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UTILIZING THE INFORMATION CONTENT OF TRADING AND NON-TRADING PERIODS INCLUDING LUNCH BREAKS FOR STOCK MARKET VOLATILITY FORECASTING

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ABSTRACT

Purpose- This study investigates the empirical effects of information dissemination dynamics across active trading sessions and market closures on Chinese stock market volatility.
Methodology- This paper uses intraday data to explore the influences of information transmission during trading and non-trading periods (including lunch breaks that divide each trading day into two distinct sessions) on volatility in China's stock markets, and to forecast such volatility through modelling.
Findings- Its findings demonstrate that absolute overnight return and positive lunch break return both play important roles in future volatility. Moreover, the empirical results suggest that morning-session RRV is positively linked with volatility over longer prediction horizons, and afternoon-session RRV, with volatility over shorter ones.
Conclusion- Finally, this paper proposes that a simplified model, which only considers morning-session RRV, can improve the accuracy of prediction of future realized volatility.

Keywords: Overnight returns, trading volume, lunch break returns, morning and afternoon sessions, realized range-based volatility.
JEL Codes: C32, C51, G10

1. INTRODUCTION

The process of information transmission is the main reason for price fluctuation in stock markets. The sequential information arrival (SIA) hypothesis, originally proposed by Copeland (1976) and extended by Jennings et al. (1981), holds that the new information received by traders arrives in a sequential, random fashion, and assumes that there will be intermediate equilibria en route to a final state of equilibrium. Subsequently, Andersen (1996) both suggested that trading volume can serve as a proxy measure of the unobservable amount of information that flows into the market. Darrat et al. (2003) supported the SIA hypothesis, on the grounds that trading volume and return volatility followed a clear lead-lag pattern in a large number of the Dow Jones Industrial Average stocks.

However, information transmission in non-trading periods will also cause changes in stock prices, especially opening ones. In particular, overnight returns are often regarded as an information-transmission variable. Gallo (2001) demonstrated the explanatory power of overnight returns over the squared residuals of intra-day returns and also found that the former provided a better fit for conditional-variance estimates. Ahoniemi and Lanne (2013) found that a realized volatility estimator that optimally incorporates overnight information is more accurate in-sample for the S&P 500 index. Todorova and Souček (2014) showed that considering overnight information separately, rather than adding it to daily realized-volatility estimates, consistently led to better out-of-sample results despite the higher number of parameters involved. And some prior studies have suggested that overnight returns play an important role in the volatility of asset returns (Wang et al., 2015; Jayawardena et al., 2016; Zhu et al., 2017; Jayawardena et al., 2020; Kim and Goh, 2024; Masyhuri et al., 2024).

On the other hand, despite Ahoniemi and Lanne's (2013) above-mentioned finding regarding realized-volatility estimators, they suggested that such estimators are more accurate for individual stocks if they do not incorporate overnight information. Some recent studies have also shown that overnight information has no significant effect on volatility prediction, and that it

may even result in inferior volatility-prediction performance, as compared to estimators that do not incorporate overnight information (Dhaene and Wu, 2020; Lyócsa and Todorova, 2020).

At present, some Asia-Pacific stock markets take lunch breaks, including in China, Indonesia, Japan, Malaysia, Singapore and Thailand. This in effect creates separate morning and afternoon sessions on each trading day. However, during lunch breaks, information transmission continues, causing fluctuations, especially in opening prices in afternoon sessions. Wang et al. (2015) and Zhu et al. (2017) both found that additional leverage effects captured by negative lunch break returns and negative overnight returns played significant roles in forecasting volatility in China's stock and futures markets, respectively.

The development of China's stock market began in 1990 and has been characterized by sharp and frequent fluctuations of stock prices. Another of its characteristics has been that bull markets tend to be shorter, and bear markets longer than in other stock markets around the world. This has been ascribed to China's stock market being young and highly speculative (Wang et al., 2015). Given such characteristics, understanding the impact of information transmission on stock-price fluctuation is especially important to investors and policymakers in China.

To avoid non-trading-hours issues when making volatility calculations, Takaishi et al. (2012) separately calculated two realized volatilities (RVs) for the Tokyo Stock Exchange (TSE), one for the morning session and the other for the afternoon session and tested their statistical properties. Jayawardena et al. (2020) found that bridging the TSE's lunch break with information from adjacent markets, i.e., Australia, Hong Kong and China, led to improvements in volatility forecasting. Inspired by Takaishi et al. and Jayawardena et al.'s work, this study incorporates the information-content variables of trading and non-trading periods – including trading volume, overnight return, and lunch break return – into a heterogeneous autoregressive RV (HAR-RV) model. Then, we explore the impacts of the information content of trading and non-trading periods on volatility and attempt to achieve the improvements in the forecasting for the realized range-based volatility (RRV) of the China Securities Index 300 (CSI 300).

Additionally, due to the above-mentioned lunch breaks in China's stock market, we calculate separate RRVs for the morning and afternoon sessions of the CSI 300 and examine their relative usefulness in forecasting the RRV of the next trading day. The HAR-RV model, first proposed by Corsi (2009), is a simple approximate long-memory dynamics model of RV, and has achieved excellent forecasting performance, along with valuable economic implications. Our work extends it into an HAR-RRV model.

RRV, as proposed by Christensen and Podolskij (2007), has proven more accurate than traditional measures of RV. More recently, Christensen and Podolskij (2012) proposed realized range-based multi-power variation (RMV) and showed how it could be used both to estimate ex-post quadratic return variation and to make jump-robust inferences about integrated variance. However, the same authors suggested that realized range-based tri-power variance (RTV) was not only a more robust estimator of integrated variance than RMV, but also the most efficient estimator so far devised. Thus, we adopted RTV as the regressor in the HAR-RRV model.

This paper makes the following contributions. First, it examines whether information- content variables from trading and non-trading periods, including trading volume, overnight return, and lunch break return, have an important influence in the volatility of asset returns of China's stock market. Second, it differs from Jayawardena et al.'s (2020), which bridged non-trading periods by using intraday data from related markets and instead incorporates the RRVs of two trading sessions separated by a lunch break into the novel HAR-RRV model. To the best of our knowledge, our paper is the first to incorporate morning- and afternoon-session RRVs into a HAR model aimed at improving the forecasting of volatility in China's stock market.

In light of that primary aim, based on in-sample estimation results, we adjust and assess out-of-sample forecasting accuracy and performance, with the subsidiary aim of arriving at a forecasting model that is not only simpler, but also more accurate. The success of that effort allows us to demonstrate that, in the case of the CSI 300, the RRVs of morning sessions do play a significant role in the RRVs of the subsequent trading days.

Numerous studies have explored overnight or lunch break information content's impact on RV,[1] but little attention has thus far been paid to the parallel impact of the existence of morning and afternoon sessions that lunch breaks imply. This paper therefore complements the literature on the impacts of information from both trading and non-trading periods on RRV. Moreover, our empirical results do not support the SIA hypothesis in the case of China's stock markets. They do, however, demonstrate that overnight and lunch break returns do have a significant impact on future RRV. Moreover, having tested separate models for forecasting short-term and long-term periods of volatility, we concluded that a single model could be used to perform more accurate out-of-sample forecasting at all forecasting time horizons than our original HAR-RRV model.

[1]See, for example, Ahoniemi and Lanne (2013); Todorova and Souček (2014); Wang et al. (2015); Jayawardena et al. (2016); Zhu et al. (2017); Dhaene and Wu (2020); Jayawardena et al. (2020); and Lyócsa and Todorova (2020).

The remainder of this paper is organized as follows. Our data sources and methodology are described in Section 2, along with the specifications of the HAR-RRV and modified models. Section 3 presents our empirical findings, and the final section, our concluding remarks.

2. DATA AND METHODOLOGY

2.1. Data

There are two securities exchanges on the mainland China, the Shanghai Securities Exchange (SHSE) and the Shenzhen Securities Exchange (SZSE). They officially open at 9:30 a.m. and close at 3:00 p.m., with a lunch break from 11:30 a.m. to 1:00 p.m., giving a total of four trading hours per working day. The CSI 300, consisting of the country's 300 largest and most liquid A-share stocks, was created by China Securities Index Co., Ltd. in 2005 to serve as a proxy for the broader Chinese economy.

The CSI 300's intraday data, daily trading volume, overnight returns, and lunch break returns were collected from the iFinD database. Our empirical data for the sample period from April 11, 2005, to December 31, 2019, thereby provides 48 data periods of 5-minute duration within a single trading day, for a total of 3584 trading days. We felt that the CSI300 was a good case for exploring the impact of information transmission on stock markets, because of the more noise trader in Chinese stock markets.

2.2. Realized Volatility Measures

RV, firstly proposed by Andersen and Bollerslev (1998), is an assessment of variation in returns for an asset that uses high-frequency intraday data within a defined period. It can be divided into two components, a continuous-volatility component and a jump component, both of which influence stock prices. Prior studies have suggested that RVs' jump components would be of little help in predicting future RVs (Andersen et al., 2007). In response, Christensen and Podolskij (2007) replaced each squared intra-day return with the high-low range for the same period, to create a novel and more efficient estimator, RRV. Based on their results, they argued that intraday range-based estimation of volatility was a more accurate and efficient method of predicting volatility.

In this paper, we use intraday data from the CSI 300 to measure daily RRV and predict future RRV. Following Christensen and Podolskij (2006, 2007), the basis for our analysis is an equidistant grid, $t_j=j/n$, $j=1,\ldots,n$, where n is the sampling frequency. The intraday range is computed as

$$S_{t,j} = \text{Max}(p_h - p_l), \text{ for } j = 1,2,\ldots, n \quad (1)$$

where p_h (p_l) is the highest (lowest) price during a given 5-minute period. Thus, we have a total of 48 observations of p per trading day.

