integer between 1 and 5 as a value.

The test results are as in the table given below:

Table 1

Fourier ADF Unit Root Test Results

	Level	**First Difference**
Bitcoin CO_2 Emission	-3.1873 (2)	-8.1883 (2) ***
Bitcoin Energy Consumption	-3.1371 (2)	-8.6372 (4) ***
Bitcoin Price	-1.9801 (4)	-8.0106 (4) ***
Ethereum CO_2 Emission	-2.9449 (1)	-10.0616 (1) ***
Ethereum Energy Consumption	-2.9302 (1)	-9.9496 (3) ***
Ethereum Price	-3.3625 (1)	-8.2290 (4) ***

*Note: *** Indicates significance with 99% confidence. Values in parentheses indicate optimal Fourier values.*

In the first test results, no stationarity was observed in any of the variables of Bitcoin CO2 Emission, Bitcoin Energy Consumption, Bitcoin Price, Ethereum CO2 Emission, Ethereum Energy Consumption, Ethereum Price, and the hypothesis that there is a unit root was accepted. For this reason, the difference of all available variables was taken and as a result, stationarity was determined in all variables with 99% confidence.

3.2.2. Fourier Granger Causality Test

Since Granger causality analysis ignores structural breaks when performed with the Vector Autoregression (VAR) model, Enders and Jones (2016) added Gallant's (1981) Fourier functions to the VAR model and developed a new test that takes into account the structural breaks without knowing the date and number. This new test developed by Enders and Jones (2016) is the Fourier Granger causality test and

the model is as in equation 2. The null hypothesis of the test was established as no causal relationship (Pata and Ela, 2020).

$$\alpha(t) = \alpha_0 + \sum_{k=1}^{p} \alpha_k \sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{p} \beta_k \cos\left(\frac{2\pi kt}{T}\right) \quad (2)$$

$$y_t = \theta + \phi_1 y_{t-1} + \cdots + \phi_u y_{t-i} + u_t \quad (3)$$

$$y_t = \theta_0 + \varphi_{1k}\sin\left(\frac{2\pi kt}{T}\right) + \varphi_{2k}\cos\left(\frac{2\pi kt}{T}\right) + \phi_1 y_{t-1} + \cdots + \phi_i y_{t-i} + u_t \quad (4)$$

T in the equation represents the number of observations, the smallest value of the k residual sum of squares, and the value of π is 3.1416. Equation 2 represents the Fourier trigonometric functions, equation 3 represents the VAR model, and equation 4, which is obtained by adding the Fourier trigonometric functions to the VAR model, represents the Fourier-Granger causality test model (Yurtkuran, 2021).

The results of the Fourier-Granger Causality test are given in Table 2.

Table 2

Fourier Granger Causality Test Results

	Fourier Number	Test Statistics	Asymptotic Probability Value	Bootstrap Probability Value
BP → BEC	2	7.022***	0.006	0.020
BP → BCE	2	3.853**	0.050	0.050
BCE → BP	2	7.830***	0.005	0.004
BEC → BP	2	5.184**	0.023	0.020
EP → EEC	1	0.000	0.991	0.996
EP → ECE	1	0.000	0.994	0.993
EEC → EP	1	0.556	0.456	0.435
ECE → EP	1	0.425	0.429	0.393

*Note: In Table 2; * means with 90% reliability, ** with 95% reliability, *** with 99% reliability. BP=Bitcoin Price, BEC= Bitcoin Energy Consumption, BCE= Bitcoin CO2 Emission, EP=Ethereum Price, EEC= Ethereum Energy Consumption, ECE= Ethereum CO2 Emission, → indicates the direction of causality.*

As a result of the Fourier Granger Causality Test of the variables examined bilaterally in Table 2, a bidirectional causality relationship was determined between Bitcoin Price, Bitcoin Energy

consumption and Bitcoin CO2 Emission data. For BF→BET and BCE→BF with 99% confidence, and for BF→BCE and BET→BF 95% confidence significance was determined. On the Ethereum side, no directional causality relationship was detected between the variables.

3.2.3. Fourier ADL Cointegration Test

The cointegration models introduced to the literature by Granger (1981) and Engle and Granger (1987) have been criticized for establishing the null hypothesis as no cointegration (Gazel, 2018). The Fourier ADL Cointegration Test was used in this study to determine whether the variables act together in the long run (Barut and Kaya, 2020). The Fourier ADL Cointegration Test, which was created by adding trigonometric functions to the ADL cointegration model by Banerjee et al. (2017), differs from other cointegration tests because the single frequency component can capture unknown multiple structural breaks (Aztimur et al., 2023:778; Barut and Kaya, 2020). In this model, in which the test statistic is compared with the critical values suggested by Banerjee et al. (2017), if the test statistic value is greater than the critical values, the H0 basic hypothesis, which represents the result of cointegration, is accepted. With this test, in cases where the frequency numbers are low, very different types of refraction can be detected, thus increasing the power of the test and preventing the use of more dummy variables (Barut and Kaya, 2020).

The model of the test is as follows:

$$\Delta y_{1t} = d(t) + \delta_1 y_{1,t-1} + \gamma' y_{2,t-1} + \varphi' \Delta y_{2t} + e_t \qquad (5)$$

In Equation 5, y_{1t} represents the dependent variable, and the symbols δ, γ and φ are the independent variables. The current $d(t)$ deterministic component in the Fourier approach is defined as in Equation 6.

$$d(t) = \gamma_0 + \sum_{k=1}^{q} \gamma_{1,k} \sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{q} \gamma_{2,k} \cos\left(\frac{2\pi kt}{T}\right),\ q \leq T/2 \qquad (6)$$

The hypotheses of the test are as shown below:

$H_0: \delta_1 = 0 \qquad H_1: \delta_1 < 0$

The statistic test is calculated as in Equation 7.

$$t_{ADL}^{F} = \frac{\hat{\delta}_1}{se(\hat{\delta}_1)} \qquad (7)$$

Here, $\hat{\delta}_1$ is the PLS (Partial Least Squares) estimator, and $se(\hat{\delta}_1)$ represents the standard error of $\hat{\delta}_1$ obtained from the PLS estimation (Aztimur et al., 2023).

Fourier ADL Cointegration test results are given in Table 3.

Table 3

Fourier ADL Cointegration Test Results

	Test Statistics	Frequency	Min AIC
BP − BEC	-4.473069**	2	6.782503
BP − BCE	-5.082497***	2	5.519302
EP − EEC	-3.003339	1	4.443543
EP − ECE	-2.989543	1	2.969159

*Note: In Table 3; ** Represents significance with 95% confidence, and *** Represents with 99% confidence. BP=Bitcoin Price, BEC= Bitcoin Energy Consumption, BCE= Bitcoin CO2 Emission, EP=Ethereum Price, EEC= Ethereum Energy Consumption, and ECE= Ethereum CO2 Emission.*

According to Fourier ADL Cointegration test results, for Bitcoin Price variable; It is accepted that Bitcoin CO2 Emission and Bitcoin Energy Consumption variables are above the critical values calculated for 1%, 5% and 10% significance levels, respectively, and that there is a cointegration relationship between them. In this direction, Bitcoin Price and Bitcoin CO2 Emission and Bitcoin Energy Consumption variables have cointegrated in the long run. On the Ethereum side of the tests, since no cointegration relationship was detected between the variables, there is no relationship in the long run.

4. Concluding remarks

Bitcoin, which has become widespread today, and crypto assets with similar working principles have caused intense energy consumption and emission problems brought by the mining process; These problems have also led to the emergence of criticism on crypto assets. In addition, alternatives have been sought to develop environmentally friendly steps to reduce intense energy consumption and carbon emissions in order to reduce these risks in the transactions of crypto assets, which offer various advantages to the user such as fast and low-cost transactions. The Proof of Stake mechanism is one of the main alternatives offered in this context. Ethereum, a crypto asset with a high market value like Bitcoin, switched from the Proof of Work mechanism, which requires intense energy consumption, to the

Proof of Stake mechanism, which is seen as more advantageous in terms of energy efficiency, in September 2022. With this development, it is aimed to prevent intense energy consumption by giving the blockchain update authority to randomly selected validators instead of competing miners in Proof of Work.

In this study, it is aimed to examine the relationship between energy consumption, carbon emission and prices of crypto assets by considering the price, CO2 emission, energy consumption series of Bitcoin and Ethereum for the period 17 March 2021-15 March 2023 on a weekly basis. First, the stationarity of the series was examined by using the Fourier ADF Unit Root Test with the available data, and then the causality between variables was investigated with the Fourier Granger Causality Test. Considering the causality test results; it can be said that since the price increase on the Bitcoin side directly affects the demand for this asset, the energy consumption caused by Bitcoin mining operations has increased with this demand. In addition, the causality relationship from the detected Bitcoin price to Bitcoin carbon emission can be explained by the fact that the price increases in this asset cause negative environmental effects. The lack of causality between the variables on the Ethereum side can be explained by the breaking of causality as a result of the significant decrease in energy consumption and carbon emissions after the transition to the Proof-of-Stake mechanism of the data obtained after September 21, 2022 in the series discussed. Fourier ADL Cointegration Test was applied to the series in order to examine the relationship between the variables. In the results, the long-term cointegration relationship of Bitcoin Price and Bitcoin CO2 Emission and Bitcoin Energy Consumption variables were determined. In Ethereum, however, no relationship was detected among the variables. The reason for this situation can be explained similarly to the situation in causality.

When comparing the findings with the studies in the literature, it can be said that the cointegration tests between Bitcoin and CO2 emissions gave similar results with Felek et al. (2023). On the other hand, in their paper where Zheng et al., (2023) aimed to examine the causality relationship between cryptocurrency transactions and electricity consumption, it was concluded that transactions are important determinants of electricity consumption due to the computing power distributed wherever there is high profit. Ampel (2023), another study examining the repercussions of Ethereum's protocol change, found that Ethereum's mechanism change had a positive effect on the

price as a result of its analysis. The study stated that the transition from Proof of Work to Proof of Stake has positive effects both environmentally and in terms of increasing investment opportunities. These findings are similar to the results obtained in our study.

In future studies, research on this subject can be expanded with different econometric methods and studies can be increased to contribute to the literature on the relationships between variables and their effects on each other. Energy and carbon market values are not discussed in this study. In this sense, it is anticipated that it may be useful to examine the market values of these variables in future studies. In this study, the reflections of Ethereum's consensus protocol change, which is an important step in preventing high energy consumption resulting from transaction processes in crypto assets, were examined by considering crypto asset prices, carbon emission and energy consumption variables. Considering the results of the analysis, it was observed that Ethereum's transition to the Proof of Stake protocol had positive effects. In this regard, it is aimed to contribute to the literature through econometric results that will clarify the current situation with the data obtained and to guide future studies. In this sense, in order to prevent the negative environmental effects of crypto assets, whose use has become widespread, research can be conducted to determine whether a protocol change will be appropriate for other crypto assets, similar to Ethereum. If possible, environmental damage can be prevented by taking steps towards this change. Finally, technology companies or companies open to innovation can also contribute to this field through initiatives and support for different research on preventing intense energy consumption, and governments can implement policies to support initiatives in this field and even provide incentives for these research and practices with state-supported projects.

References

1. Afjal, M. and Sajeev, K. C. (2022). Interconnection between cryptocurrencies and energy markets: an analysis of volatility spillover. OPEC Energy Review, 46(3), 287. https://doi.org/10.1111/opec.12227
2. Ampel, B. (2023). The Effect of Consensus Algorithm on Ethereum Price and Volume, 1.
3. Aztimur, H., Çadırcı, Ç. and Kaya, L. (2023). Ticari açıklığın kamu kesimi büyüklüğüne etkisi: Çin için ekonometrik bir inceleme.

Fiscaoeconomia, 7(1), 778-779. https://doi.org/10.25295/fsecon.1195372

4. Bada, A. O., Damianou, A., Angelopoulos, C. M. and Katos, V. (2021). 'Towards a green blockchain: A review of consensus mechanisms and their energy consumption', In 2021 17th International Conference on Distributed Computing in Sensor Systems (DCOSS), IEEE, pp. 503. http://dx.doi.org/10.1109/DCOSS52077.2021.00083
5. Badea, L. and Mungiu-Pupăzan, M. C. (2021). The economic and environmental impact of bitcoin. IEEE Access, 9, 48091. http://dx.doi.org/10.1109/ACCESS.2021.3068636
6. Bai, J., and Perron, P. (2003). Computation and analysis of multiple structural change models. Journal of Applied Econometrics, 18(1), 1-22. https://doi.org/10.1002/jae.659
7. Banerjee, P., Arčabić, V. & Lee, H. (2017). Fourier ADL cointegration test to approximate smooth breaks with new evidence from crude oil market. Economic Modelling, 67, 114-124. https://doi.org/10.1016/j.econmod.2016.11.004
8. Barut, A. and Kaya, E. (2020). COVID-19 ve seçilmiş BIST sektör indeksleri ilişkisinde sıcaklığın moderatör etkisi. Turkish Studies, 15(6), 162. https://dx.doi.org/10.7827/TurkishStudies.44474
9. Cengiz, K. (2018). En popüler kripto para birimi: Bitcoin. Bandırma Onyedi Eylül Üniversitesi Sosyal Bilimler Araştırmaları Dergisi, 1(2), 90.
10. Charandabi, S. E. and Kamyar, K. (2021). Prediction of cryptocurrency price index using artificial neural networks: a survey of the literature. European Journal of Business and Management Research, 6(6), 17. http://dx.doi.org/10.24018/ejbmr.2021.6.6.1138
11. Corbet, S., Lucey, B. and Yarovaya, L. (2021). Bitcoin-energy markets interrelationships-New evidence. Resources Policy, 70, 101916. https://doi.org/10.1016/j.resourpol.2020.101916
12. Das, D. and Dutta, A. (2020). Bitcoin's energy consumption: Is it the Achilles heel to miner's revenue?. Economics Letters, 186,1. https://doi.org/10.1016/j.econlet.2019.108530
13. De Vries, A. (2023). Cryptocurrencies on the road to sustainability: Ethereum paving the way for Bitcoin. Patterns, 4(1), 1-2-3. https://doi.org/10.1016/j.patter.2022.100633
14. Enders, W. and Jones, P. (2016). Grain prices, oil prices, and multiple smooth breaks in a VAR. Studies in Nonlinear Dynamics & Econometrics, 20(4), 399-419. https://doi.org/10.1515/snde-2014-0101
15. Engle, R.F. and Granger, C.W.J. (1987). Cointegration and Error Correction: Representation, Estimation, and Testing. Econometrica, 55 (2), 251-276. https://doi.org/10.2307/1913236

16. Felek, Ş., Karademir, C. and Ceylan, R. (2023). Bitcoin ile Karbon Emisyonu İlişkisi: Doğrusal Olmayan Eşbütünleşme Analizi. Ekonomi Politika ve Finans Araştırmaları Dergisi, 8(1), 157. https://doi.org/10.30784/epfad.1261418
17. Gallant, A.R. (1981). On the bias in flexible functional forms and an essentially unbiased form: the Fourier flexible form. Journal of Econometrics, 15(2), 211-245. https://doi.org/10.1016/0304-4076(81)90115-9
18. Gazel, S. (2018). Değerli metaller ve makroekonomik değişkenler: Türkiye için bir fourier eşbütünleşme testi uygulaması. Yönetim ve Ekonomi Dergisi, 25(2), 534. https://doi.org/10.18657/yonveek.310335
19. Granger, C.W.J. (1981). Some properties of time series data and their use in econometric model specification. Journal of Econometrics, 16 (1), 121-130.
20. Heimbach, L., Schertenleib, E. and Wattenhofer, R. (2023). DeFi lending during the Merge. Available at SSRN 4341346. Pp. 1-2
21. Huynh, A.N.Q., Duong, D., Burggraf, T., Luong, H.T.T. and Bui, N.H. (2022). Energy consumption and Bitcoin market. Asia-Pacific Financial Markets, 29(1), 79-90. https://doi.org/10.1007/s10690-021-09338-4
22. İzolluoğlu, Z. (2019). Zaman serileri birim kök testleri ve bir uygulama (Master's thesis, Inonu University, Malatya). http://hdl.handle.net/11616/18395
23. İnal, V., Canbay, Ş. and Kirca, M. (2023). Determinants of food prices in Türkiye: fourier Engle-Granger cointegration test. Journal of Economic Policy Researches, 10(1), 142. http://dx.doi.org/10.26650/JEPR1132061
24. Kapetanios, G., Shin, Y. and Snell, A. (2006). Testing for cointegration in nonlinear smooth transition error correction models. Econometric Theory, 22(2), 279-303. https://doi.org/10.1017/S0266466606060129
25. Mike, F. and Alper, A. E. (2020). Gelismis ve gelismekte olan ülkeler için issizlik histerisinin incelenmesi: Fourier ADF test bulgulari. Cankiri Karatekin Universitesi Iktisadi ve Idari Bilimler Fakultesi Dergisi, 10(1), 6. https://doi.org/10.18074/ckuiibfd.661615
26. Öztürk, M. B., Arslan, H., Kayhan, T. and Uysal, M. (2018). Yeni bir hedge enstrumanı olarak Bitcoin: Bitconomi. Ömer Halisdemir Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 11(2), 219. https://doi.org/10.25287/ohuiibf.415713
27. Pagnottoni, P. (2023). Superhighways and roads of multivariate time series shock transmission: Application to cryptocurrency, carbon emission and energy prices. Physica A: Statistical Mechanics and its Applications, 128581. https://doi.org/10.1016/j.physa.2023.128581

28. Pata, K. and Ela, M. (2020). Türkiye'de finansal gelişmenin vergi gelirleri üzerindeki etkileri: Fourier eşbütünleşme ve nedensellik testleri. Mali Çözüm Dergisi, 30, 181.
29. Perron, P. (1990). Testing for a unit root in a time series with a changing mean. Journal of Business & Economic Statistics, 8(2), 153-162.
30. Saleh, F. (2021). Blockchain without waste: Proof-of-stake. The Review of financial studies, 34(3), 2. https://doi.org/10.1093/rfs/hhaa075
31. Siim, J. (2017). Proof-of-stake. In Research seminar in cryptography, pp. 1-2.
32. Symitsi, E. and Chalvatzis, K. J. (2018). Return, volatility and shock spillovers of Bitcoin with energy and technology companies. Economics Letters, 170, 127-130. https://doi.org/10.1016/j.econlet.2018.06.012
33. Yılmaz, M. K. and Kaplan, A. (2022). Kriptopara madenciliğinin çevresel sürdürülebilirlik üzerine etkileri. Döngüsel Ekonomi ve Sürdürülebilir Hayat, pp. 145. http://dx.doi.org/10.53478/TUBA.978-605-2249-97-0.ch06
34. Yumuşaker, M. C. (2019). Kripto para ve tipleri, bitcoin olgusu ve muhasebesi. OPUS International Journal of Society Researches, 12, 1009. https://doi.org/10.26466/opus.585051
35. Yurtkuran, S. (2021). Türkiye'de Feldstein-Horioka Hipotezinin Geçerliliği: DOLS Uzun Dönem Tahmincisi ve Fourier Granger Nedensellik Testi. Atatürk Üniversitesi İktisadi ve İdari Bilimler Dergisi, 35(1), 161-163. https://doi.org/10.16951/atauniiibd.750416
36. Yücesan, M. (2021). Fourier tipi birim kök testleri ile Türkiye ekonomisinde sayın alma gücü paritesinin geçerliliğinin test edilmesi (1980: M1-2019: M9). Yönetim Bilimleri Dergisi, 19(39), 51. https://doi.org/10.35408/comuybd.682219
37. Zhang, R. and Chan, W. K. V. (2020). Evaluation of energy consumption in block-chains with proof of work and proof of stake. In Journal of Physics: Conference Series, 1584(1), pp. 1. https://doi.org/10.1088/1742-6596/1584/1/012023
38. Zheng, M., Feng, G. F., Zhao, X., & Chang, C. P. (2023). The transaction behavior of cryptocurrency and electricity consumption. Financial Innovation, 9(1), 1-4-6. https://doi.org/10.1186/s40854-023-00449-7
39. Zivot, E. and Andrews, D.W.K. (1992). Further evidence on the great crash, the oil price shocks and the unit root hypothesis, Journal of Business of Economic and Statistics 10, 251-270.

Online sources

- Cambridge Centre for Alternative Finance (CCAF). Cambridge Bitcoin Electricity Consumption Index, Available at: https://ccaf.io/cbeci/ghg/index / [18 Mar 2023.]
- Crypto Carbon Ratings Institute (CCRI), CCRI Crypto Sustainability Metrics Available at: https://indices.carbon-ratings.com/ [18 Mar 2023].
- Investing, Available at: https://tr.investing.com/crypto/bitcoin/historical-data [18 Mar 2023]

THE ROLE OF FINANCIAL INCLUSION IN WOMEN'S ECONOMIC EMPOWERMENT: EVIDENCE FROM NIGERIA

Omoniyi Yemi OGUNRINDE, PhD Candidate*

Abstract

The inclusion of women into the financial system promotes economic development. However, in Nigeria, women face disproportionate financial exclusion. The main purpose of this study was to examine the role of financial inclusion in women's economic empowerment within the Nigerian context. Employing a quantitative approach, the study surveyed Nigerian women in two self-help groups to evaluate the extent to which financial inclusion had contributed to their economic empowerment. The results indicate that financial inclusion significantly facilitates women's economic empowerment in terms of improved access to financial systems, affordable financial products, and investment avenues. These underscore the role of financial inclusion in elevating women's economic empowerment. Policymakers, practitioners, and researchers can leverage these findings to inform tailored interventions promoting women's financial inclusion and empowerment. The researcher's unique contribution lies in the comprehensive exploration of the relationship between financial inclusion and economic development significantly furthering the expansion of specialised scientific literature by enhancing discourse on the intricate relationship between financial inclusion and women's economic empowerment. The study encourages further research to explore the connection between financial inclusion and women's economic empowerment by assessing diverse social, cultural, and economic contexts, the long-term impact of financial inclusion, and gaining deeper insight into the role of this inclusion through qualitative inquiry.

* *Programme Policy Officer, United Nations Nigeria, Abuja, Nigeria.*

Keywords: female inclusion, social welfare, financial system, economic empowerment, Nigeria

JEL Classification: G21; I32; J16

1. Introduction

The concept of financial inclusion has garnered substantial scholarly interest in recent times. This is because of its vital role as a pivotal catalyst for fostering economic expansion and advancement (Badullahewage, 2019; Hendriks, 2019). In particular, women's inclusion in the financial system has been identified as a crucial factor in promoting economic development. The financial inclusion of women facilitates gender equality and women's economic empowerment (World Bank, 2018; International Monetary Fund, 2018). However, this sense of gender equality is yet to be attained. This is because women and girls continue to earn less, learn less, own less, as well as wield limited economic power compared to their brothers and husbands (Hendriks, 2019). Female-headed households are among the poorest. A large portion of the hardcore poor tends to be women since they face social barriers to accessing economic assets including credits and property (Jedi, 2022). This makes it difficult for them to overcome poverty. Therefore, this is a situation that has led to negative effects on women's health, employment prospects, education, and the extent of control that women have over their lives and choices (Hendriks, 2019).

Nigeria, like many other developing countries, consists of a large informal economy and a significant proportion of its population is unbanked (Central Bank of Nigeria, 2019). This has led to limited access to financial services for a significant portion of the vulnerable population, particularly women (Onukogu, 2021). Despite being a major contributor to the economy, women in Nigeria face significant barriers to economic empowerment, including limited access to education and training (United Nations Development Programme, 2020), and a lack of access to credit and other financial services (International Labour Organization, 2018). Additionally, women have to contend with systems that are entrenched with considerable biases excluding them. For instance, there is a lot of bias in financial, market, legal, and agricultural systems that hinder women from accessing productive and economic resources (Hendriks, 2019). Some examples of this include women engaging less with financial institutions, therefore, making a larger portion of the unbanked population

(Hendriks, 2019). Another example is the difficulty that female entrepreneurs face in securing resources or capital. This is an occurrence that has relegated many of these female entrepreneurs into smaller, home-based enterprises encompassed in low-growth sectors.