Following the measures of realized range-based estimation of integrated variance used by Christensen and Podolskij (2006, 2012), we RRV and RTV as

$$RRV_t^b = \frac{1}{\lambda_2}\sum_{j=1}^{n}(s_{t,j})^2 \quad (2)$$

$$RTV_t = \frac{n}{n-2}\left(\frac{1}{\lambda_{2/3}}\right)^3 \sum_{j=3}^{n}(s_{t,j})^{2/3}(s_{t,j-1})^{2/3}\,(s_{t,j-2})^{2/3} \quad (3)$$

where $\lambda_r = 4/\sqrt{\pi}(1-4/2^r)2^{r/2}\Gamma((r+1)/2)\varsigma(r-1)$. The superscript *b* appearing in the formula for RRV indicates that it will be downward biased in the presence of jumps (Christensen and Podolskij, 2006).

Christensen and Podolskij (2012) proposed that RTV provides an alternative means of drawing inferences from the continuous path component of the quadratic variation. They suggested that the RTV extension is more efficient than its bi-power equivalent. Accordingly, we consider the purely range-based estimator that is consistent for the quadratic variation of the jump diffusion semi-martingale to be:

$$RRV_t \equiv \lambda_2 RRV_t^b + (1-\lambda_2)RTV_t \xrightarrow{p} \int_0^t \sigma^2(t)dt + \sum_{0<t_j<t}\kappa^2(t) \quad (4)$$

2.3. Volatility Modelling

The HAR model, proposed by Corsi (2009), holds that agents with different time horizons perceive, react to, and cause different types of volatility components. It also successfully captures the long-memory feature of realized variance for various forecasting horizons. Moreover, Christensen and Podolskij (2006) suggested that RRV is more efficient than RV. Thus, this paper uses an efficient range-based estimator to describe dynamic volatility in the HAR model. Meanwhile, we adopt RTV as the regressor for prediction of RRV. Our HAR-RRV model is therefore specified as

$$RRV_{t,t+H} = \beta_0 + \beta_D RTV_{t-1,t} + \beta_W RTV_{t-5,t} + \beta_M RTV_{t-20,t} + \varepsilon_{t,t+H} \quad (5)$$

where *H* denotes the prediction horizons. The measures of multi-period realized volatility, comprising $RTV_{t\text{-}5,t}$ and $RTV_{t\text{-}20,t}$, each represent the arithmetic mean of daily volatilities over the relevant time period. We focus on the prediction of future realized volatility using 1-day and 1- to 4-week horizons (i.e., H=1, 5, 10, 15 and 20).

2.4. Modified HAR Models

Innovation at the opening of the markets reflects the accumulation of information absorbed during market closure periods and is bound to have an important influence on the market during the trading day. Gallo (2001) suggested that overnight returns have explanatory power over the squared residuals of intraday returns. More recent studies have further suggested that overnight information has predictive power over, and improves the forecasting performance of, future volatility.[2]

After the opening of the market, investors' receipt of new information and resulting investment decisions will be reflected in asset prices through trading volumes. The SIA hypothesis holds that the lagged trading volume has not been completely assimilated into the prior change in price. Thus, the main implication of the SIA hypothesis is that sequential reactions to information make asset-price volatility potentially predictable via trading volume. As pointed out in previous studies, trading volume can be regarded as a proxy measure for the unobservable flow of information into the market (Andersen, 1996). More recently, Todorova and Souček (2014) concluded that trading volume was an important factor in the volatility-volume relationship.

It is also important to note that some securities exchanges in the Asia-Pacific region with lunch breaks for 1-2 hours, and thus also undergo a non-trading period of information transmission during the day. Wang et al. (2015) and Zhu et al. (2017) both found that lunch break returns had a large long-term impact on the volatility of stock and futures markets. More recently, Jayawardena et al. (2020) demonstrated that taking account of information from neighbouring markets during the TSE's lunch break led to improvements in TSE volatility forecasting.

Our primary objective is to explore the impact on RV of information transmission during periods of market opening and closure, as a means of achieving overall improvement in volatility forecasting. To this end, we propose a refined model that could improve the predictability of future realized volatility. After incorporating overnight returns, lagged trading volume, and lunch break returns into the HAR-RRV model, as described above, we further propose the following specification, to obtain our HAR-RRV-OVL model:

$$RRV_{t,t+H} = \beta_0 + \beta_D RTV_{t-1,t} + \beta_W RTV_{t-5,t} + \beta_M RTV_{t-20,t} + \beta_{OD} ONR_{t-1,t} + \beta_{VD} VOL_{t-1,t} + \beta_{LD} LBR_{t-1,t} + \varepsilon_{t,t+H} \quad (6)$$

where *ONR* defines the absolute value of overnight return; *VOL* defines the logarithm trading volume; *LBR* defines the positive lunch break return, that is equal to max ($LBR_{t\text{-}1,t}$, 0), which measures the leverage effects for news arrival.

Additionally, due to lunch break effects, Takaishi et al. (2012) calculated two RVs separately, one for the morning session and the other for the afternoon session of the TSE. They examined the statistical properties of both by investigating their respective standardized returns. Similarly, Jayawardena et al. (2020) decomposed total realized power variation (RPV) into morning and afternoon sessions and examined the impact on the predictability of total RPV that resulted from bridging the TSE's overnight period using global market information. Inspired by both these articles, we decomposed CSI 300 RRV into morning and afternoon sessions and incorporated these separate RRVs into our HAR-RRV model. Our original specification is modified into the HAR-RRV-MA model using the following formula,

$$RRV_{t,t+H} = \beta_0 + \beta_D RTV_{t-1,t} + \beta_W RTV_{t-5,t} + \beta_M RTV_{t-20,t} + \beta_{MS} RRV^{MS}_{t-1,t} + \beta_{AS} RRV^{AS}_{t-1,t} + \varepsilon_{t,t+H} \quad (7)$$

where RRV^{MS} defines the RRV of morning session; RRV^{AS} defines the RRV of afternoon session.

3. EMPIRICAL RESULTS

3.1. In-Sample Results

Table 1 presents the descriptive statistics of RRV levels for the CSI 300, as well as its overnight returns, trading volumes, lunch break returns, and the respective RRVs of its morning and afternoon sessions. Notably, the mean and standard values of RTV are smaller than those of RRV. This tends to confirm that, as pointed out by Christensen and Podolskij (2012), the range-based tri-power extension is more efficient than the bi-power one. In addition, the LB statistics for ONR, VOL, LBR, RRV^{MS},

[2] See, for example, Ahoniemi and Lanne (2013); Todorova and Souček (2014); Wang et al. (2015); Jayawardena et al. (2016); Zhu et al. (2017); Jayawardena et al. (2020).

and RRV^{AS} have a high degree of serial correlation, indicating that these variables might facilitate the prediction of future market volatility. Moreover, the mean and standard values of RRV^{MS} are higher than RRV^{AS}, implying that fluctuation during the morning session is bigger than in the afternoon one. This finding is consistent with those of Takaishi et al. (2012) regarding the statistical characteristics of TSE stock-price fluctuations.

Table 1: Descriptive statistics, realized range-based volatility levels for the CSI 300 [a]

Variable	Statistical Parameter						
	Mean	**S.D.**	**Skew**	**Kurtosis**	**Min.**	**Max.**	**$LB_{(10)}$** [b]
RRV	1.466	2.186	5.526	52.161	0.055	35.289	8973.160
RTV	0.724	1.143	7.120	84.059	0.044	19.775	10000.747
ONR	0.422	0.626	5.236	47.803	0.000	8.577	1956.227
VOL	25.016	0.954	-0.746	4.293	21.789	27.579	31568.741
LBR	0.012	0.038	23.058	742.200	0.000	1.428	440.212
RRV^{MS}	0.879	1.392	6.009	57.389	0.025	20.788	6890.989
RRV^{AS}	0.580	1.032	6.933	80.120	0.001	19.359	5208.651

[a] *RRV*=realized range-based variance; *RTV*=realized range-based tri-power variation; *ONR*=absolute value of the overnight return; *VOL*=logarithm trading volume; *LBR*=positive lunch break return; RRV^{MS}=*RRV* of the morning session; RRV^{AS}=*RRV* of the afternoon session; S.D.=standard deviation.

[b] The critical value of the test statistics for $LB_{(10)}$ was 18.307.

The in-sample results for the CSI 300 are provided in Table 2, with Panel A providing the results of the HAR-RRV model, and Panel B, the results of the HAR-RRV-OVL model. In Panel A, all the estimates of β_D, β_W and β_M are statistically significant at least at the 10% level, except for β_W for the 2- to 4-week prediction horizon, indicating the existence of highly persistent volatility dependence. Moreover, the adjusted R^2 ranges from 0.530 for the 1-day horizon to 0.462 for the 4-week horizon, and the mean squared error (MSE) ranging from 2.256 to 1.288 across the five prediction horizons.

Table 2: In-sample estimates for the CSI 300 using the HAR-RRV and HAR-RRV-OVL models[a]

Variable	Horizon									
	1 day		1 week		2 weeks		3 weeks		4 weeks	
	Coeff.[b]	S.E.	Coeff.[b]	S.E.	Coeff.[b]	S.E.	Coeff.[b]	S.E.	Coeff.[b]	S.E.
Panel A: *HAR-RRV* Model ($RRV_{t,t+H}=\beta_0+\beta_D RTV_{t-1,t}+\beta_W RTV_{t-5,t}+\beta_M RTV_{t-20,t}+\epsilon_{t,t+H}$)										
β_0	0.274***	0.059	0.376***	0.084	0.471***	0.094	0.536***	0.096	0.580***	0.095
β_D	0.755***	0.107	0.651***	0.092	0.480***	0.093	0.341***	0.077	0.299***	0.068
β_W	0.656***	0.180	0.346**	0.148	0.215	0.181	0.263	0.204	0.279	0.210
β_M	0.236*	0.135	0.508***	0.168	0.680***	0.202	0.681***	0.229	0.645***	0.218
Adj_R^2	0.530		0.564		0.502		0.473		0.462	
MSE	2.256		1.468		1.435		1.359		1.288	
Panel B: *HAR-RRV-OVL* Model ($RRV_{t,t+H}=\beta_0+\beta_D RTV_{t-1,t}+\beta_W RTV_{t-5,t}+\beta_M RTV_{t-20,t}+\beta_{OD} ONR_{t-1,t}+\beta_{VD} VOL_{t-1,t}+\beta_{LD} LBR_{t-1,t}+\epsilon_{t,t+H}$)										
β_0	1.032	0.721	-0.325	0.121	-1.475	1.487	-2.052	1.708	-2.490	1.791
β_D	0.745***	0.101	0.642***	0.095	0.460***	0.097	0.317***	0.080	0.273***	0.069
β_W	0.593***	0.178	0.312**	0.155	0.183	0.184	0.237	0.203	0.256	0.209
β_M	0.227*	0.127	0.493***	0.163	0.651***	0.195	0.645***	0.221	0.605***	0.210
β_{OD}	0.365***	0.096	0.194***	0.085	0.175***	0.066	0.140**	0.058	0.125**	0.058
β_{VD}	-0.033	0.029	0.027	0.045	0.077	0.060	0.103	0.069	0.123	0.072
β_{LD}	-2.167***	0.626	-1.269	0.833	0.180	1.006	1.175	1.108	1.349	1.173
Adj_R^2	0.539		0.568		0.506		0.480		0.470	
MSE	2.209		1.453		1.420		1.342		1.269	

[a] The table presents adjusted R^2 and mean squared error (MSE) for 1-day and 1- to 4-week in-sample predictions of *RRV* for the CSI 300. The S.E. values are based upon Newey-West HAC standard errors. The dependent variables for the HAR-RRV and HAR-RRV-OVL models for all horizons are standardized realized variance: $RRV_{t,t+H}/H$.

[b] *** indicates significance at the 1% level; ** indicates significance at the 5% level; and * indicates significance at the 10% level.

Similarly, as shown in Panel B of Table 2, highly persistent volatility dependence is also discernible in the HAR-RRV-OVL model. In this table, we focus on the influence of three variables on the volatility forecasting: ONR, VOL, and LBR. Firstly, it is worth noting that, in the HAR-RRV-OVL model, the estimates for β_{OD} were positive and statistically significant for all prediction horizons at least at the 5% level. Because the ONR represents the absolute value of overnight returns, the empirical results show that when important news arrives during the night, it exacerbates volatility, irrespective of whether it is good news or bad.

Additionally, estimates of β_{VD} for all prediction horizons in the HAR-RRV-OVL model were found to be insignificant at conventional levels of significance, indicating that the impact on volatility of information transmission during trading periods was not particularly important. Our empirical results from this model also do not support the SIA hypothesis, in the case of the CSI 300.

Turning to estimates of β_{LD} in the HAR-RRV-OVL model, it is interesting to note that only the β_{LD} for the 1-day prediction horizon was found to be statistically significant (and negative) at the 1% level. The LBR=max ($LBR_{t-1,t}$, 0), which represents positive lunch break returns. These empirical results reveal that good news during the lunch break mitigates volatility at shorter prediction horizons, implying a significant role of additional leverage effects captured by positive lunch break returns. But on the other hand, good news received during lunch break periods had little impact on volatility at the longer prediction horizons. These empirical findings are inconsistent with those of Wang et al. (2015) and Zhu et al. (2017), who claimed a significant role in volatility forecasting for additional leverage effects captured by negative lunch break returns and negative overnight returns.

Lastly, it should be pointed out that the explanatory and predictive abilities of our HAR-RRV-OVL model were better than those of our HAR-RRV model, as confirmed by the adjusted R^2 and MSE terms, which were higher (lower) across all prediction horizons in the HAR-RRV-OVL model.

Table 3 reports in-sample estimation results for the CSI 300 using our HAR-RRV-MA model. Here, it should be noted that the estimates for β_{MS} for the 3-week and 4-week prediction horizons using this model were positive and statistically significant at the 10% and 5% levels, respectively. This indicated that morning-session RRV had a positive impact on volatility at the longer prediction horizons. It is also interesting to note that the estimate for β_{AS} in the HAR-RRV-MA model was positive and statistically significant at the 5% level at the 1-day prediction horizon only. This differs sharply from our findings regarding β_{MS} and implies that afternoon-session RRV drives up volatility only at the shortest prediction horizon. However, adjusted R^2 (MSE) was also higher (lower) across all prediction horizons in the HAR-RRV-MA model than in the HAR-RRV model. In short, the RRVs of trading sessions, whether in the morning or the afternoon, indeed play important roles in volatility for the CSI 300, that is novel findings of this study, which also is a part of little pay attention in the prior literature.

Table 3: In-sample estimates for the CSI 300 using the HAR-RRV-MA models [a]

Variable	Horizon									
	1 day		1 week		2 weeks		3 weeks		4 weeks	
	Coeff.[b]	S.E.	Coeff.[b]	S.E.	Coeff.[b]	S.E.	Coeff.[b]	S.E.	Coeff.[b]	S.E.
HAR-RRV-MA Model ($RRV_{t,t+H}=\beta_0+\beta_D RTV_{t-1,t}+\beta_W RTV_{t-5,t}+\beta_M RTV_{t-20,t}+\beta_{MS} RRV^{MS}_{t-1,t}+\beta_{AS} RRV^{AS}_{t-1,t}+\epsilon_{t,t+H}$)										
β_0	0.245***	0.053	0.354***	0.077	0.452***	0.088	0.516***	0.090	0.556***	0.089
β_D	0.245	0.229	0.363	0.290	0.246	0.298	0.065	0.249	-0.060	0.201
β_W	0.679***	0.188	0.339**	0.143	0.209	0.175	0.260	0.197	0.285	0.201
β_M	0.226*	0.125	0.505***	0.161	0.678***	0.197	0.678***	0.222	0.640***	0.208
β_{MS}	0.197	0.135	0.181	0.126	0.147	0.101	0.159*	0.086	0.177**	0.076
β_{AS}	0.371**	0.162	0.137	0.165	0.111	0.175	0.147	0.152	0.222	0.137
Adj_R^2	0.537		0.569		0.505		0.478		0.469	
MSE	2.222		1.451		1.424		1.345		1.269	

[a] The table presents the adjusted R^2 and mean squared error (MSE) for 1-day and 1- to 4-week in-sample predictions of *RRV* for the CSI 300. The S.E. values are based upon Newey-West HAC standard errors. The dependent variables for the HAR-RRV-MA model for all horizons are standardized realized variance: $RRV_{t,t+H}/H$.

[b] *** indicates significance at the 1% level; ** indicates significance at the 5% level; and * indicates significance at the 10% level.

3.2. Out-of-Sample Results

Although the two modified models discussed above both have lower MSE values than the HAR-RRV base model, this does not necessarily mean that the modified models will significantly outperform the base model in out-of-sample forecasting. To explore whether this was the case, we conducted a modified Diebold-Mariano (DM) test, as proposed by Harvey et al. (1997). The in-sample period ran from April 11, 2005, to December 28, 2018, whilst the out-of-sample period ran from January 2, 2019 to December 31, 2019. The out-of-sample forecasting method used in this paper is the rolling-window approach, in which the sampling window is expressed relative to the forecasting date and automatically shifts forward with the passage of time. Table 4 presents the out-of-sample results of the HAR-RRV and modified models, with Panel A reporting their MSEs, and Panel B, the *t*-statistics of the modified DM test. Panel A reveals that MSE was lower in the HAR-RRV-OVL model than in the benchmark model only at the 1-day forecasting horizon. However, in the case of the HAR-RRV-MA model, MSE results were all lower than in the benchmark model, irrespective of forecasting-horizon length.

Table 4: Comparison of the Accuracy of the Three Initial Models' out-of-sample CSI 300 Forecasting Performance

Horizon	HAR-RRV	HAR-RRV-OVL	HAR-RRV-MA
Panel A: *HAR-RRV Model*[a]		MSE	
1 day	0.253	0.240	0.248
1 week	0.198	0.207	0.189
2 weeks	0.242	0.275	0.234
3 weeks	0.272	0.324	0.263
4 weeks	0.291	0.364	0.282
Panel B: Modified DM test[b]		*t-stat.*[c]	
1 day	—	1.812 **	0.337
1 week	—	-2.014	2.030 **
2 weeks	—	-1.922	2.077 **
3 weeks	—	-1.909	2.045 **
4 weeks	—	-2.022	1.963 **

[a] The table presents the out-of-sample forecasts for the CSI 300 using 5-minute intraday data covering the period from January 2, 2019 to December 31, 2019, with data from April 11, 2005 to December 28, 2018 being used to estimate the HAR-RRV model parameters. The dependent variables for all models are standardized realized variance: $RRV_{t,t+H}/H$, and the table entries represent the mean standard error (MSE) for the out-of-sample predictions based upon 1-day and 1- to 4-week out-of-sample *RRV* prediction horizons. The different columns refer to the different HAR-RRV-type models.

[b] Modified Diebold-Mariano (DM) test *p*-values are presented for 1-day and 1- to 4-week out-of-sample *RRV* predictions. The benchmark model for all horizons is the HAR-RRV model.

[c] *** indicates significance at the 1% level; ** indicates significance at the 5% level; and * indicates significance at the 10% level.

In the modified DM test (Panel B of Table 4), the HAR-RRV model was taken as the benchmark for all forecasting horizons. If *t*-statistics is positive (negative), it indicates that the examined model is more (less) accurate than the benchmark model. The Panel B results show that the HAR-RRV-OVL model performed significantly better than the benchmark model, at the 5% level, only at the 1-day forecasting horizon. Additionally, except for 1-day forecasting horizon, the HAR-RRV-MA model performed significantly better than the benchmark, again at the 5% level, implying that this model indeed improved upon overall forecasting performance of future volatility in the CSI 300. Based on the empirical results of this paper, we recommend that, to maximize forecasting accuracy, short-term periods of volatility should be forecast using the HAR-RRV-OVL model, and long-term ones, using the HAR-RRV-MA model.