Financial inclusion is significant because it has the potential to address some of the above difficulties by providing women with access to credit, savings, and other financial services (United Nations, 2020). This can help women to start and grow businesses (World Bank, 2017), invest in education and training (African Development Bank, 2019), and manage their finances more effectively (International Monetary Fund, 2018). In addition, financial inclusion can help to promote gender equality by addressing the cultural and social norms that limit women's access to financial services (United Nations Children's Fund, 2016). An additional benefit of financial inclusion is women's empowerment. Women's economic empowerment is the process of increasing women's ability to participate in and benefit from economic activities (UN Women, 2013). Women's empowerment remains a significant area of interest in many parts of the world especially in developing economies. This level of empowerment is among the recent priority issues in developing nations because of the disadvantages that women face (Siddik, 2017). This form of empowerment plays an integral role in fostering gender equality. Women's economic empowerment acts as a powerful lever for change which can enable gender equality outcomes contributing to broader intergenerational benefits for women, their children, and households (Adera & Abdisa, 2023; Hendriks, 2019). Economically empowering women is indispensable as a means of upholding their rights and attaining broader developmental goals (Golla et al., 2011; Sadiq et al., 2023). Some of these goals are poverty reduction, economic growth, and social welfare.

Despite the growing recognition of the importance of financial inclusion in economically empowering women and promoting gender equality, there remains a significant research gap regarding the current state of financial inclusion in Nigeria and its impact on women's economic well-being and freedom. Studies that have examined the problem of financial inclusion and women's economic empowerment have done so mainly in isolation (Anyanwu et al., 2018; Bhatia & Singh, 2019; Nguse et al., 2022). Thus, there is still a lack of adequate research exploring the interplay between these two factors within the Nigerian context. Therefore, the research purpose of this study is to examine the relationship between financial inclusion and women's

economic empowerment in Nigeria identifying the related challenges and opportunities for expanding financial inclusion for the women of this country.

Conducting this research study is significant for several reasons. First, Nigeria has a large population of women who face various socio-economic constraints, limiting their access to financial services and opportunities for economic empowerment. Second, understanding the relationship between financial inclusion and women's economic empowerment is crucial for formulating effective policies and interventions that can enhance women's economic participation and well-being. Finally, by addressing the research gap in this area, this study contributes to the existing literature on financial inclusion and women's empowerment, providing valuable insights for policymakers and practitioners working towards gender equality in Nigeria. Therefore, undertaking this study aims to bridge the knowledge gap in the vital relationship between financial inclusion and women empowerment within the context of Nigerian women.

The paper is organized as follows: First, the paper offers an overview of the current state of financial inclusion and women's economic empowerment in Nigeria. This will be followed by a review of the literature on the relationship between financial inclusion and women's economic empowerment. Next, the research methodology and data analysis will be presented. The paper will conclude with a discussion of the findings, implications, and recommendations for future research.

2. Literature review

Financial inclusion has been widely recognised as a crucial aspect of economic development and poverty reduction (Eton et al., 2018; George & Thomachan, 2018). Over the past few decades, a significant amount of research has been conducted on the role of financial inclusion in various areas of the economy (Hendriks, 2019; Musa et al., 2015). This literature review aimed to examine the role of financial inclusion in women's economic empowerment, highlighting the importance of access to financial services and the challenges that women face in accessing these services within the context of Nigerian women.

There are several definitions of financial inclusion presented in the literature. Financial inclusion refers to access to useful and

inexpensive financial services and products that meet the needs of people and companies (World Bank, 2018). Further, financial inclusion is the ability of individuals and households to access and use financial products and services, such as savings accounts, credit, and insurance. Financial inclusion is also the process of enabling banking and financial services for persons, therefore, supporting growth and the broader development of economic goals (Nguse et al., 2022).

Extant research explores the significance of financial inclusion. Financial inclusion is important because it allows people to save money, access credit, and manage risks, enabling them to improve their livelihoods and financial stability (Agarwal & Jack, 2011). The significance of financial inclusion also includes serving as an effective catalyst for the economic growth of nations (Nguse et al., 2022). Further significance of financial inclusion is enabling people to successfully manage their financial obligations, reducing levels of poverty, and providing wider economic growth (Fareed et al., 2017). Consequently, financial inclusion facilitates economic growth by increasing the financial resources needed to enable economic activities (Alenoghena et al., 2020). Increasing access to and use of quality financial products and services is vital to enabling economic growth and poverty reduction (Holloway et al., 2017). Participation in the financial system results in people who can manage risk and start and invest in a business.

Access to transaction accounts serves as the initial step towards financial inclusion. This is according to Shaah and Dubhasi (2015) who explain that a transaction account enables people to send and receive money as well as store it. Further, this sense of access should encompass supplying financial services to people including banking and payment services (Eton et al., 2018). This needs to take place without discrimination. Accordingly, providing access to financial services is instrumental in reducing poverty.

A well-developed body of literature show illustrates that women are disproportionately affected by the lack of financial inclusion. A study published by the World Bank (2018) found that globally, the majority of unbanked adults were women. The gender gap in account ownership is 4% with 78% of men and 74% of women around the world. The average gap between developed and developing economies is now 6% down from 9% after many years of stability (Demirgüç-Kunt et al., 2021). In 2021, 74% of men and only 68% of women had accounts in developing economies. The study attributes this disparity to a lack of

access to financial services, as well as to legal and cultural barriers that limit women's ability to open and use bank accounts. For this reason, addressing this issue is crucial for achieving economic empowerment and improved living standards for women (Eton et al., 2018; Jedi, 2022; Siddik, 2017).

In the context of Nigeria, the country faces a significant and growing gender gap in financial inclusion (Central Bank of Nigeria, 2019). Between 2012 and 2020, Nigeria's gender gap in financial access increased from 10.2% to 12% (Central Bank of Nigeria, 2019). Further, forecasting illustrates that the gap will not reduce below 10% until 2027 (Central Bank of Nigeria, 2019). This is even more so if interventions are not taken at both regulator and industry levels. Women in Nigeria typically earn less than men and their income is often designated for daily household spending (Central Bank of Nigeria, 2019). Thus, this results in little or no disposable income they can make investments, save, or purchase larger goods (Onukogu, 2021). Further, women are usually not permitted to make independent financial decisions. In Nigeria, women in the North tend to be more excluded compared to their peers in the South (Onukogu, 2021). A major reason for this is conservative socio-cultural gender norms. Some of the financial products and services that women are excluded from in Nigeria include payment systems, structured savings solutions, family-oriented financial products and services, informational services, and structured group finance products (Central Bank of Nigeria, 2019).

The review of the literature reveals that there are several meanings to empowerment. Rahman (2013) defines empowerment as the change in the balance of power within a society. Thus, empowerment encompasses the redistribution of power specifically in a household. The empowerment of women is an essential element of research focus today. This empowerment of women encompasses developing women as people with more awareness, politically active, independent, and economically active, and making decisions on matters impacting their lives (Mamta, 2014). Attaining security in social, environmental, economic, and political factors, is crucial to the empowerment of women and promoting gender equality (Badullahewage, 2019). Therefore, empowerment leads to women gaining equal access to and control over resources.

While there is a need for fostering social and political empowerment of women, this study focused on their economic empowerment. The economic empowerment of women entails women

having the opportunity to access and control productive resources and having some form of financial autonomy (Eton et al., 2018; Manoj et al., 2023). According to Golla et al. (2011), the economic empowerment of women occurs when the women attain the ability to succeed and advance economically including making economic decisions. Moreover, the economic empowerment of women is the process of providing women with the opportunity to attain equal access and control over economic resources while ensuring that they can utilize them to achieve more control over their lives (Hunt & Samman, 2016). Additionally, economic empowerment is the capacity to contribute towards the growth processes in a manner that recognises the value of contributions and undertaking fair wealth distribution enabling access to economic resources (Bhatia & Singh, 2019). Attaining economic empowerment further entails women being granted access to educational and occupational resources thus increasing the opportunities for professional development (Hendriks, 2019). This type of empowerment can also mean that women can take part in economic activities, access savings, and have control over their income as well as other productive assets including business, land, and industries (Eton et al., 2018). Additionally, the economic empowerment of women includes the allotment of some proportion of credit, foreign exchange, and public spending as well as enhancing and funding women's organizations such as cooperatives and trade unions (Eton et al., 2018).

The ability of women to participate in economic activities as indicated by their economic empowerment is one of the most essential criteria applied for the measurement of the progress and growth of societies (Bhatia & Singh, 2019; Siddik, 2017). This is even more so within the context of sustainable development goals (SDGs). Accordingly, the empowerment of women and the improvement of their status need to be national priorities. Women who are economically empowered can control and reap the benefits of resources, assets, and income (Kumari, 2022). Governments, corporations, communities, and other organizations may gain from enacting programs and policies that embrace the idea of female empowerment.

Financial inclusion is widely recognized as a crucial aspect of economic development and poverty reduction and has been shown to play a key role in women's economic empowerment (Eton et al., 2018). Access to financial services can increase women's income, reduce their vulnerability to financial risks, and improve their decision-making

power (Hendriks, 2019). Despite the potential benefits of financial inclusion, several challenges remain in ensuring that women have access to financial services. Some of these challenges include limited access to information, discriminatory social norms, a lack of affordable financial products, and a lack of financial literacy (George & Thomachan, 2018; Hendriks, 2019).

Studies have shown that women face significant challenges in accessing financial services, including limited access to information, discriminatory social norms, and a lack of affordable financial products (Eton et al., 2018; Hendriks, 2019). Further, there are barriers to financial inclusion for women including lack of access to financial services, legal and cultural barriers, lack of collateral and limited access to credit, lack of access to financial education and information, and discrimination and bias within the financial sector (Central Bank of Nigeria, 2019; George & Thomachan, 2018; Musa et al., 2015).

Additionally, the challenges that women face in attaining financial inclusion are limited access to information, discriminatory social norms, a lack of affordable financial products, and a lack of financial literacy (Chaudhary & Kumari, 2022; Saluja et al., 2023). For example, studies have shown that women often face discriminatory practices in accessing financial services, such as lower loan amounts, higher interest rates, and discriminatory collateral requirements (Agarwal & Jack, 2011). Additionally, women may face limited access to information about financial services and limited financial literacy, making it difficult for them to make informed decisions about financial services (Jedi, 2022).

Research by Saluja et al. (2023) found that despite progress in recent years, women still face significant barriers to financial inclusion. These include a lack of access to financial education and information, as well as discrimination and bias within the financial sector. The study also found that digital financial services can play a key role in increasing financial inclusion for women, but that these services must be designed and implemented in ways that consider the specific needs and constraints faced by women.

Additionally, gender inequality is yet another challenge towards the economic empowerment of women. This relates closely to social stigma relating to the position of women in society which is closely connected to their socially defined gender roles (Hendriks, 2019). Roy and Patro (2022), make similar findings and assert that in some countries, women lack financial inclusion because of social norms and

gender differences. Thus, there are gender-related barriers preventing women from gaining the ability to access financial services undermining their sense of empowerment. In the same way, Jedi (2022) observed that gender inequality becomes a hindrance to financial inclusion when women are less likely than men to access formal financial services. For instance, some women's access to financial services entails dependence on family members resulting in many of them relinquishing their financial powers to male family members. According to Holloway et al. (2017), many women are highly dependent on their husbands.

Many of the above challenges towards women attaining financial inclusion are experienced in Nigeria. Some of these challenges within the Nigerian experience include a lack of education and limited financial literacy, limited social and physical mobility, and the digital divide (Financial Alliance for Women, 2022). The low education and high rate of illiteracy have made it difficult for Nigerian women to access financial services. The lack of social and physical mobility is a barrier to financial services for Nigerian women as they are less mobile particularly those living in socially conservative communities. The digital divide prevents Nigerian women from accessing financial inclusion because few women own mobile phones compared to men. Additional challenges to Nigerian women accessing financial inclusion are eligibility, affordability, and lack of income (Alliance for Financial Inclusion, 2016).

Literature reveals that financial inclusion is an essential aspect of attaining economic empowerment among women. Financial inclusion can serve as a significant motive for women's economic empowerment (Jedi, 2022). Unfortunately, literature covering financial inclusion and women empowerment is scarce especially, for an emerging economy such as Nigeria (Anyanwu et al., 2018).

This inclusion empowers women to become included in the formal financial system. That is, financial inclusion allows for the attainment of economic growth and poverty reduction goals of countries (Siddik, 2017). Economically and socially excluded people can integrate better into the economy and protect themselves from economic shocks thanks to access to the financial system, which also helps create equal opportunities. Access to basic financial services assists the poor and vulnerable, particularly women, in breaking free from the vicious cycle of poverty and empowering themselves and their families (Chaudhary & Kumari, 2022). Similar findings are made by

Jedi (2022) who asserts that financial inclusion fosters women's economic empowerment by improving their economic participation, reducing poverty, and developing equitably.

Financial inclusion initiatives have been shown to have a positive impact on women's inclusion, by increasing access to financial services, improving the quality of financial products and services, and reducing gender-based discrimination (Rojas-Suarez, 2016). Therefore, financial inclusion is considered to play a key role in empowering women and promoting gender equality, as access to financial services can increase women's income, reduce their vulnerability to financial risks, and improve their decision-making power (Kabeer, 2015). An example of these financial services includes savings accounts. Ownership of financial accounts is yet another element of women gaining economic empowerment. This ownership of financial accounts empowers women to become financially independent (Jedi, 2022). Women who have access to individual private savings accounts are better able to make financial decisions, purchase more durable goods, and have more bargaining power with their spouses and other household members (Dupas & Robinson, 2013).

The findings of Hendriks (2019) further illustrate that financial inclusion facilitates women's empowerment by providing them with financial tools. Women can utilize these financial tools to make decisions and gain better control over resource allocation. An example of these financial tools is microfinancing. Kabeer (2015) found that access to microfinance services increased women's economic empowerment by increasing their income, improving their decision-making power, and reducing their vulnerability to financial risks. Another study by Agarwal and Jack (2011) found that access to formal financial services increased women's economic participation, improved their ability to manage risks, and reduced their dependence on informal financial services.

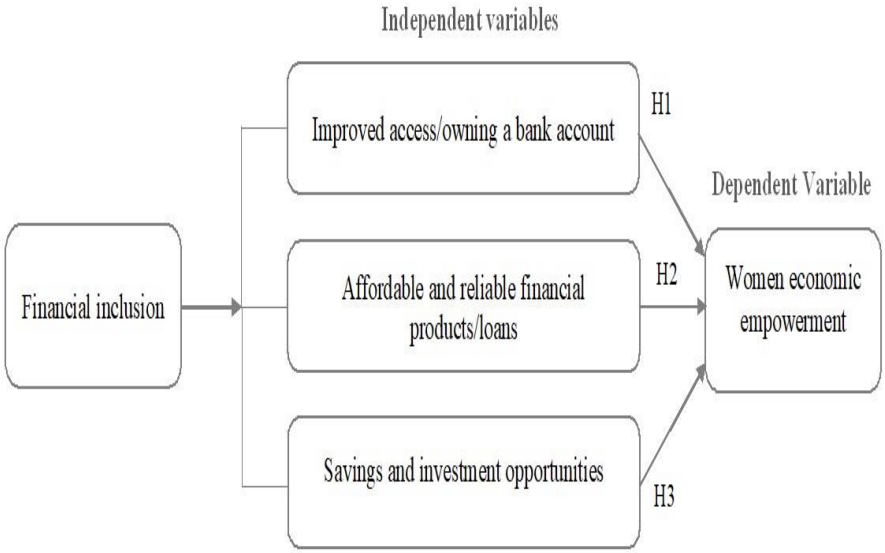
To investigate the potential impact of financial inclusion on women's empowerment in Nigeria, the formulation of research hypotheses was essential. Research hypotheses serve as the fundamental building blocks for conducting research (Barroga & Matanguihan, 2022). Therefore, this study formulated three research hypotheses, outlined as follows.

- *H1: Improved access to financial systems through bank accounts positively influences women's economic empowerment.*
- *H2: The availability of affordable and reliable financial products such as loans positively influences women's economic empowerment.*
- *H3: Savings and investment opportunities positively influence women's economic empowerment.*

The conceptual framework depicts the potential relationships between the independent and dependent variables therefore guiding the investigation of the impact of financial inclusion on women empowerment in Nigeria. The figure below illustrates the integration of the research hypotheses and the conceptual framework. This integrated approach makes sure that the conceptual framework and the research hypotheses mutually support one another, facilitating a thorough understanding of the research topic. It depicts how the various components of financial inclusion interact with the theories put forth in the research.

Figure 1

Conceptual framework of the study



3. Methods and materials

This section highlights the research methods applied for this study and rationalizes their selection based on the study objectives and context. Selecting these research methods entailed ensuring their alignment with the research questions, allowing for successful data collection and analysis, and providing reliable and valid results. Thus, in the case of studying the role of financial inclusion in women's economic empowerment in Nigeria, the following research methods were applied.

This quantitative research study involved the collection and analysis of statistical data to investigate the impact of financial inclusion on women's economic empowerment. The use of a quantitative method provides a structured and rigorous approach to explore the phenomenon under investigation and draw unbiased conclusions (Mohajan, 2020). Quantitative research analyses and interprets data using numerical data and statistical methods, allowing for generalization and the identification of trends and relationships (Stockemer, 2019). The primary aim of this quantitative study was to quantify and measure the variables, bank accounts access to financial services, and financial products like loans that were related to the research topic, enabling the provision of objective and statistically significant results. This research design allows for the testing of the three hypotheses, the identification of correlations or associations between variables, and the generalizability of findings to a larger population (Barroga & Matanguihan, 2022). By utilizing a quantitative research method, this study aimed to provide empirical evidence and contribute to the existing body of knowledge on the research topic.

The sampling technique applied for this research study was simple random sampling. Simple random sampling is a commonly used method in quantitative research that ensures every individual in the population has an equal chance of being selected for the study (Martínez-Mesa et al., 2016; Singh & Masuku, 2014). In this study, the sampling unit consisted of 150 women selected from two women groups in Nigeria.

A survey was conducted to gather data on the current state of financial inclusion, its impact on women's economic empowerment in Nigeria, and the challenges, and opportunities for expanding financial inclusion for women in Nigeria. The survey was administered to a sample of a group of women living in Nigeria who have access to

financial services. The survey included closed-ended questions, and covered aspects such as access to financial services, use of financial services, and the impact of financial services on women's economic empowerment. A five-point Likert scale was utilized to rate the answers from 1-5 indicating strongly disagree, disagree, neutral, agree, and strongly agree. The items for economic empowerment were adapted from Raj et al. (2018) and Postmus et al. (2013). The questionnaire was scrutinized by two academicians and two senior financial specialists with experience in the area of financial inclusion. This was essential in making improvements to the questionnaire ensuring that all the items were easily understood. In addition, the reliability of the responses was checked using the alpha Cronbach's estimation. The value of Cronbach's Alpha was found to be 0.853 which confirmed the reliability of the schedule.

The collected data was analysed using both descriptive and inferential statistics. Descriptive statistics was used to summarize and describe the demographic characteristics of the participants while inferential statistics were utilized to conclude. This included conducting hypothesis testing using regression analysis. The regression analysis was used to assess the relationship between the dependent and independent variables. Statistical software like SPSS (Statistical Package for the Social Sciences) was used to carry out the regression analysis. SPSS is a widely used piece of software for statistical analysis, data management, and data visualisation (Rahman & Muktadi, 2021). It can run different statistical analyses, create regression models, and create graphical displays of the data (Stockemer, 2019). Therefore, it proved invaluable in analysing data and reviewing the relationship between the dependent and independent variables of the research hypotheses.

The study was conducted with the utmost ethical considerations, safeguarding the participants' rights and well-being. Additionally, it adhered to ethical principles of confidentiality, informed consent, benevolence, integrity, and fairness in all aspects of the research process.

4. Results and discussion

4.1 Results

The study attained a high response rate. From the 150 questionnaires issued, 121 were returned. This demonstrates a response rate of approximately 80.66%.

Table 1

Distribution of Response Rate

Response	Frequency	Percentage (%)
Returned	121	80.67
Not returned	29	19.33
Total	**150**	**100**

Source: Author

The results provided a comprehensive overview of the demographics of the surveyed women, with a focus on their age, employment status, education, income, and possession of a bank account. In the end, 121 respondents participated in the survey.

Table 2

Participants' Demographic Characteristics

Category	Frequency	Per cent	Valid Per cent	Cumulative Per cent
Age group				
26 - 35 years	5	4.1	4.1	4.1
36 - 45 years	98	81.0	81.0	85.1
45 and above	18	14.9	14.9	100.0
Employment status				
Employed	21	17.4	17.4	17.4
Self-employed	100	82.6	82.6	100.0
Education				
Bachelor's degree	23	19.0	19.0	19.0
Post-graduate Degree	13	10.7	10.7	29.8
Secondary School	85	70.2	70.2	100.0
Income (in Naira)				
101,000 - 200,000	9	7.4	7.4	7.4
201,000 - 300,000	22	18.2	18.2	25.6
301,000 and above	90	74.4	74.4	100.0
Bank Account Ownership				
Yes	121	100.0	100.0	100.0

Source: Author

The participants were categorized into different age groups. Among the respondents, 4.1% fell within the age range of 26 to 35 years. Most of the participants, 81%, were aged between 36 and 45 years. Those aged 45 and above accounted for 14.9% of the respondents. Regarding employment status, 17.4% of the respondents indicated that they were employed, while a substantial 82.6% stated that they were self-employed. This distribution suggests a higher proportion of self-employed individuals within the surveyed group. Concerning education, the participants were divided into three categories. Of the respondents, 19.0% held a bachelor's degree, while 10.7% possessed a post-graduate degree. The majority, comprising 70.2%, had completed their education up to the secondary school level. The cumulative percentage of 100% underscores the educational diversity within the sample. The participants' income distribution revealed that 7.4% of respondents earned between 101,000 and 200,000 Naira. A larger group, constituting 18.2%, fell within the income range of 201,000 to 300,000 Naira. Many of the participants, accounting for 74.4%, reported an income of 301,000 Naira and above. The cumulative data illustrates the varying income levels among the participants. All 121 respondents confirmed owning a bank account, representing 100% of the surveyed group.

This data offers insights into the demographic and financial attributes of the surveyed group. Most of the respondents belonged in the 36 to 45 age range, with a significant portion being self-employed. Educational backgrounds were diverse, ranging from Secondary School education to advanced degrees. The income distribution was skewed toward higher income brackets, and all participants possessed a bank account, indicating a high level of financial integration.

The inferential results proved indispensable in assessing the research hypotheses central to this study. These findings revealed the relationships among the key research variables through rigorous statistical analysis. This proved significant in validating the proposed hypotheses.

Table 3 (in the Appendix) refers to the determination of the relationship between access to financial systems and its influence on women's economic empowerment. The regression analysis was conducted at a 95% confidence interval (a significant value of 0.05). The P-value of the regression analysis as established from the regression analysis is 0.011, which is less than the significant value of 0.05 (P-value<0.05). This means that the null hypothesis is rejected.

Hence, the hypothesis that improved access to financial systems through bank accounts positively influences women's economic empowerment is supported.

Table 4 (in the Appendix) illustrates the determination of the relationship between the availability of affordable and reliable financial products such as loans to enable women's economic empowerment. The regression analysis was conducted at a 95% confidence interval (a significant value of 0.05). The P-value of the regression analysis as established from the regression analysis is 0.004, which is less than the significant value of 0.05 (P-value<0.05). This means that the null hypothesis is rejected. Hence, the hypothesis that the availability of affordable and reliable financial products such as loans positively influences women's economic empowerment is supported.

Table 5 (in the Appendix) demonstrates the determination of the relationship between savings and investment opportunities and women's economic empowerment. The regression analysis was conducted at a 95% confidence interval (a significant value of 0.05). The P-value of the regression analysis as established from the regression analysis is 0.027, which is less than the significant value of 0.05 (P-value<0.05). This means that the null hypothesis is rejected. Hence, the hypothesis that savings and investment opportunities positively influence women's economic empowerment is supported.

4.2 Discussion

The first result indicates that improved access to financial systems using bank accounts has a statistically significant positive influence on women's economic empowerment. The obtained P-value of 0.011, which is below the set significance level of 0.05, indicates that the observed relationship is unlikely to have occurred by chance. In other words, the evidence suggests that women who have access to bank accounts are more likely to experience economic empowerment. This finding aligns with the notion in existing literature that financial inclusion can catalyse women's economic advancement (Bhatia & Singh, 2019). When women access bank accounts, they gain a platform to manage their finances, save, and transact securely (Jedi, 2022). This access can lead to increased control over their economic resources, greater financial decision-making power within their households, and enhanced opportunities for entrepreneurship and investment (Badullahewage, 2019; Govindapuram et al., 2023; Hendriks, 2019). Overall, this result supports the hypothesis that

improved access to financial systems positively influences women's economic empowerment.