3.3. More Accurate and Simplified Volatility-Forecasting Model

Next, we attempted to simplify our modeling while also improving its volatility-prediction ability. To that end, based on our in-sample estimation results, we adjusted the independent variables and re-examined its volatility forecasting for out-of-sample results. Specifically, the variables that were found to be statistically significant in the case of the in-sample results, i.e., ONR, LBR, RRV^{MS} and RRV^{AS}, were incorporated into a simplified version of the HAR-RRV model called the HAR-RRV-X model (with "X" referring to any one of ONR, LBR, RRV^{MS} or RRV^{AS}), specified as:

$$RRV_{t,t+H} = \beta_0 + \beta_D RTV_{t-1,t} + \beta_W RTV_{t-5,t} + \beta_M RTV_{t-20,t} + \beta_{XD} X_{t-1,t} + \varepsilon_{t,t+H} \quad (8)$$

Table 5 presents comparisons among the HAR-RRV and four "X" models' out-of-sample forecasting accuracy, with Panel A reporting the MSE and Panel B reporting the *t*-statistics of the modified DM test. The former panel shows that the MSE results for the HAR-RRV-ONR model were lower than for the benchmark model only at the 1-day and 1-week forecasting horizons. This was very different from the HAR-RRV-LBR model, whose MSE results were lower than those of the benchmark model at the 2-week, 3-week, and 4-week forecasting horizons. The MSE results of the HAR-RRV-AS model were slightly lower than those of the benchmark model at the 3-week and 4-week forecasting horizons. The HAR-RRV-MS model, meanwhile, had the lowest MSE results of any model at all forecasting horizons.

Table 5: Comparison of the accuracy of the four simplified models' out-of-sample CSI 300 forecasting performance against that of the benchmark model

Horizon	*HAR-RRV*	*HAR-RRV-ONR*	*HAR-RRV-LBR*	*HAR-RRV-MS*	*HAR-RRV-AS*
Panel A: *HAR-RRV Model*[a]			MSE		
1 day	0.253	0.249	0.257	0.246	0.254
1 week	0.198	0.196	0.201	0.184	0.198
2 weeks	0.242	0.243	0.240	0.228	0.242
3 weeks	0.272	0.273	0.268	0.254	0.269
4 weeks	0.291	0.293	0.285	0.268	0.287
Panel B: Modified DM test[b]			*t-stat.*[c]		
1 day	—	0.586	-2.066	1.803**	-0.032
1 week	—	1.899**	-5.476	3.120***	0.523
2 weeks	—	-1.540	4.211***	2.677***	0.953
3 weeks	—	-1.246	4.459***	3.819***	1.082
4 weeks	—	-1.084	4.286***	3.701***	1.104

[a] The table presents the out-of-sample forecasts for the CSI 300 using 5-minute intraday data covering the period from January 2, 2019 to December 31, 2019, with data from April 11, 2005, to December 28, 2018 being used to estimate the HAR-RRV model parameters. The dependent variables for all models are standardized realized variance: $RRV_{t,t+H}/H$, and the table entries represent the mean standard error (MSE) for the out-of-sample predictions based upon 1-day and 1- to 4-week out-of-sample *RRV* prediction horizons. The different columns refer to the different HAR-RRV-type models.

[b] Modified Diebold-Mariano (DM) test *p*-values are presented for 1-day and 1- to 4-week out-of-sample *RRV* predictions. The benchmark model for all horizons is the HAR-RRV model.

[c] *** indicates significance at the 1% level; ** indicates significance at the 5% level; and * indicates significance at the 10% level.

Turning now to Panel B, the HAR-RRV-ONR model's forecasting performance was significantly better than the benchmark model (at the 5% level) only at the 1-week horizon. The HAR-RRV-LBR model, on the other hand, significantly outperformed the benchmark model (at the 1% level) at the 2-week, 3-week, and 4-week forecasting horizons; and the HAR-RRV-MS model significantly outperformed the benchmark (at the 5% level or better) at all forecasting horizons. However, the HAR-RRV-AS model insignificantly outperformed the benchmark model at all forecasting horizons.

This study has demonstrated that morning-session RRV does play a significant role in RRV for the next trading day of the CSI 300. This suggests that the information content of morning sessions is more important than that of afternoon ones. A possible explanation is that information that arrives during the night is accorded more importance by traders than information that arrives during the day, and this is also reflected in more intense levels of morning-session RRV (see Table 1). In short, the HAR-RRV-MS model not only was found to be more accurate than the HAR-RRV base model, but also it was a simplified volatility-forecasting model.

4. CONCLUSIONS

Focusing on the RRV impacts of 1) information during trading and non-trading periods, and 2) differences between morning and afternoon sessions, this paper complements prior literature that has linked the RRVs of half-day trading sessions separated by formal lunch breaks to overall RRV and incorporated its findings into improved HAR models for forecasting volatility in the CSI 300.

This study has three key findings. First, it demonstrated that the SIA hypothesis is not supported in the CSI 300; instead, absolute overnight returns and positive lunch break returns were both found to play significant roles in volatility, and therefore potentially in the forecasting of volatility. These results hold for both in-sample and out-of-sample forecasting. Second, its empirical results imply that the respective RRVs of morning and afternoon sessions have important influence over longer-term volatility in the CSI 300 – implying that our HAR-RRV-MA model achieved our aim of improving the forecasting of future volatility at longer forecasting horizons (i.e., 1 week or more), while our HAR-RRV-OVL model achieved our parallel aim with regard to shorter ones (i.e., less than 1 week). Thus, thirdly, to avoid the need for using two different models for different forecasting horizons, this study proposed a simplified volatility-forecasting model that, in the event, proved the most accurate. Specifically, the HAR-RRV-MS model significantly outperformed the benchmark HAR-RRV model in terms of forecasting accuracy in the out-of-sample results at all forecasting horizons. In sum, our findings indicate that the HAR-RRV-MS model can improve the accuracy of predictions of RRV.

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A RESEARCH ON INDEPENDENT AUDITORS' PERSPECTIVES ON DIGITAL AUDITING

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ABSTRACT

Purpose- This study was conducted to determine the opinions of auditors who have been and are continuing their professional activities in Diyarbakır on digital auditing.

Methodology- In this direction, a face-to-face survey was conducted among independent auditors in Diyarbakır. The population of the research consists of 103 independent auditors. In the study, 63 auditors returned the questionnaire.

Findings- As a result of the answers given by the participants to the statements prepared in accordance with the scope of the study, it is seen that these statements are generally agreed with. It is noteworthy that especially the statements containing negativity have low averages. The average score given by female participants to the working statements is higher than the average score given by male participants to the working statements. In addition, a statistically negative and significant relationship was found between the gender variable of the participants and the auditors' perspectives on digital auditing. In addition, auditors in the middle age group think that digital auditing has a positive effect on audit activities. In addition, no statistically significant relationship was found between the educational level of the participants and the auditors' perspectives on digital auditing. a statistically positive and significant relationship was determined between the professional experience variable and the perspectives on digital auditing.

Conclusion- Digital auditing provides many advantages to groups and businesses that have adopted auditing as a profession. One of these advantages is to accelerate audit processes by using automation and data analytics. This saves auditors more time and allows them to focus on more complex problems. It increases the accuracy of the audit process by reducing manual errors. Thus, data analytics provide auditors with the ability to quickly and accurately analyse larger data sets. Digital auditing offers auditors the opportunity to gain a deeper understanding of all operations and financial condition of the business. This enables a more comprehensive risk assessment and the development of more effective audit strategies. Digital audit tools provide auditors with the ability to monitor the entity's financial condition and business processes in real time. This will enable early identification of potential problems and rapid intervention.

Keywords: Independent audit, digital audit, independent auditor, digitalization
JEL Codes: M40, M41, M42

1. INTRODUCTION

Independent audit can be expressed as evaluating and reporting the financial statements and information as a result of auditing the records, books and documents that can be applied with independent auditing techniques that may be deemed necessary in auditing standards with the aim of obtaining the necessary independent audit evidence that can give confidence as a result of proving whether the financial statements and information comply with financial reporting and proving the accuracy required as a result of this compliance. The concepts of independent audit and independent audit have increased in the literature over time. The audit activity performed by auditors provides reasonable assurance to users of financial statements by an independent party. For this reason, the importance of independent audit is increasing day by day.

With the recent financial scandals and legal regulations, digital audits are becoming more important than independent audit methods. Digital audit refers to the recording and reporting of transactions in digital environments by taking part in real-time audit systems. Thanks to digital auditing, transparency levels in enterprises can be increased, thus accountability can be ensured, and internal audit can achieve more effective results. In the study, it is aimed to examine the perspectives of independent auditors on digital auditing and to reveal the effects of auditors' qualifications on digital audit quality. The aim

of the study was determined by taking into account the more effective fulfilment of digital auditing, which is increasingly used today, by independent auditors.

In this study, the primary objective is to present a conceptual framework that aims to elicit the perspectives of independent auditors on the subject of digital transformation. Subsequently, hypotheses related to the study were determined. The objective of this study is to conduct hypothesis tests and subsequently present the results in tabular form. The results of the study and recommendations for future research are presented in the final section.

2. CONCEPTUAL FRAMEWORK

The developments experienced in todays and recent times and the rapid discovery, storage, organisation and presentation of the information obtained due to these developments have provided significant levels of development and transformation in more than one field. During this period of rapid development and changes experienced with information technology, audit activities carried out by public and private enterprises have started to be carried out in digital environments. Developments in the electronic field are of great importance and have been reflected in audit systems and practices. With the globalisation of the world, it has become an inevitable situation for businesses that want to progress in a way that will adapt to the change and transformation resulting from the competition. With the rapidly advancing digitalisation, multiple digital innovations such as artificial intelligence, data analytics, blockchain, cyber security and cloud technology have emerged. These innovations are referred to as "Industry 4.0, Industry 4.0" and "Audit 4.0" in some sources. While the needs of institutions and organisations for auditing have increased with digitalisation, it has also formed the basis for the use of various techniques and methods in the formation of activities (Celayir & Celayir, 2020).

Digitalisation is the process of transferring the data and existing resources (documents and files) that we can access to the digital environment in readable and processable ways with the help of computers and the process to be applied. From the point of view of businesses, the transfer of assets and information to the digital environment and the provision of more services by auditing these processes in a modern approach is called Digital Audit. Digital auditing leads to a more systematic implementation of both approaches and processes, as well as to improve and change the style of work done with great care. In addition, businesses and companies are asking themselves what can be done to take on more effective roles in the digitalised cycle (Mckinsey, 2017).

Increasing digital activities together with digitalisation cause major changes in the auditing profession. Today, when it is impossible to audit the data recorded in electronic media traditionally, it is inevitable to use information technologies in the process of collecting evidence, making evaluations and conducting audits for continuous and quality audits. Information Technology (IT) deals with the use of computer and telecommunication equipment to store, transmit and process data (Ghasemi et al., 2011). With the adoption of a high quality and digital age-compliant audit model in the field of auditing, change and development are inevitable in order to analyse the data in a transparent, reliable manner and to reach the right results (Özdemir & Sarıoğlu, 2018). Digitalisation is defined as the process of collecting, processing and automating data and saving auditors from manual data collection and analysis processes that take too much time. Therefore, potential risks and errors caused by fraud can be easily identified (KPMG, 2017).

Digitalisation can change the way auditors handle their activities by providing preliminary views in order to respond to the needs of their clients. In order for auditors to reach wide audiences by advancing their boundaries and to continue the services they offer to these audiences with maximum quality and reliability, it becomes important to ensure that the digital infrastructure is effectively suitable for independent auditing. At this point, it is necessary to look at the development and development process of digital audit. Digital audit has become widespread in the globalised business environment in the last twenty years. Especially with the rapid changes seen in the increasing needs of customers, it achieves great success in terms of coping with the compliance process in which its competitors are involved and providing maximum quality service with minimum costs. Therefore, the use of digital audit throughout the process increases efficiency. In this way, communication can be provided and stored quickly. It guarantees the protection of the data that can be stored (Debreceny et al., 2005; Curtis and Payne, 2008). The quality of the audit field is increasing day by day with the use of approaches that come with digitalisation. New digital tools have the ability to collect and process big data, allowing for analyses that can be comprehensive about the client, to apply big data collection and processing to audit processes, and to detect most misstatements in control systems and financial statements (Lambardi et al., 2015; Krahel and Titera, 2015). As with all technological developments, there are some key indicators identified for the changes needed in digital auditing. These indicators include changes in business models, rapid increases in the volume of big data, introduction of automation, and the demand for a proactive approach (Suffield, 2020).

Digital auditing activities provide support services not only as auditing of transactions, but also in many aspects related to business activities such as business performance, increasing the level of business performance, and improving the business process. For example, the realisation of analytical applications based on forecasts in matters such as decisions to be taken regarding stock support, what to do about stock mobility, etc. puts businesses ahead in terms of effectiveness and efficiency

(Hardy & Laslett, 2015). In the near future, it is of great importance to make auditing faster and easier, to benefit from digitalisation at the highest level and to equip auditors with digital skills and abilities to use the new technologies available. In order for businesses and companies to produce maximum data, auditor roles should be required to change and evolve (Nwankpa, 2014). Digital auditing, refers to the application of advanced technologies such as artificial intelligence (AI), data analytics, blockchain, and robotic process automation (RPA) to enhance the efficiency, accuracy, and scope of audit processes (Yoon, Hoogduin & Zhang, 2015). The integration of digital technologies into auditing enables real-time data analysis and continuous monitoring. It also changes the auditors' roles, skills, and ethical considerations (Issa, Sun, & Vasarhelyi, 2016).

Since today's developments have a continuously changing structure, making fast, instant, accurate and appropriate decisions is the most important reason for the long-term survival of businesses (Yıldız & Ağdeniz, 2019). A business can use digital audit information to gain competitive advantage and be ahead of other businesses (Kaya, 2018). Digital developments, changes in the economy and the resulting global competitions have also affected the visions of businesses. These effects have caused significant changes and developments in audit systems. Therefore, the need for digitally equipped auditors is increasing in order to continue the audit processes effectively and to adapt to the changes and developments in national and international areas (Akyel & Yıldız, 2018).

Today, audit firms are rapidly digitalising. In order to provide sufficient value to clients, they are improving their business processes and exploring how to make use of new digital tools and big data. Thus, digitalisation can make auditing much more efficient and improve audit quality. In addition, audit activities respond appropriately to the needs of shareholders and other stakeholders. With digital tools, the auditor can evaluate not only the sampling method, but instead all the data of the companies. Furthermore, digitalisation of the audit process improves risk assessments and the quality of judgements by identifying all irregularities and proposing solutions to highlighted problems. Digitalisation has had a significant impact on the business world and is changing the way audit firms do business in all areas of activity (Dengler and Matthes, 2018). Data analysis, one of the most important activities of digital auditing, is integrated into the field of technology. While data analyses were previously performed with manual methods, with the developments brought by digitalisation, the manual method has been replaced by the data analysis method. Such digitalisation is used to process important data quickly and easily in order to increase the effectiveness and efficiency of the audit process (Özdemir & Sarıoğlu, 2018).

As I. James & Gladyshev (2013) point out, the field of digital forensics is growing rapidly. They emphasize the need for global collaboration to improve legal and technical infrastructures. It is imperative to acknowledge that while automation is being increasingly integrated into digital investigations, the prevailing reliance on existing tools often results in incomplete analyses and potential errors due to inadequate software verification. This foundational understanding is instrumental in recognizing the complexities auditors encounter in the digital realm. In the context of internal auditing, Marx and Ravjee (2015) argue that the pervasive impact of information technology has necessitated a shift in the competencies required of auditors. The authors illustrate how technological advancements have reshaped internal audit functions, aligning with key regulatory frameworks such as the King III report and ISACA standards. This evolution underscores the critical need for auditors to adapt their skills and methodologies to remain relevant in a rapidly changing environment. As posited by C. Oldhouser in 2016, the transformative effects of emerging technologies on auditing practices are further emphasized. The advent of continuous monitoring and real-time audits signifies a shift towards more efficient and effective auditing processes, highlighting the imperative for auditors to embrace these innovations to maintain competitiveness. As posited by Brender et al. (2018), the advent of blockchain technology has the potential to transform the audit paradigm, thereby shifting its focus from a retrospective to a forward-looking approach. It is suggested that as auditors integrate data-driven analysis, there will be an increased demand for advisory services, necessitating a broader skill set that includes understanding complex technologies and their implications for audit practices.

As posited by Ježovita et al. (2018), the role of analytical procedures within the domain of internal auditing is of paramount importance. In this regard, the necessity of adapting to contemporary business conditions is also emphasized. The argument is made that the integration of advanced data analytics is crucial for auditors to effectively manage risks and enhance the quality of assurance engagements. This assertion reflects the necessity for continuous skill development in response to technological advancements. As Barta (2018) emphasizes, the role of IT auditors within the context of financial auditing is becoming increasingly prominent. This is due to the fact that the advancement of digital technologies not only leads to an enhancement in productivity but also imposes the necessity for financial auditors to possess a more profound comprehension of IT systems. This shift has given rise to concerns regarding cybersecurity risks and the necessity for auditors to adapt to a more technology-driven role. The discourse continues with the work of Colavizza et al. (2021), who explore the implications of AI on archival practices, suggesting that traditional methods may become obsolete in the face of new technologies. Their work underscores the necessity of reevaluating archival concepts to ensure transparency and accountability, a matter of particular pertinence for auditors engaging with algorithmic outputs. (Vecchione et al., 2021) contribute to the conversation by examining the historical context of audit studies, urging a careful approach to algorithmic auditing. They advocate for a nuanced understanding of discrimination and the ethical implications of audit methodologies, emphasizing the need for meaningful engagement with affected communities. Thelen et al. (2022) introduce the concept of

digital twin technology, which integrates various enabling technologies to enhance modeling and analytics in auditing. A thorough review of the literature reveals the significance of formulating efficacious implementations that capitalize on these technologies to enhance the efficacy of audit outcomes.

In conclusion, MohanRaj Alenezi (2023) identifies the technical, legal, and ethical challenges that digital forensics faces in the context of auditing. He emphasizes the imperative for sustained research and development to address these challenges, particularly in the context of rapid technological advancements and the intricacies of data management in digital investigations.

3. DATA AND METHODOLOGY

Digital auditing focuses on assessing the reliability and accuracy of internal control and financial reporting systems, while automating analyses and processes and providing a more comprehensive data analysis.

This study aims to determine the perceptions of independent auditors affiliated to the Public Oversight Authority (POA) on digital auditing. In addition, it is tried to determine the perceptions of independent auditors on the factors that are important for increasing the quality of digital audit activities. In the study, 103 independent auditors in the list of independent auditors registered in Diyarbakır province on the Public Oversight Authority (POA) website between 2023-2024 were selected as the main mass.

Independent audit activities are based on the coordinated work of both internal and external auditors. The study ensures that the independent audit is carried out in the digital environment by drawing the data recorded in the digital environment into digital audit applications. In this way, the independent audit is developed in the digital environment, the process can be used economically, standardization can be achieved in the audit, and as a result of the application of audit procedures, much more realistic audit evidence is provided and working papers that can form the basis of the audit report are prepared. Digital audit is a tool that accelerates and facilitates the audit. The human factor is at the forefront in the audit. At the stage of reporting the audit, the audit result, which can be formed by the auditor's personal opinion, is a voluntary decision. The effect of digital audit for the formation of this opinion is limited to mediation. If digital audit can be used effectively and correctly, its contribution to the audit will be of great importance.

In the study, the survey method, which is one of the frequently used data collection methods within the field research method, was applied. In order to reach the entire main mass within the scope of the research, a face-to-face, e-mail and telephone survey was conducted to independent auditors in line with the telephone numbers and e-mail addresses of the institutions by using the Independent Public Oversight (KGK) system.