The second result indicates that the availability of affordable and reliable financial products, specifically loans, contributes positively to women's economic empowerment. With a calculated P-value of 0.004, which is below the significance level of 0.05, there is strong statistical evidence supporting this relationship. This implies that women who have access to such financial products are more likely to experience economic empowerment. These results indicate that access to loans can provide women with the necessary capital to undergo economic growth. These results show similarity with those in the literature indicating that financial access such as loans helps women to begin or expand businesses, invest in education or skills development, and seize economic opportunities that may have been otherwise unattainable (Bhatia & Singh, 2019; Eton, et al., 2018). Further, loans can mitigate financial barriers and empower women to take charge of their economic destinies (George & Thomachan, 2018; Hendriks, 2019). This result reinforces the hypothesis that the availability of affordable and reliable financial products, including loans, positively influences women's economic empowerment.

The third result highlights that savings and investment opportunities also have a statistically significant positive impact on women's economic empowerment. The calculated P-value of 0.027, below the set significance level, suggests that the relationship between savings, investment opportunities, and women's economic empowerment is not a random chance. This result underscores the significance of financial resilience and long-term planning for women's economic advancement as illustrated in the literature (Kumari, 2022). By saving and making investments, women can build assets, prepare for emergencies, and secure their financial futures (Onukogu, 2021). Additionally, access to investment opportunities opens avenues for wealth accumulation, asset diversification, and participation in economic growth (Bhatia & Singh, 2019). Ultimately, this result reinforces the hypothesis that savings and investment opportunities positively influence women's economic empowerment.

Based on the research results and the discussion, the researchers were eager to underscore the distinct scientific contributions of this study to the existing specialized literature. Foremost, our research delves into the intricate interplay between financial inclusion and women's economic empowerment, specifically

within the unique socio-economic context of Nigeria. This focused examination fills a critical void in current scholarship, offering nuanced insights into the challenges and opportunities faced by Nigerian women in accessing and benefiting from financial systems. Furthermore, through the meticulous application of quantitative methodologies, our study not only confirms but also quantifies the significant positive influence of financial inclusion on women's economic empowerment, adding empirical weight to existing theoretical frameworks. Additionally, our synthesis of findings from diverse scholarly sources enriches the discourse surrounding women's economic empowerment, providing a comprehensive understanding of the multifaceted factors at play. Importantly, by elucidating the practical implications of our research for policymakers, practitioners, and fellow scholars, we aim to catalyse meaningful action towards gender-inclusive economic development strategies. Ultimately, our contributions not only expand the boundaries of academic knowledge but also offer actionable pathways towards fostering gender equality and inclusive prosperity in Nigeria and beyond.

5. Conclusion

This study's insightful findings indicate that there is a significant connection between women's economic empowerment and financial inclusion. The results demonstrate that improved access to financial systems, the availability of affordable and reliable financial products such as loans, and opportunities for savings and investment all play pivotal roles in facilitating women's economic empowerment in Nigeria. The strong statistical evidence obtained by testing the research hypotheses of this study underscores the significance of these factors in fostering women's economic empowerment.

The implications of this study extend both theoretically and practically. The theoretical implications include the importance of considering financial inclusion as a multifaceted concept that goes beyond mere access to financial services. This study adds to the growing body of knowledge emphasizing the intersection of financial inclusion and women's empowerment. The empirical evidence has practical implications, providing valuable insights for policymakers, researchers, and practitioners operating in the fields of gender equality and economic development.

Based on the findings of this study, several recommendations are given. For instance, policymakers should prioritize initiatives aimed at expanding women's access to financial systems, promoting the availability of affordable and reliable financial products, and creating platforms for savings and investment. Additionally, financial institutions need to develop tailored products and services to address the unique needs of women, given their disproportionate final exclusion. Furthermore, educational programs can be developed to enhance financial literacy among women, equipping them with the needed skills to navigate and leverage financial systems effectively for growth.

While this study provides valuable insights regarding the role of financial inclusion towards the economic empowerment of women in Nigeria, there were several limitations which emerge as significant areas for future research. First, this study failed to investigate the relationship between financial inclusion and women's economic empowerment across diverse cultural and socioeconomic contexts. This can be explored in future research as it will be integral to validating the generalization of the impact of financial inclusion on the economic empowerment of women. Another limitation was the inability of this study to investigate the long-term impact of financial inclusion towards the economic empowerment of women. Consequently, future research can involve conducting longitudinal studies because they can provide additional insights regarding the long-term impact of financial inclusion initiatives on women's empowerment. This includes enabling the exploration of the mechanisms through which financial inclusion results in empowerment using individual experiences and stories.

References

1. Adera, A., Abdisa, L.T.(2023). Financial inclusion and women’s economic empowerment: Evidence from Ethiopia. Cogent Economics and Finance, 11(2), pp. 1-21.
2. Agarwal, B., Jack, B. (2011). The Economic Lives of the Poor. Journal of Economic Perspectives, 25(4), pp. 47-68. https://doi.org/10.1257/jep.21.1.141
3. Alliance for Financial Inclusion (2016). Nigeria confronts a challenging financial inclusion gender gap: A case study in policy change in favour of women's financial inclusion, Women's World Banking.
4. Anyanwu, F.A., Ananwude, A.C., Nnoje, A.I. (2018). Financial inclusion: Nigeria's microfinance model effect assessment on women

empowerment. European Journal of Human Resource Management Studies, 1(2), pp. 55-77. https://doi.org/10.46827/EJHRMS.V0I0.329
5. Badullahewage, S.U. (2019). Financial inclusion and women's economic empowerment in Northern Sri Lanka. International Journal of Business and Social Science, 10(8), pp. 128-134. https://doi.org/10.30845/ijbss.v10n8p16
6. Barroga, E., Matanguihan, G.J. (2022). A practical guide to writing quantitative and qualitative research questions and hypotheses in scholarly articles. Journal of Korean Medical Science, 37(16), p. e121. https://doi.org/10.3346/jkms.2022.37.e121
7. Bhatia, S., Singh, S. (2019). Empowering women through financial inclusion: A study of urban slum. The Journal for Decision Makers, 44(4), p. 182–197. https://doi.org/10.1177/0256090919897809
8. Central Bank of Nigeria (2019). Assessment of women's financial inclusion in Nigeria, s.l.: Enhancing Financial Innovation & Access (EFInA).
9. Chaudhary, A.K., Kumari, R. (2022). Impact of financial inclusion on women empowerment: A case study of Ranchi District. International Journal for Research in Applied Science and Engineering Technology (IJRASET), 10(VIII), pp. 1388-1398. https://doi.org/10.22214/ijraset.2022.46423
10. Demirgüç-Kunt, A., Klapper, L., Singer, D., Ansar, S. (2021). The global findex database: Financial inclusion, digital payments, and resilience in the age of COVID-19, World Bank Group.
11. Dupas, P., Robinson, J. (2013). Savings constraints and microenterprise development: Evidence from a field experiment in Kenya. American Economic Journal: Applied Economics 5(1), pp. 163–192. https://doi.org/10.1257/app.5.1.163
12. Eton, M., Mwosi, F., Ogwel, B.P., Edaku, C., Obote, D. (2018). Financial inclusion and women empowerment in Uganda a case of Lango Sub Region, Northern Uganda. Economics, Commerce and Trade Management: An International Journal (ECTIJ, 2(1), pp. 1-11.
13. Financial Alliance for Women (FAW) (2022). Towards women's financial inclusion: A gender data diagnostic of Nigeria, Financial Alliance for Women (FAW).
14. George, B., Thomachan, K.T. (2018). Financial inclusion and women empowerment: A gender perspective. International Journal of Research-Granthaalayah, 6(5), pp. 229-237. https://doi.org/10.29121/granthaalayah.v6.i5.2018.1443
15. Golla, A.M., Malhotra, A., Nanda, P., Mehra, R. (2011). Understanding and measuring women's economic empowerment: Definition, framework, and indicators, s.l.: International Center for Research on Women (ICRW).

16. Govindapuram, S., Bhupatiraju, S., Sirohi, R.A. (2023). Determinants of women's financial inclusion: Evidence from India. Annals of Public and Cooperative Economics, 94(1), pp. 131-158.
17. Hendriks, S. (2019). The role of financial inclusion in driving women's economic empowerment. Development in Practice, 29(8), p. 1029–1038. https://doi.org/10.1080/09614524.2019.1660308
18. Holloway, K., Niazi, Z., Rouse, R. (2017). Women's economic empowerment through financial inclusion: A review of existing evidence and remaining knowledge gaps, Innovation for Poverty Action.
19. Hunt, A., Samman, E. (2016). Women's economic empowerment: Navigating enablers and constraints, London: Development Progress.
20. International Monetary Fund (2018). Pursuing women's economic empowerment, Washington, D.C: International Monetary Fund.
21. Jedi, F.F. (2022). The relationship between financial inclusion and women's empowerment: Evidence from Iraq. Journal of Business and Management Studies, 4(3), pp. 104-120. https://doi.org/10.32996/jbms
22. Kabeer, N. (2015). Gender Equality, Economic Growth, and Women's Agency: the `Endless Variety' and `Monotonous Similarity' of Patriarchal Constraints. Feminist Economics 22 (1), pp. 295–321.
23. Kumari, S. (2022). Financial inclusion and women empowerment: A case study in India. Economics, Business, Accounting and Society Review, 1(2), pp. 88-95. https://doi.org/10.55980/ebasr.v1i2.19
24. Manoj, P.K., Lakshmi, K.S., Sebastian, R. (2023). Women empowerment in digital India and the Kerala knowledge economy. Academy of Marketing Studies Journal, 27(1), pp. 1-11.
25. Martínez-Mesa, J., González-Chica, D.A., Duquia, R.P., Bonamigo, R.R., Bastos, J.L. (2016). Sampling: How to select participants in my research study? Anais Brasileiros de Dermatologia, 91(3), pp. 326-330. https://doi.org/10.1590/abd1806-4841.20165254
26. Mohajan, H.K. (2020). Quantitative research: A successful investigation in natural and social sciences. Journal of Economic Development, Environment, and People, 9(4), pp. 52-79. https://doi.org/10.26458/jedep.v9i4.679
27. Musa, A., Abdullahi, B., Idi, A., Tasiu, M. (2015). Drivers of financial inclusion and gender gap in Nigeria. The Empirical Econometrics and Quantitative Economics Letters, 4(4), pp. 186 - 199.
28. Nguse, T., Desalegn, G., Oshora, B., Tangl, A., Nathan, R.J., Fekete-Farkasne, M. (2022). Enhancing women economic empowerment through financial inclusion: Evidence from SMEs in Ethiopia. Polish Journal of Management Studies, 25(1), pp. 270-291. https://doi.org/10.17512/pjms.2022.25.1.17

29. Onukogu, C. (2021). The impact of financial inclusion on the economic empowerment of Nigerian women. SSRN. http://dx.doi.org/ 10.2139/ssrn.3933830
30. Postmus, J.L., Plummer, S.B., McMahon, S., Zurlo, K.A. (2013). Financial literacy: Building economic empowerment with survivors of violence. Journal of Family and Economic Issue, 34(3), p. 275–284. https://doi.org/10.1007/s10834-012-9330-3
31. Rahman, A. (2013). Women's empowerment: Concept and Beyond. Global Journal of Human Social Science Sociology and Culture, 13(6), pp. 8-13.
32. Rahman, A., Muktadi, G. (2021). SPSS: An imperative quantitative data analysis tool for social science research. International Journal of Research and Innovation in Social Science, V(X), pp. 300-302. http://dx.doi.org/ 10.47772/IJRISS.2021.51012
33. Raj, A., Silverman, J.G., Klugman, J., Saggurti, N., Donta, B., Shakya, H.B. (2018). Longitudinal analysis of the impact of economic empowerment on risk for intimate partner violence among married women in Rural Maharashtra, India. Social Science and Medicine, Volume 196, p. 197–203. https://doi.org/10.1016/j.socscimed.2017.11.042
34. Rojas-Suarez, L. (2016). Financial Inclusion in Latin America: Facts and Obstacles, Washington, DC: Center for Global Development.
35. Roy, P., Patro, B. (2022). Financial Inclusion of Women and Gender Gap in Access to Finance: A Systematic Literature Review. Vision, 26(3), pp. 282-299.
36. Sadiq, M., Ihsan, A., Khattak, A.H. (2023). Women Economic Empowerment through the Lens of Financial Inclusion in Pakistan: Analysis of the Moderation Effect of Financial Literacy. Journal of Business and Tourism, 9(1), pp. 21-36.
37. Saluja, O. B., Singh, P., Kumar, H. (2023). Barriers and interventions on the way to empower women through financial inclusion: A 2 decades systematic review (2000–2020). Humanities and Social Sciences Communications, 10(148), pp. 1-14. https://doi.org/10.1057/s41599-023-01640-y
38. Siddik, N.A. (2017). Does financial inclusion promote women empowerment? Evidence from Bangladesh. Applied Economics and Finance, 4(4), pp. 169-177.
39. Singh, A.S., Masuku, M.B. (2014). Sampling techniques and determination of sample size in applied statistics research: An overview. International Journal of Economics, Commerce and Management, 2(11), pp. 1-22.
40. Stockemer, D. (2019). Quantitative methods for the social sciences: A practical introduction with examples in SPSS and Stata. Cham, Switzerland: Springer International Publishing AG.

41. United Nations Development Programme (2020). 2019 Annual Report: Gender Equality Strategy 2018-2021, New York, United States: United Nations Development Programme.
42. United Nations (2020). United Nations Capital Development Fund (UNCDF), s.l.: United Nations.
43. World Bank (2017). Financial inclusion and women's entrepreneurship in Nigeria. [Online]. Available at: https://www.worldbank.org/en/topic/financialinclusion/brief/financial-inclusion-and-womens-entrepreneurship-in-nigeria [Accessed 8 June 2023].
44. World Bank (2018). Financial inclusion and gender equality. [Online] Available at: https://www.worldbank.org/en/topic/financialinclusion/brief/financial-inclusion-and-gender-equality. [Accessed 8 June 2023].

Appendix

Table 3

Access to Financial Systems and Economic Empowerment

Model	R	R Square	Adjusted R Square	Std. Error of the estimate	Sum of Squares	df	Mean Square	F	Sig.
1	.230a	.053	.045	.663	2.920	1	2.920	6.652	.011

Model	Unstandardised coefficients (B)	Std. Error	Standardised Coefficients (Beta)	t	Sig.
1	(Constant)	3.127	.499	6.264	.000
	How often do you use your bank account for financial transactions?	.341	.132	.230	2.579

Source: Author

Table 4

Affordable and Reliable Financial Products and Economic Empowerment

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sum of Squares	df	Mean Square	F	Sig.
1	.263a	.069	.061	.424	1.585	1	1.585	8.811	.004

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
1	(Constant)	3.254		12.669	.000
	If 1, how would you rate the affordability and reliability of the loan product you used?	.234	.079	.263	2.968

Source: Author

Table 5

Savings and Investment and Economic Empowerment

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Sum of Squares	df	Mean Square	F	Sig.
1	.202a	.041	.033	.462	1.074	1	1.074	5.040	.027

Model	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	t	Sig.
1	(Constant)	4.850		20.325	.000
	Do you actively save money?	-0.167	-0.202	-2.245	.027

Source: Author

THE IMPACT OF ISLAMIC BANKS' PROFITABILITY INDEX ON THE PERFORMANCE OF THE AMMAN STOCK EXCHANGE DURING 2011-2021

Maher Mohammad Saleh SHARRAB*

Zaid Othman Mohammed DANNOUN, PhD**

Abstract

In the evolving global economic landscape marked by technological advancements, liberalized markets, and the ascent of multinational corporations, Islamic banks have emerged as pivotal entities within the new economic paradigm, addressing the financial needs of societies eschewing Riba (interest) transactions. This study investigates the impact of Islamic banks' profitability indices on the performance of the Amman Stock Exchange (ASE) through the lens of the Stock Price Index (PIX) over the period 2011-2021, with Jordan serving as the focal point due to its significant financial sector development, particularly in Islamic banking. Employing a quantitative analysis approach, the study leverages financial data from three major Jordanian Islamic banks and the ASE, applying statistical tools within the EViews software for analysis. The findings indicate a positive and significant relationship between the profitability indices of Islamic banks and the PIX, affirming the hypothesis that Islamic banks' profitability indices significantly influence the ASE's performance. This relationship underscores the integral role of Islamic banking in enhancing financial market performance, particularly in economies with a substantial Islamic banking sector. The study highlights the resilience and success of Islamic banks amidst global economic challenges and their ability to positively impact the financial market's performance, recommending further research on the multifaceted effects of Islamic banking on market dynamics and advocating for liquidity management to bolster economic activity and market performance.

---

* *Assistant Teacher, Business College, Hashemite University, Zarqa, Jordan.*

** *Assistant Professor, Faculty of Finance and Administrative Sciences, Al-Madinah International University, Kuala Lumpur, Malaysia.*

Keywords: Jordan economy, financial institutions, financial market, COVID-19

JEL Classification: G21; O16

1. Introduction

In the twenty-first century, the global economic fabric has undergone transformative changes, spurred by the technological revolution, the liberalization of markets, and the dismantling of trade barriers, fostering a climate of increased competitiveness and economic integration. This era has heralded the ascendancy of Islamic banks as crucial players within the financial domain, adapting to cater to societies that eschew interest-based transactions. Despite the formidable challenges wrought by these global shifts, Islamic banks have not only thrived but also secured a robust foothold in both local and international banking arenas. They have adeptly navigated the capitalist milieu, which prioritizes interest rates as a central banking tool, by offering an array of Sharia-compliant financial products, services, and investment avenues (Hussien et. al., 2019). This investigation seeks to delineate the influence of Islamic banks' profitability ratios—specifically, the Return on equity (ROE)—on the performance of the Amman Stock Exchange (ASE), as measured by the Stock price index (PIX) over the period 2011 to 2021. Jordan serves as an exemplary context for this study due to its significant strides in financial sector development, particularly within Islamic banking, hosting four operational Islamic banks (Kieso et al., 2011; Malkiel, 2015).

The paper is structured as follows: Section 1 defines the problem statement, shedding light on the challenges and opportunities presented by global economic openness for Islamic banks and their consequential impact on the performance of economic sectors, notably the ASE. Section 2 establishes the theoretical foundation, elucidating the economic significance of Islamic banking and the financial performance indicators critical for this study. Section 3 describes the methodology employed, a quantitative analysis leveraging statistical tools to examine the relationship between the profitability of Islamic banks and the performance of the ASE. Section 4 analyses and tests the hypothesis, applying statistical methodologies to assess the data collected. The conclusion in Section 5 encapsulates the study's findings, affirming the pronounced impact of Islamic banks' profitability

on the ASE's performance, and underscores the need for further exploration into this dynamic interplay, with a particular emphasis on non-financial determinants such as regulatory changes and economic policies.

Hence the idea of this study was chosen as a model for the study because of the great development witnessed by its economy, especially in the financial sector in general and the Islamic banking sector in particular, as there are currently four operating Islamic banks in Jordan, namely: Jordan Islamic Bank, Islamic International Arab Bank, Safwa Islamic Bank, and Al Rajhi Bank. Al Rajhi Bank was excluded as it is a bank of Saudi origin, while the period from 2011 to 2021 was chosen because this period witnessed the presence of the three main Islamic banks, as before this date the Jordan Islamic Bank and the Arab Islamic Bank were operating in the Jordanian banking market, while the Safwa Islamic Bank was launched in 2011 under its old name, Jordan Dubai Islamic Bank, and later in 2018 it became Safwa Islamic Bank.

Through this meticulous examination, the study not only contributes to the existing body of knowledge on Islamic banking and financial markets but also offers insights for policymakers and financial strategists aiming to enhance the synergy between Islamic banking operations and market performance, thereby fostering a more resilient and inclusive economic environment.

The problem of the study is represented in those global economic challenges based on economic openness, market liberalization and removal of obstacles to the flow of goods, services and elements of production across borders, which created a wide level of competitiveness, and posed a challenge to achieving the desired levels of performance by banks in general and Islamic banks in particular, and this constituted a clear impact on the performance of all economic sectors and their institutions, due to the nature of the complementary relationship between the different sectors and the close relationship between the banking sector and the financial markets, including the Amman Stock Exchange, which It is expected that the improvement in the level of performance of banks will have a positive impact on the performance of the ASE in it, therefore, the main question that follows from the problem of the study and revolves in the mind of the researcher is: What is the impact of the profitability index of Islamic banks on the performance of the Amman Stock Exchange for the period 2011-2021?

This study aims to measure the impact of the profitability index of Islamic banks on the performance of the Amman Stock Exchange for the period 2011-2021, and accordingly, the hypothesis of the study can be formulated as follows:

H0: *There is no statistically significant impact of the profitability index of Islamic banks on the performance of the Amman Stock Exchange for 2011-2021.*

The importance of this study stems from the reality of the complementary relationship, which links the economic sectors to each other, and imposes a mutual impact on their overall performance, in addition to that the methodology used in this study contributes to the formation of a set of research knowledge, and the results of this study will also contribute to providing recommendations on how to address the challenges facing Islamic banks, and reduce their negative impact on the economic aspect in the region, and this study will provide some factors to improve the strategy of Islamic banks to attract and encourage more investors.

2. Theoretical Framework

Islamic banks are one of the important economic financial institutions, especially their role in financing commercial and investment activities and providing financial services to individuals and companies, which contributes to achieving economic and social growth, on the other hand, evaluating the performance of Islamic banks is important for investment decision-making by current and future dealers and investors (Kotz, 2017), and accordingly, the financial performance indicators associated with this study will be presented in this part.

Financial performance can be defined as maximizing the return per share, and its profitability in terms of financial data and indicators for analysis, and making various comparisons (Sahara et. al., 2018), or it is a measure to determine the luxury of companies' efficiency and effectiveness in employing their available resources, and the extent to which profits are achieved for them, and their reflection on the market prices of the share, and accordingly; There are many financial indicators that can be used to analyze the financial performance of companies, and one of the main indicators that will be used in this study is the profitability index, as this indicator reflects the basic ability The company is committed to achieving profits, followed by several sub-indicators through which the financial performance of the profitability

index is measured, including (net profit ratio, gross profit ratio, return on assets ratio, return on investment ratio, and return on equity ratio).

There are many financial indicators that can be used to measure the performance of the financial market, and each indicator differs from the other based on the factors on which it is based, in light of the above, the Amman Stock Exchange has provided many performance indicators that help investors and researchers to evaluate performance and establish confidence in the mechanisms of evaluating and trading securities, and these indicators include (Main Market Index, Liquidity Index, Return Index, Asset Debt Index, General Market Index, Capital Return Index, Volume Index, Stock Price Index).

Many studies, including Alaagam (2019), Bayrakdaroglu et al. (2017), Hutasoit et al. (2022), and Al Maani et al. (2021) have confirmed the existence of a positive relationship between the profitability index and the stock price index by market value.

The development of Jordanian Islamic banks

Jordan Islamic Bank is the oldest Islamic bank in Jordan, as it was established in 1978 and began operating in 1979 its capital reached (200) million Jordanian dinars, and its geographical spread increased through the establishment of branches in all governorates of the Kingdom, reaching (105), and the number of ATMs through which the bank provides its various services (withdrawal, deposit, account statement, transfers, and other services) to citizens to reach (78) ATMs (Jordan Islamic Bank Annual Report, 2022). While the Islamic International Arab Bank was established as a public shareholding company under the Companies Law in 1989 and began its work in 1997 its capital reached (100) million Jordanian dinars. Its geographical spread increased through the establishment of branches in all governorates of the Kingdom, where its number reached (46), as well as the number of ATMs through which the bank provides its various services it (withdrawal, deposit, account statement, transfers, and other services) to citizens to reach (168) ATMs (Islamic International Arab Bank Annual Report, 2022). Safwa Islamic Bank was established in 2010 under the name of Jordan Dubai Islamic Bank, and in 2017, Union Investments Company acquired 51% of the bank's shares and took a decision to change its name to become Safwa Islamic Bank, and its capital reached (100) million Jordanian dinars, and its geographical spread increased. The bank's branches expanded to become (42) branches spread in all governorates of the Kingdom,

as well as the number of ATMs through which the bank provides its various services (withdrawal, deposit, account statement, transfers). And other services) for citizens to reach (233) ATMs (Safwa Islamic Bank Annual Report, 2022).

The following is an explanation of the reality of the development of the profitability index for Jordanian Islamic banks. The profitability index is one of the important and necessary indicators that give a strong impression of the financial position of Islamic banks and their performance, so the researcher adopted this indicator in this study and collected data from the audited and approved annual reports of Islamic banks for the period 2011-2021 (Table 1).