In order to determine the degree of understanding of the statements in the questionnaire and the reliability of the questionnaire form, pre-application was made to a few randomly selected independent auditors and the statements that could allow misunderstandings and contradictions between the questions were corrected.

The questionnaire consists of two parts. In the first part, statements on general information about independent auditors are asked. Some of the statements in this section are descriptive statements, while the other part is prepared according to a 5-point Likert scale. In the second part of the questionnaire, there are 22 statements prepared according to the 5-point Likert scale to determine the perspectives of the independent auditors participating in the survey on digital auditing. In this study, the Alpha coefficient (Crombach's Alpha) value was taken into consideration to investigate the level of reliability. With the Cronbach's Alpha value of 0.86 in the added value section of digital auditing, which consists of 22 statements, this value is considered to have a high degree of reliability in social sciences studies.

The hypotheses determined below in line with the statements determined in accordance with the scope of the study are as follows.

H1: There is a significant relationship between auditors' perspectives on digital auditing according to gender variable.

H2: There is a significant relationship between auditors' perspectives on digital auditing according to age variable.

H3: There is a significant relationship between auditors' perspectives on digital auditing according to the education level variable.

H4: There is a significant relationship between auditors' perspectives on digital auditing according to professional experience variable.

3.1. Analysis and Findings

Analyses have been tried to be carried out in line with the data obtained from the questionnaire form applied on independent auditors operating in the province of Diyarbakır. As a result of the answers given by the participant auditors to the statements

specified within the scope of the study, the relevant analysis results and interpretation of these results were tried to be made.

Table 1: Demographic Characteristics of the Participants

VARIABLES	n	%
GENDER		
Man	57	90,5
Woman	6	9,5
Total	63	100,0
AGE		
30 years old and under	7	11,1
31-40 years old	15	23,8
41-50 years old	17	27,0
51 years old and above	24	38,1
Total	63	100,0
PROFESSIONAL EXPERIENCE		
3 years and less	5	7,9
4-10 years	16	25,4
11-20 years	10	15,9
21 years and above	32	50,8
Total	63	100,0
EDUCATION LEVEL		
Undergraduate	41	65,1
Postgraduate	22	34,9
Total	63	100,0

Information on the age distribution of the auditors who participated in the study is given in Table 1. According to these data, 11,1% of the auditors participating in the research are 30 years old and below, 23,8% are between 31-40 years old, 27% are between 41-50 years old and 38,1% are between 51 and above. Of the auditors participating in the study, 90.5 per cent were male and 9.5 per cent were female. According to Table 1, 7.9% of the participants have less than 3 years of experience, 25.4% have 4-10 years of experience, 15.9% have 11-21 years of experience and 50.8% have 21 years or more of experience. In addition, it was determined that 65.1% of the auditors participating in the study had bachelor's degree and 34.9% had postgraduate education.

Table 2: Statistical Information on Auditors' Responses to the Statements of Work

QUESTIONS	N	Average	Standard Deviation
Digital auditing saves auditors from excessive data and information complexity.	63	3,46	1,090
Digital auditing provides the auditor with ease of work, saving time and financial means.	63	4,06	,759
Auditors have the opportunity to notice inconsistencies and deviations in data early through digital auditing.	63	3,89	,805
Auditors positively affect the national economy as they prevent deficiencies and omissions in internal audit through digital auditing.	63	3,75	,822
Digital auditing has led to an increase in the audit techniques used by auditors.	63	3,98	,924
Digital auditing has contributed to the specialisation of auditors' professional experience.	63	3,83	,908
Digital auditing helps auditors to make accurate financial reporting in the analysis of data and thus make the right decisions.	63	4,32	,618
Auditors help information users to make the right decisions through digital auditing.	63	3,97	,782
For auditors, digital auditing poses a threat to cyber security.	63	3,08	1,021
For auditors, digital auditing poses a threat to the reliability and confidentiality of corporate information.	63	2,94	1,105
Auditors need technological innovations that can prevent destructive risks in digital risks.	63	4,19	,435
Auditors will integrate and secure information systems more by using digital audits	63	3,81	,840

Digital auditing has reduced the need for the audit profession.	63	4,05	,633
The continuous increase in digital data has caused a change in the roles of auditors.	63	2,33	1,122
Digital auditing has reduced the use of excess audit evidence. Digital auditing makes it difficult to manage and store audit evidence.	63	3,24	1,187
Digital auditing facilitates auditors' subsequent audit activities.	63	2,81	1,105
Digital auditing improves auditors' audit quality.	63	2,57	1,187
Digital auditing has led to a reduction in auditors' workload.	63	4,14	,737
Digital auditing has required auditors to update their professional experience and expertise.	63	4,06	,914
Digital auditing is not a process that every auditor can perform. Because digital auditing cannot be done without training.	63	3,57	1,132
Digital auditing has reduced the need for the audit profession.	63	4,20	,800
The continuous increase in digital data has caused a change in the roles of auditors.	63	4,38	,771
Average	**63**	**3,665**	**,895**

Table 2 shows the statistical information regarding the auditors' responses to the study statements. As a result of the answers given by the participants to the statements prepared in accordance with the scope of the study, it is seen that these statements are generally agreed with. It is noteworthy that especially the statements containing negativity have low averages.

According to Table 2, the statement "Digital audit is not a process that every auditor can do. Because digital audit cannot be performed without training." The statement with the second highest mean is "Digital auditing helps auditors to make accurate financial reporting in the analysis of data and thus make the right decisions.", while the third highest mean is "Digital auditing has made it necessary to update the professional experience and experience of auditors.". Accordingly, the auditors participating in the research think that digital auditing activities, professional training is important and auditors should revise themselves to keep up with the developing information technologies.

According to Table 2, the statement "Digital auditing has reduced the need for the audit profession." has the lowest mean in the participants' working statements. The second lowest mean is the statement "Digital auditing makes it difficult to manage and store audit evidence." The third lowest mean is found in the statement "Digital auditing has reduced the use of excess audit evidence." In this direction, it shows that they think that digital auditing activities do not lead to the extinction of the auditing profession or a decrease in its need. In addition, auditors think that the most important issue of auditing activities, the collection of evidence and their evaluation processes, have not been reduced or made difficult to store with digital auditing.

3.2. Hypothesis Tests and Results of the Study

In this section, the hypotheses of the research and the results of these hypotheses are explained by tabulating the responses of the auditors participating in the survey. T-test and ANOVA test were conducted to test the study hypotheses.

Table 3: T-Test Results Regarding Gender Variable and Auditors' Perspectives on Digital Auditing

Gender	N	Average (X)	Standard Deviation	sd	T	p
Man	57	3,6667	,58878	24,471	-3,588	0,001
Woman	6	4,1667	,38925			

According to Table 3, the average score given by female participants to the working statements is higher than the average score given by male participants to the working statements. In addition, a statistically negative and significant relationship was found between the gender variable of the participants and the auditors' perspectives on digital auditing ($p<0.05$). According to Table 3, female auditors think that digital auditing has more positive reflections on audit activities than male auditors. Considering the above data, hypothesis H1 is accepted.

Table 4: ANOVA Analysis Results Regarding Age Variables and Auditors' Perspectives on Digital Auditing

Yaş	N	Average (X)	Standard Deviation	F	P
30 years old and under	7	4,2857	,75593	7,915	,000
31-40 years old	15	4,1333	,35187		
41-50 years old	17	3,5882	,50730		
51 years old and above	24	3,5000	,51075		
Total	63	3,7619	,58790		

Table 4 shows the determination of a statistically significant relationship between the age variable and the auditors' perspectives on digital auditing and statistical information about the age variable of the participants. According to Table 4, a statistically positive and significant relationship was determined between the age variable and the perspectives on digital auditing ($p<0.05$). Therefore, considering this data, H2 hypothesis is accepted. Tukey test was performed to determine between which groups the relationship was determined.

Table 5: Tukey HSD Test Results

(I) Age	(J) Age	Mean Differences (I-J)	Std. Dev	Sig.
30 years old and under	31-40 years old	-,15238	,23294	,914
	41-50 years old	,69748*	,22854	,017
	51 years old and above	,78571*	,21860	,004
31-40 years old	30 years old and under	-,15238	,23294	,914
	41-50 years old	,54510*	,18027	,019
	51 years old and above	,63333*	,16750	,002
41-50 years old	30 years old and under	-,69748*	,22854	,017
	31-40 years old	-,54510*	,18027	,019
	51 years old and above	,08824*	,16132	,947
51 years old and above	30 years old and under	-,78571*	,21860	,004
	31-40 years old	-,63333*	,16750	,002
	41-50 years old	-,08824	,16132	,947

Table 5 shows the Tukey test conducted to determine the relationship between the age variable of the participants and their perspectives on digital auditing. According to Table 5, it is determined that there is a relationship between auditors in the middle age group and auditors with advanced age. In addition, auditors in the middle age group think that digital auditing has a positive effect on audit activities.

Table 6: T-Test Results Regarding Level of Education Variable and Auditors' Perspectives on Digital Auditing

Education Level	N	Average (X)	Standard Deviation	sd	t	p
Undergraduate	41	3,6452	,66073	55,405	-1,562	,124
Postgraduate	22	3,8750	,49187			
Total	63	3,7601	,5763			

According to Table 6, the average score given by the participants with postgraduate education level to the study statements is higher than the average score given by the participants with undergraduate education level to the study statements. In addition, no statistically significant relationship was found between the educational level of the participants and the auditors' perspectives on digital auditing ($p>0.05$). Considering the above data, hypothesis H3 is rejected.

Table 7: ANOVA Analysis Results Regarding Professional Experience Variable and Auditors' Perspectives on Digital Auditing

Professional Experience	N	Average (X)	Standard Deviation	F	P
3 years and less	5	4,4000	,89443	9,297	,000
4-10 years	16	4,1250	,34157		
11-20 years	10	3,3000	,48305		
21 years and above	32	3,6250	,49187		
Total	63	3,7619	,58790		

Table 7 shows the determination of a statistically significant relationship between the professional experience variable and the auditors' perspectives on digital auditing and the statistical information of the participants regarding the professional experience variable. According to Table 7, a statistically positive and significant relationship was determined between the professional experience variable and the perspectives on digital auditing ($p<0.05$). Therefore, considering these data, hypothesis H4 is accepted. The relationship between the groups was determined by performing the Tukey test.

Tablo 8: Tukey HSD Test Results

(I) Professional Experience	(J) Professional Experience	Mean Differences (I-J)	Std. Dev.	Sig.
3 years and less	4-10 years	,27500	,25443	,702
	11-20 years	1,10000*	,27200	,001
	21 years and above	,77500*	,23881	,010
4-10 years	3 years and less	-,27500	,25443	,702
	11-20 years	,82500*	,20019	,001
	21 years and above	,50000*	,15205	,009
11-20 years	3 years and less	-1,10000*	,27200	,001
	4-10 years	-,82500*	,20019	,001
	21 years and above	-,32500	,17991	,281
21 years and above	3 years and less	-,77500*	,23881	,010
	4-10 years	-,50000*	,15205	,009
	11-20 years	,32500	,17991	,281

Table 8 shows the Tukey test conducted to determine the relationship between the participants' professional experience variable and their perspectives on digital auditing. According to Table 8, it is determined that there is a relationship between auditors with low professional experience and auditors with high professional experience. In addition, auditors with low professional experience think that digital auditing has a positive effect on audit activities.

4. CONCLUSION AND IMPLICATIONS

Digital audit is an approach to improving audit processes using technology and data analytics. Especially with cloud technology, it provides its clients with the ability to connect worldwide in real time, providing more value and deeper analyses. While digital audit can make businesses more effective and efficient, it also brings new risks and responsibilities. Therefore, it is important to consider these risks when developing digital audit strategies.

Digital audit activities aim to evaluate the financial status, activities and business processes of the enterprises from an objective perspective. It also provides a customised advisory service that supports businesses in achieving their financial objectives. The creation of reflections of physical assets with the help of computer technologies increases the benefits of auditing by uploading financial and non-financial data of enterprises and their stakeholders to the digital environment simultaneously. However, digital audit expertise, which recognises the entity and its environment, including the entity's internal control, applies analytical procedures, observation and audit procedures for risk assessment procedures and transfers them to management, is becoming increasingly important.

This study was carried out to determine the opinions of auditors who have been and are continuing their professional activities in Diyarbakır province on digital auditing. As a result of the study, the opinion that the advantages of digital auditing have a high degree of contribution to the profession was dominant. In addition, the importance of professional training in the realisation of audit procedures was emphasised.

As a result of the study, the following issues were emphasised in line with the opinions of auditors. Digital auditing provides many advantages to groups and businesses that have adopted auditing as a profession. One of these advantages is to accelerate audit processes by using automation and data analytics. This saves auditors more time and allows them to focus on more complex problems. It increases the accuracy of the audit process by reducing manual errors. Thus, data analytics provide auditors with the ability to quickly and accurately analyse larger data sets. Digital auditing offers auditors the opportunity to gain a deeper understanding of all operations and financial condition of the business. This enables a more comprehensive risk assessment and the development of more effective audit strategies. Digital audit tools provide auditors with the ability to monitor the entity's financial condition and business processes in real time. This will enable early identification of potential problems and rapid intervention.

Digital auditing provides auditors with the ability to transform complex data sets into understandable and user-friendly reports. This enables business leaders to more easily understand audit findings and make informed decisions. Finally, digital auditing allows for a reduction in the use of paper and offers an audit process that has a lower harmful impact on the environment. These advantages show why digital auditing is so valuable for businesses. However, digital auditing also brings

new challenges, particularly in the areas of data security and privacy. Therefore, it is important to consider these risks when developing digital audit strategies.

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THE IMPACT OF VIX RISK APPETITE INDEX ON THE DYNAMICS OF TIME-VARYING MARKET EFFICIENCY IN BORSA ISTANBUL

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ABSTRACT

Purpose – The purpose of this research is to investigate the time-varying efficient market structure of the Borsa Istanbul (BIST-100) index at a daily frequency from 1988 to 2024, as well as to examine the impact that the risk appetite index (VIX) has on this structure.
Methodology – A vector autoregression (VAR) model and a time-varying variance ratio test are used in this research project to evaluate the effectiveness of the market and its time-varying dynamic development.
Findings – According to the findings, market efficiency changes over time due to domestic and global political issues. This suggests that market efficiency is not static but rather dynamic. The market had a low level of efficiency between the years 1988 and 1995, then moved to a semi-efficient form between 1995 and 2002, and then reached a strong form between 2002 and 2010, despite undergoing fluctuations. Worldwide crises caused these fluctuations. For the period spanning from 2010 to 2020, the most significant degree of efficiency and the most efficient flow of information is shown. On the other hand, following 2020, market efficiency exhibited a complicated pattern, alternating between semi-efficient and strong forms.
Conclusion – Risk appetite shocks favorably impact short-term market efficiency but adversely impact market efficiency over the long term. In this context, information asymmetry and irrational investment conduct seem to contribute to a gradual decline in market efficiency. The research contributes to the existing form of knowledge by providing a methodological framework that can be used to analyze the development of dynamic market efficiency. Furthermore, the results shed light on the need for policymakers to pursue structural changes based on behavioral finance to maintain market efficiency.

Keywords: Efficient Market Hypothesis, Time-Varying Variance Ratio, Risk Appetite, Borsa Istanbul, Market Shocks.
JEL Codes: F37, G02, G32

1. INTRODUCTION

Two essential societal paradigms, based on the ideals of freedom and equality, have significantly influenced the development of the modern political economy. In Western nations founded on liberty, a fundamental behavioral human archetype has been required to shape economic theories and institutions. Consequently, the rational individual, expected to make logical economic choices influenced by the Aristotelian rationalism of Ancient Greece, was chosen as the archetype.

Hypotheses concerning economic and financial markets (money and capital) were created based on the assumption of rational human conduct. The optimal market structure is considered a totally competitive marketplace, which is presumed to minimize costs and optimize returns by allowing unrestricted entry and exit from the market (Markowitz, 1952; Sharpe, 1964; Lintner, 1965; Mossin, 1966). However, observing inconsistencies in establishing perfect competitive conditions in economic and financial markets throughout the 1950s resulted in the birth of finance as a separate discipline from economics (Mossin, 1966). Moreover, observations and theoretical models of financial markets have relied on an investor profile presumed to make rational judgments (Fama, 1965). In this context, modern portfolio theory, the capital asset pricing model, and the efficient markets hypothesis were respectively developed under the assumption of rational decision-making by financial actors and perfectly competitive market conditions (Markowitz, 1952; Sharpe, 1964; Lintner, 1965; Mossin, 1966).

According to the Efficient Market Hypothesis (EMH), financial markets are structured to quickly and completely include all available information into pricing, therefore reducing the probability of investors obtaining anomalous returns (Fama, 1965). Fama classified the hypothesis in his first study by looking at financial market efficiency in three basic types: weak, semi-strong, and strong (Fama, 1970). This theory holds that stock prices follow a random walk, hence making future prices impossible to forecast only from past data (Samuelson, 1965).

Figure 1. Efficient Market Types

Source. Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. Journal of Finance, 25(2), 383-417.

Nevertheless, the validity of this concept has been a subject of extensive discourse within the academic literature on finance for the last five decades. The extant literature has progressively incorporated critiques of the Efficient Market Hypothesis (EMH), claiming its occasional invalidity and the potential for market structure to evolve over time. Grossman and Stiglitz (1980) contended that a perfectly efficient market structure is unfeasible. They asserted that one of the core assumptions of perfect competition, specifically that the costs of acquiring financial information are negligible, is invalid. Shiller (1981) asserted that the significant volatility in market prices cannot be ascribed to dividend policy and payments that may change.

Several studies in the literature have suggested that market efficiency may vary over time, resulting in the emergence of anomalies at specific periods. Lo and MacKinlay (1988) provided empirical evidence demonstrating that stock prices do not adhere to a completely random walk. Basu (1977) posited that firms with low price/earnings ratios outperform the market as a whole, underscoring the notion that distinct stocks may exert disparate impacts on developing an efficient market structure. Moreover, he proposed that the efficient market structure may undergo dynamic alterations over time.

This paper analyzes the dynamic time-varying efficient market structure of the BIST-100 index on Borsa Istanbul from 1988 to 2024. The objective is to examine the impact of risk appetite on the variation in market efficiency, utilizing fundamental methodologies from existing research. This method has examined the evolution of the efficient market structure over time and its impact on investor behavior. The study has used the time-varying variance ratio test to identify the time-varying efficient market framework. The impact of risk appetite on the efficient market structure is examined using impulse-response functions developed from the VAR (Vector Auto Regressive) technique. Risk appetite phenomena are used to test the time-varying Efficient Market Hypothesis, which is driven by its assumptions and goals. The efficient market hypothesis says that financial markets should concentrate on average returns rather than remarkable profits to be predictable.

The precise evaluation of average returns relies on optimal risk assessment. Considering the prevailing trends in financial markets, characterized by diminished trading hours and substantial surges in trade volume, analyzing the time-varying Efficient Market Hypothesis in conjunction with varying risk appetite is likely to enrich the current literature, both theoretically and practically substantially.