Table 1

Profitability Index for Islamic Banks (2011-2021)

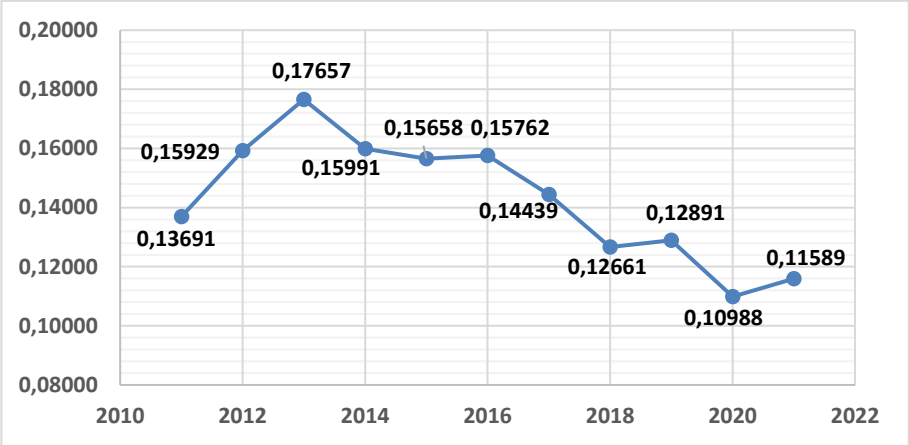
Year	Profitability Index based on (Return on Equity Ratio)		
	Jordan Islamic Bank	Islamic International Arab Bank	Safwa Islamic Bank
2011	0.137	0.118	0.047
2012	0.159	0.114	0.017
2013	0.177	0.135	0.011
2014	0.160	0.102	0.015
2015	0.157	0.119	0.025
2016	0.158	0.148	0.043
2017	0.144	0.165	0.041
2018	0.127	0.164	0.038
2019	0.129	0.160	0.070
2020	0.110	0.124	0.066
2021	0.116	0.127	0.086

Source: prepared by authors, based on the annual reports of Islamic banks, 2011-2022

According to Table 1, the profitability of Islamic banks was upward from 2011 to 2013 and then began to decline, with a downward trend from 2017 to 2020, following a slight improvement in 2021. This indicates that the company is facing challenges, which are mostly due to the conditions of the COVID-19 pandemic and the deepening of the economic recession. The following figure shows the profitability of the Jordan Islamic Bank for 2011-2021 (Figure 1).

Figure 1

Jordan Islamic Bank Profitability Index 2011-2021

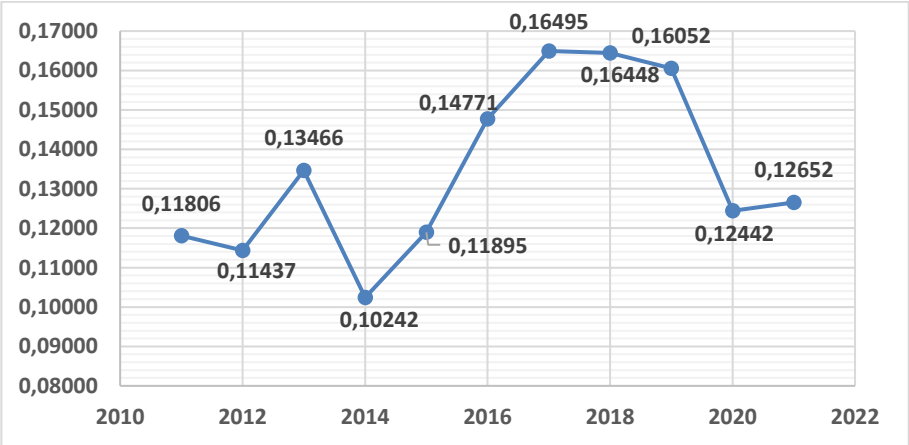


Source: Prepared by authors, based on the data extracted from annual reports of Jordan Islamic Bank

Regarding the Islamic International Arab Bank (see Figure 2), the profitability index appears to have had an upward trend from 2011 to 2017, followed by a period of almost constant fluctuation, which indicates a strong and stable performance.

Figure 2

Islamic International Arab Bank Profitability Index 2011-2021

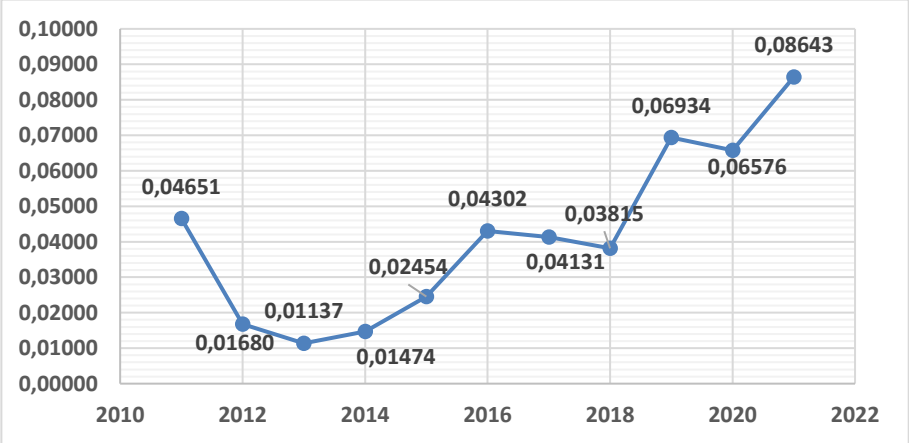


Source: Prepared by authors, based on the data extracted from annual reports of the Islamic International Arab Bank

Table 1 shows that the profitability index for Safwa Islamic Bank showed clear fluctuations from 2011 to 2018. However, it began to stabilize and grow from 2019 to 2021, with an upward trend from 2017 to 2021. The following figure illustrates the development of profitability for Safwa Islamic Bank from 2011 to 2021 (see Figure 3).

Figure 3

Safwa Islamic Bank Profitability Index 2011-2021



Source: Prepared by authors, based on the data extracted from annual reports of the Safwa Islamic Bank

The development of the Amman Stock Exchange (ASE)

Amman Stock Exchange was established on March 11, 1999, as an independent non-profit institution, and obtained the necessary licenses to operate as a regulated market for securities trading within the Kingdom on February 20, 2017, the Amman Stock Exchange was transformed into a public shareholding company with full government ownership, and it became considered the legal and actual form followed by the ASE, and the management of the Amman Stock Exchange Company is carried out through a board of directors consisting of seven members appointed by the General Assembly, in addition to a full-time executive director concerned with Managing the day-to-day business of the ASE. The Articles of Association of the Amman Stock Exchange Company stipulate the main tasks, and these tasks include the practice, operation, management and development of all the work of the securities and derivatives markets, whether inside or outside the Kingdom, and the ASE also aims to provide an

appropriate environment for interaction between the forces of supply and demand, in accordance with sound, clear and fair trading standards, and to spread the culture of investment and increase knowledge related to financial markets, and the Amman Stock Exchange seeks to enhance the transparency of financial markets and enhance confidence among investors, through the development of legislation to protect the rights of Investors and ensuring that there are no illegal or unethical practices in the financial market, the Amman Stock Exchange works to provide the necessary information for investors to make appropriate decisions regarding financial investments, by publishing periodic financial reports and providing important economic and financial data for companies listed on the market. The Jordan Securities Commission monitors and regulates trading operations in the Amman Stock Exchange and ensures the application of specific regulations and rules of the market, with the aim of providing a sound and favourable trading environment for investment. The Amman Stock Exchange (ASE) is one of the active financial markets in the region, enjoying a high level of stability, transparency, and trust among investors. The Jordanian government is working in cooperation with the Jordan Securities Commission to develop the market and improve the investment environment in the country, by improving legislation and regulations and enhancing the transparency of financial markets (Amman Stock Exchange, 2022).

The index of Stock Price Index by market value is one of the important and necessary indicators that give a strong impression of the financial performance of the Amman Stock Exchange, so the researcher adopted this indicator in this study as a dependent variable, and collected data through the statistical reports of the Amman Stock Exchange for the period (2011-2021), and the data collected were as follows:

Table 2

The Stock Price Index of the Amman Stock Exchange (2011-2021)

Year	Stock Price Index
2011	4,65
2012	4,59
2013	4,34
2014	4,24
2015	4,23

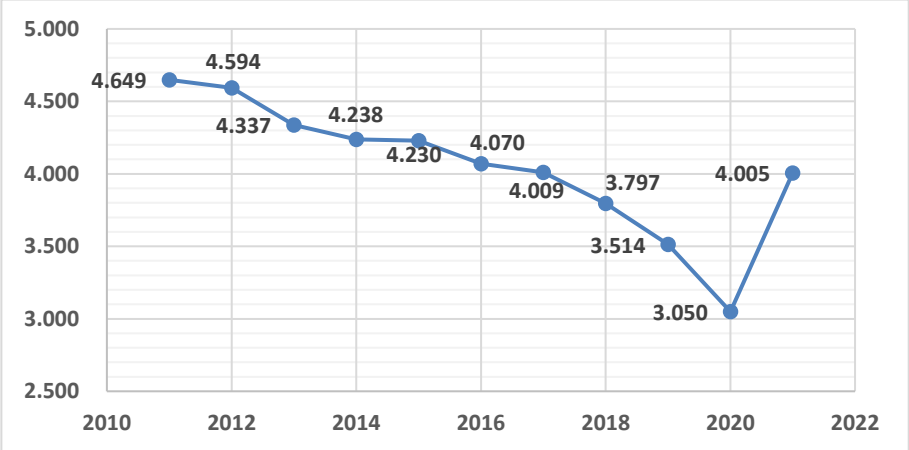
Year	Stock Price Index
2016	4,07
2017	4,01
2018	3,80
2019	3,51
2020	3,05
2021	4,01

Source: Prepared by authors, based on the Amman Stock Exchange (2022)

Table (2) displays the stock price index with the market value of the Amman Stock Exchange during the period from 2011 to 2021, this index provides a general understanding of the performance of the capital market Amman Stock Exchange and can be used for comparative analysis with the performance of banks that were previously analysed, during the period 2011-2015 relative stability can be observed in the index with slight fluctuations, then the period 2016-2020 witnessed a clear decline, which may be and to some extent due to the conditions of global economic crises, and the conditions of the pandemic Corona, but in the post-2020 period there is an increase in the index this year, indicating a market recovery or an improvement in economic conditions. The following figure shows the index of the stock price index of the Amman Stock Exchange for the period (2011-2021):

Figure 4

The Stock Price Index of the Amman Stock Exchange (2011-2021)



Source: Prepared by authors, based on the Amman Stock Exchange (2022)

3. Study Methodology

According to Galliers and Land (1987), the choice of methods and strategies to be adopted in the study is of great importance, and this study will adopt a quantitative analysis strategy, which works to review the natural sciences of a phenomenon and quantitative strategies include surveys, laboratory experiments, formal techniques and numerical strategies (for example, mathematical modelling), and in the field of financial and banking sciences, researchers noted that the quantitative approach is one of the most adopted methods in such studies.

3.1. Study Design

The quantitative approach has been widely used in the social sciences, this approach is considered appropriate for using financial data extracted from financial reports as a basic tool for data collection, and then the data is collected and analyzed using statistical tools, according to Lawrence (2006) the research methodology must be specific because it includes the methods by which the researcher determines the information, as the basic premise behind quantitative studies is the study of structures and relationships through formulated hypotheses, and therefore the current study relied on Specifically, the quantitative analysis approach, using the EViews program in the field of statistical science.

3.2. Study Population and Sample

The study population consisted of all Islamic banks working in the Hashemite Kingdom of Jordan until the end of 2022 and numbered (3), while the study sample consisted of all these banks (Jordan Islamic Bank, Islamic International Arab Bank, Safwa Islamic Bank), while Al-Rajhi Bank was excluded for being a foreign bank working in Jordan (Saudi dependency), and the following table shows the study sample:

Table 3

Study Sample

	Bank Name	Bank Code
1	Islamic International Arab Bank	IIAB
2	Jordan Islamic Bank	JIBA
3	Safwa Islamic Bank	SIB

Source: authors'

3.3. Data Collection

The researcher collected data through the financial statements of Islamic banks listed on the Amman Stock Exchange and through the financial statements of the Amman Stock Exchange for the period 2011-2021. In addition to other sources such as books specialized in the field of financial accounting and financial analysis, articles specialized in this field, refereed research in specialized courses, scientific journals, reports and publications of the Amman Stock Exchange, educational and professional sites specialized in the field of financial analysis, stocks, and related articles on the Internet.

3.4. Statistical Methods

The hypotheses were tested using the following statistical procedures: descriptive statistics analysis, Pearson correlation analysis, Panel Unit Root tests, Panel Co-integration tests, Breusch and Pagan Lagrange Multiplier tests, Hausman tests, and Fixed Effect Model test.

In order to study the impact of the financial performance of Jordanian Islamic banks (Profitability Index), and on the Stock Price index (PIX) for the period 2011-2021, the following standard model (1) was built:

$$PIX_{it} = \beta_0 + \beta_1 PR_{it} + \varepsilon_{it} \quad (1)$$

Where: i - Islamic bank; t -year; β_0 - constant term; β_1 – coefficient of the independent variables; ε_{it} = random errors; PIX = stock price index; PR = profitability index.

4. Analysis and Testing of Hypotheses

4.1. Descriptive Statistics Analysis

In this section, the descriptive statistical analysis of the data was carried out by calculating the arithmetic mean, standard deviation, and normal distribution of variables as shown in Table 4.

Table 4

Descriptive Statistical Analysis Results

Variable	PIX	PR
Mean	4.045	10.629
Median	4.070	11.895
Maximum	4.649	17.657
Minimum	3.050	1.137

Variable	PIX	PR
Std. Dev.	0.450	5.140
Skewness	-0.758	-0.556
Kurtosis	3.059	1.968
Jarque-Bera	3.167	3.165
Probability	0.205	0.205
Sum	133.475	350.762
Sum Sq. Dev.	6.481	845.384

Source: Prepared by authors, based on EViews

Table 4 shows that the value of the arithmetic means of the dependent variable The return on the stock price index (PIX) is 4.045, the standard deviation is 0.450, the lowest value is 3.050 and the highest value is 4.649, while the arithmetic mean value of the independent variable Profitability Index (PR) is 10.629, the standard deviation is 5.140, the lowest value is 1.137 and the highest value was 17.657. As shown by the results of Jarque-Bera, all variables are distributed normally which means that there is no dispersion in the data that later reduces Significant results.

4.2. Pearson Correlation Analysis

The results in Table 5 show that all variables are within the acceptable range of the correlation coefficient, which means that multiple linear correlation is not a problem.

Table 5

Pearson Correlation Analysis Results

Variable	PIX	PR
PIX	1	
PR	-0.357	1

Source: Prepared by authors, based on EViews

Table 5 shows Pearson's correlation coefficients between different variables, as Pearson's correlation coefficient ranges from -1 to +1. The coefficient of +1 means a strong direct correlation, -1 means a strong inverse correlation, and a value of 0 means no correlation. The relationship between the profitability index (PR) and the market capitalization-weighted stock price index (PIX) shows that the correlation coefficient is -0.357, which indicates a negative average correlation between the two variables.

4.3. Panel Unit Root Tests

The stability of the data in time series in general and for financial and economic data in particular is one of the important topics in the analysis because unstable data gives incorrect results or misleading results, and this is called Spurious Regression (Gujarati and Porter, 2008) and there are statistical methods through which stability is tested, the most important and most accurate is the Unit Roots test, which aims to examine the properties of the time series for each variable.

Table 6

Results of Unit Root Tests

Variables	I (0)	I (1)
PIX	-1.945	-2.843**
PR	1.496	-5.217*

Source: Prepared by authors, based on EViews

Table 6 in which the unit root was tested for variables, where the results show that all variables for this study are stable at the level of 1% and 5%, which indicates that the data used in the study are stable and therefore correct and non-misleading results were obtained.

4.4. Panel Co-integration Test

In this study, the Kao Residual Co-integration Test was used to examine the joint integration of the variables. This ensured that the statistical relationship between all the variables of the study was constant and that there was joint integration in the long term and short term.

Table 7

Panel Co-integration Test Results

	T-Statistics	Probability
ADF	6.346	0.001*
Series: PIX, PR		
Sample: 2011 – 2021		

Source: Prepared by authors, based on EViews

As it is shown in Table 7, the cointegration between the study variables was tested using the Kao test, where the symbol * indicates significance at the significance level of 1%. The results of the Kao Residual Co-integration Test show that the value of t-statistics = 6.346 is significant at the significance level of 1%, which indicates that the

statistical relationship between all study variables is constant and there is a common integration in the long-term and short-term.

4.5. Breusch and Pagan Lagrange Multiplier Test

The Breusch and Pagan Lagrange Multiplier Test was performed to compare the Panel Data models, including the Pooled Ordinary Least Square (OLS) Model and the Generalized Least Square Models.

Table 8

Lagrange Multiplier Test Results

Chi-Square Statistics	Probability
0.510**	0.043
Series: PIX, PR Sample: 2011 – 2021	

Source: Prepared by authors, based on EViews

In Table 8, the Lagrange multiplier was tested using the Breusch and Pagan test, where the symbol ** indicates significance at the significance level of 5%. The results of the Lagrange multiplier test show that the Chi-Square Statistics value = 0.510 is significant at the significance level of 5%, so the ideal is to use Generalized Least Square Models, including the Random Effect Model and the Fixed Effect Model.

4.6. Hausman Test

The Hausman Test was conducted to compare the Random Effect Model and the Fixed Effect Model.

Table 9

Hausman Model Test Results

	T-Statistics	Probability
ADF	5.526**	0.137
Series: PIX, PR Sample: 2011 – 2021		

Source: Prepared by authors, based on EViews

In Table 9, the cointegration between the study variables was tested using the Hausman Test. The results of the Hausman test show that the value of t-statistics = 5.526 is significant at the significance level of 5%, and therefore, the optimal approach is to use the Fixed Effect Model.

4.7. Hypothesis testing with the Fixed Effect Model

The results for the estimation of the parameters of the Fixed Effect Model for the PIX variable are shown in the table below (Table 10).

Table 10

Fixed Effect Model Test Results

Variable	Coefficient	t-Statistic	Prob.
PIX	4.976	2.668	0.015
PR	4.044	1.151	0.000

Source: Prepared by authors, based on EViews

It is noticed that there is a positive and significant relationship between the profitability index (PR) and the stock price index (PIX) at the level 1%, where the value of the coefficient was 4.976, while the value of t-statistic was 2.668, and this means that the higher the profitability index (PR), this will necessarily lead to a rise in the stock price index (PIX) for Jordanian Islamic banks listed on the Amman Stock Exchange, and this is supported by the results of previous studies (Alaagam, 2019; Bayrakdaroglu et al., 2017; Hutasoit et. al., 2022) show a positive correlation between the profitability index and the stock price index.

5. Conclusion

This study makes a significant contribution to the existing body of knowledge by meticulously examining the impact of Islamic banks' profitability on the performance of the Amman Stock Exchange (ASE), specifically through the lens of the Stock Price Index (PIX) from 2011 to 2021. By focusing on Jordan—an economy that has seen considerable growth in its financial sector, especially in Islamic banking—this research provides a nuanced understanding of how Islamic financial institutions influence broader market dynamics in a predominantly interest-based global financial system.

The study enhances existing academic literature in several ways. First, it offers empirical evidence on the relationship between the profitability of Islamic banks and stock market performance, an area that has seen limited exploration, especially in Jordan. Using a comprehensive dataset and robust statistical analysis, this research provides conclusive insights that contribute to a deeper understanding of Islamic banking's role in financial markets.

This research advances the previous state of knowledge by employing a more extensive dataset covering a significant period (2011-2021), which includes various economic cycles and the effects of global events such as the COVID-19 pandemic. The inclusion of this period allows for a more detailed analysis of the resilience and impact of Islamic banking in both stable and volatile economic conditions. Additionally, by focusing on Jordan, the study illuminates the specific dynamics of Islamic banking in an emerging market, contributing to a more global perspective on Islamic finance.

The authors contribute to the development of the field by providing a framework for understanding the intricate relationship between Islamic banking profitability and stock market performance. This framework can be used by policymakers, financial analysts, and scholars to further explore and leverage the potential of Islamic finance in enhancing economic stability and growth. Furthermore, the study's findings underscore the importance of adopting and promoting Sharia-compliant financial instruments as viable alternatives to conventional banking products, thereby broadening the scope of financial inclusion and sustainability.

In summary, this research significantly enhances our understanding of the contribution of Islamic banks to the performance of financial markets. By offering new insights into the mechanisms through which Islamic banking influences stock market dynamics, the study paves the way for future research in Islamic finance and its role in global economic development. The findings also have practical implications for investors, financial regulators, and Islamic banks themselves, providing evidence-based recommendations for strategies that can harness the potential of Islamic finance to foster more inclusive and resilient financial systems.

Finally, the data results of the analysis in the previous sections showed a statistically significant impact of the profitability index of Islamic banks on the performance of the Amman Stock Exchange for the period 2011–2021. It is a positive relationship in the long and short term, and therefore the hypothesis was accepted, which states that “there is a statistically significant impact of the profitability index of Islamic banks on the performance of the Amman Stock Exchange for the period 2011-2021.” Through the results of this study and the review of previous literature, the researcher recommends conducting more research on the direct and indirect impact of the performance of Jordanian Islamic banks on the performance of the Amman Stock

Exchange, with a focus on non-financial factors such as regulatory developments and economic policies, in addition to the need for Islamic banks to maintain liquidity at a level that achieves the possibility of meeting the demand for financing and in a way that reflects positively on their performance, specifically on their profitability indicators, which will achieve a number of benefits at the level of macroeconomic activity and its institutions, including. Amman Stock Exchange.

References

1. Al Maani, A., Alawad, A.S. and Karaki, B.S.A. (2021). Impact of liquidity and profitability ratios on the stock market value of Jordan insurance companies. *Academy of Accounting and Financial Studies Journal*, 25(2), pp.1-14.
2. Alaagam, A. (2019). The relationship between profitability and stock prices: Evidence from the Saudi Banking Sector. *Research Journal of Finance and Accounting*, 10(14), pp. 91-101.
3. Amman Stock Exchange (2022). Annual Report. Available at: https://www.ase.com.jo/en/library-and-publications
4. Bayrakdaroglu, A., Mirgen, C., Kuyu, E. (2017). Relationship between profitability ratios and stock prices: an empirical analysis on BIST-100. *PressAcademia Procedia*, 6(1), pp.1-10.
5. Galliers, R.D., Land, F.F. (1987). Choosing appropriate information systems research methodologies. *Communications of the ACM*, *30*(11), pp.900-902.
6. Gujarati, D., Porter, D. (2008). Basic Econometrics, 5th Ed, pp. McGraw-Hill Education
7. Hussien, M.E., Alam, M.M., Murad, M.W., Wahid, A.N.M. (2019), The performance of Islamic banks during the 2008 global financial crisis: Evidence from the Gulf Cooperation Council countries. *Journal of Islamic Accounting and Business Research*, 10(3), pp. 407-420. https://doi.org/10.1108/JIABR-01-2017-0011
8. Hutasoit, D.T.M., Toni, N. and Ariesa, Y. (2022). Effect of loan to deposit ratio, capital adequacy ratio, return on equity, and dividend payout ratio on stock prices with Bank Indonesia interest rates as moderating variables in banking companies on the Indonesia Stock Exchange. *International Journal of Social and Management Studies*, 3(3), June, pp.137-149.
9. Kieso, D.E., Weygandt, J.J., Warfield, T.D. (2011). Intermediate Accounting, Problem Solving Survival Guide, Vol. 1. 14th Ed. John Wiley & Sons.
10. Kotz, D.M. (2009). The financial and economic crisis of 2008: A systemic crisis of neoliberal capitalism. *Review of Radical Political Economics*, 41(3), pp. 305-317.

11. Malkiel, B. (2015). A Random Walk Down Wall Street The Time-Tested Strategy for Successful Investing. W. W. Norton & Company.
12. Sahara, R., Prastiawan, H., Pratama, A.A. (2018). Analysis and Design Information System Personal Financial Management Based on Android. *International Journal of Computer Trends and Technology* (IJCTT), 57(1), March.

Data sources:

- Islamic International Arab Bank Annual Reports, 2011-2022.
- Jordan Islamic Bank Annual Reports, 2011-2022.
- Safwa Islamic Bank Annual Reports, 2011-2022.

Financial Studies

"Victor Slăvescu" Centre for Financial and Monetary Research
Casa Academiei 13, Calea 13 Septembrie, Building B, 5th floor
Bucharest, 050711, Romania
Phone: +40 21.318.24.19
Fax: +40 21.318.24.19
E-mail: s.vraciu@icfm.ro