2. LITERATURE REVIEW

The Efficient Market Hypothesis (EMH) holds that market prices fairly reflect all the readily available information. Investors cannot so routinely generate returns above average without incurring more risk. Initially proposed by Fama (1965), this hypothesis has evolved into a fundamental theoretical framework in financial economics and has been extensively examined

by academics covering the spectrum of market conditions. In his 1991 paper, Malkiel underlined the need for behavioral finance as a field of anomalies and objections related to effective markets. According to him, market abnormalities originate from cognitive distortions and herd mentality. According to his argument, one might be unable to assume the Efficient Market Hypothesis is legitimate. Theoretically, the Efficient Market Hypothesis has been categorized into weak, semi-strong, and strong variants, so many studies have been done in the corpus of current knowledge. Beechey, Gruen, and Vickery (2000), who underline that the theory relies on logical behavior and the quick circulation of financial information, capture this category. Conversely, the Efficient Market Hypothesis could potentially link to various facets of diverse financial markets. When Pesaran (2005) investigated the Efficient Market Hypothesis in commodities markets, he discovered events wherein actual data deviated from theoretical forecasts. Geopolitical factors explained the differences. Lo (2005), on the other hand, contended that the Efficient Market Hypothesis fits behavioral finance ideas. Later, Lo (2007) presented a more dynamic substitute for the Efficient Market Hypothesis: The Behavioral Market Hypothesis (BMH). Lo achieved these results by incorporating behavioral finance and employing advanced econometric models to scrutinize market anomalies, thereby easing the rigorous assumptions of the Efficient Market Hypothesis. According to research done by Pesaran in 2010, macroeconomic shocks have an effect on how predictable the market is. This conclusion is in line with the ideas behind the efficient market hypothesis (EMH). Sensoy (2013) researched efficiency dynamics in Middle Eastern and North African domestic markets for six years. The research concentrated on identifying the time-varying degrees of efficiency in various marketplaces. In their 2012 study of the effectiveness of derivatives markets, Sheikh and Noreen say that regulatory frameworks and market dynamics affect market efficiency. Sensoy et al. (2015) also offer a new way to measure market efficiency that is based on how inefficient the European Union (EU) stock markets change over time. Ensoy et al. (2015), on the other hand, show interesting results from a permutation entropy study of how predictability changes in Islamic and traditional capital markets. Although they underline the existence of delays in integrating new information into pricing, Vashishtha and Hooda (2015) claim that Indian stock markets show semi-efficiency. Alexandra Gabriela (2015) claims that achieving strong-form efficiency in markets marked by high volatility is somewhat difficult. Time series modeling, regression analysis, and event investigations are the main tools of EMH research. These are the most commonly applied techniques. Furthermore, the field of research on the Efficient Market Hypothesis has grown to include asset types other than equity-based ones like bonds, derivatives, and commodities. This research indicates that the specific market structure under consideration might affect the degree of market efficiency. Well-known markets like the United States and Europe often exhibit modest to poor efficiency trends. On the other hand, structural limitations, poor rules, market mix, investor behavior, and outside pressure characterize developing markets. Each of these components contributes to producing a weak-form efficiency situation. The Efficient Market Hypothesis (EMH) is still a fundamental idea for understanding market dynamics despite considerable literature criticism. The increasing evidence of market anomalies and departures from market efficiency underlines the need for a more thorough investigation of these occurrences. In the future, researchers should look into how market structure affects investor behavior, make methods better, and use ideas from behavioral finance to test the Efficient Market Hypothesis (EMH), which would add to their current approach. This work studies efficient market structure in a dynamic rather than a static form.

Still a fundamental concept in financial economics, the Efficient Market Hypothesis (EMH) is under continual research via empirical analysis. New studies released after 2020 have contributed to the debate by looking at market efficiency in different contexts, including the role of behavioral finance, the impact of global crises, and the limitations of standard efficiency models, all inside the framework of this literature review that summarizes the findings of current studies to help to grasp the evolution of market efficiency in the modern financial environment. Emphasizing that market efficiency is not fixed but dynamic, Gu (2023) probes the dynamic relationship between EMH and behavioral finance. This study introduces the Adaptive Market Hypothesis (AMH) to align evolving investor behavior with traditional EMH. Furthermore, Woo et al. (2020) look into strange things that happen in the stock market and discover that different types of assets have different levels of efficiency, which limits how widely EMH can be used.

Li et al. (2021), specifically in reaction to financial shocks, investigate how market efficiency varies with economic circumstances. Their results imply that markets show brief inefficiencies during unstable times before returning to equilibrium.. Gu (2023) notes disparities in pricing adjustments as the study looks at market responses to events connected to pandemics.

Developed markets showed a faster return to efficiency than emerging markets, which show ongoing volatility. Chen et al. (2021) conducted a similar study in which they found that information dissemination was crucial in restoring efficiency; markets changed as investors were more transparent about economic consequences. By analyzing how the pandemic long-term influenced financial markets, Wang et al. (2022) extend this research. Their studies verify that investor attitudes and outside uncertainty influence dynamically shifting efficiency. These results confirm that market efficiency is context-dependent rather than absolute. Zhang and Li (2022) highlight the methodological hurdles in EMH research, noting variations in econometric models and data selection. Their investigations use better theoretical knowledge of behavioral finance to provide a better sampling of actual market behavior. Liu et al. (2023) also investigate how algorithmic trading affects market efficiency, contending that while high-frequency trading could improve price discovery, it might also lead to transient

inefficiencies. Recent studies reveal that EMH offers a basic framework but does not thoroughly understand the dynamics of the financial markets. Psychological factors, outside shocks, and technical developments affect the various degrees of market efficiency. The forthcoming research should emphasize enhancing EMH models to integrate algorithmic and behavioral trading points of view.

3. PURPOSE, IMPORTANCE AND METHOD OF THE RESEARCH

This research seeks to assess the impact of risk appetite on establishing a time-varying efficient market structure in Borsa Istanbul from 1988 to 2024. The study will be conducted in two stages. In the first phase of the inquiry, the time-varying efficient market structure will be identified daily during the specified observation period. This will be accomplished by categorizing it as strongly efficient, semi-efficient, or weakly efficient.

In the subsequent phase, the impact of the VIX risk appetite index on the efficient market structure will be quantified. The study's most significant outcome is assessing the dynamic, time-dependent, efficient market structure. Analyses of efficient market structures in financial markets are generally performed statically over a defined observation period. This research dynamically employs the "variance ratio" test using a "rolling window" technique to assess the efficient market structure. An "impulse-response" research is used to assess the impact of risk appetite on forming an effective market structure. An analytical examination of the used research methodologies is vital in this context.

The time-varying variance ratio test assesses time-varying market efficiency, with the variance ratio adjusted through a temporally determined sliding window. The rationale behind the sliding windows equations is founded on the identical methodological framework employed in the time-varying Granger causality test and the identification of time-varying price bubbles utilizing right-sided equations (Shi et al., 2020). Formula One signifies a time-dependent variance ratio (Andrew & MacKinlay, 1988; Charles & Darne, 2009).

$$R(k) = k \cdot \frac{\text{Var}(X_t - X_{t-1})}{\text{Var}(X_t - X_{t-k})} \quad (1)$$

Xt: Logarithmic price or return at time t.
k: Delay length (default k=2)
Var: Variance of the relevant differences.

The Z-Statistic is used to determine whether VR is significantly different from 1:

$$Z = \frac{VR(k)-1}{\sqrt{\text{Var}\left(VR(k)\right)}} \quad (2)$$

Here:

$$Var\left(VR(k)\right) = \frac{2(2k-1)(k-1)}{3kN} \quad (3)$$

N: The number of observations within the window.

According to the equations obtained, it is essential whether the VR variable is less than 1 to determine whether the market structure is effective in the relevant observation:

Weak Efficiency (Random Walking): | VR − 1| < ϵ, where ϵ is a small tolerance (e.g., ϵ = 0.05). (4)

Average Rotation (Semi-Effective): VR < 1 (5)

Trend Formation (Strong Active): VR > 1 (6)

The model measuring the time-varying efficient market structure proposed by Andrew and MacKinlay (1988) will be used (See Equation 7).

$$VR = \frac{\sigma_q^2}{\sigma_1^2 \cdot q} \quad (7)$$

The formula assesses the efficient market structure at a given time. Utilizing the formula, we can provide a more detailed explanation.

$1. \sigma q2 \sigma_q^2 \sigma q2: Multi\ yields\ variance$

$$\sigma_q^2 = \text{Var}\left(\sum_{i=0}^{q-1} r_{t+i}\right)$$

$q - calculated\ by\ q\ period$

$2.\sigma_1^2: Single\ Period\ variance$:

$\sigma_1^2 = \text{Var}(r_t)$

$daily\ yields\ varaiance.$

$3.q: Combined\ time\ interval$:

$q = 5\ days.$

$4.Varianci\ Ratio\ Test$

$$VR = \frac{\sigma_q^2}{\sigma_1^2 \cdot q}$$

This formula tests whether the variance scales directly proportionally with time over q periods.5. Random Walk Hypotesis:

Assuming that markets align with the random walk hypothesis, the VR value is predicted to approximate 1.

$$VR \approx 1$$

The analysis of risk appetite shocks on the efficient market structure will occur in the second part of the study, using impulse-response functions derived from VAR equations as the secondary method (Sims, 1980; Hamilton, 1994).

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_p Y_{t-p} + \epsilon_t \; n \quad (8)$$

Y_t: Dependent variable at time t,
$A_1, A_2, \ldots, A_p$: Coefficients of the model,
$Y_{t-1}, Y_{t-2}, \ldots, Y_{t-p}$: Values of the dependent variable in past periods,
ϵ_t: Error term (random error).

$$\text{IRF(h)} = \frac{\partial Y_{t+h}}{\partial \epsilon_t} \quad (9)$$

IRF(h): Impulse-Response Function for h period,
∂Y_{t+h}: derivative of the variable at time t + h,
$\partial \epsilon_t$: derivative of the shock at time t.

4. DATASET

Data comes from two factors in the research. The time-varying efficient market structure is assessed using Borsa Istanbul's BIST. The research employs two distinct variables that compose the data set. The daily time series of the BIST-100 index closing prices for Borsa Istanbul from 03/01/1988 to 15/11/2024 is used to assess the time-varying efficient market structure. The VIX risk appetite-fear and volatility index is used daily from March 1, 1990, to November 15, 2024, to assess the structural effects of risk appetite on the time-varying efficient market framework. From 1988 to 1990, an impulse-response study was conducted on January 3, 1990, with no VIX index.

Bist-100 index closing prices from 03/01/1988 to 15/11/2024. From March 1, 1990, to November 15, 2024, the VIX risk appetite-fear and volatility index is used daily to assess risk appetite's structural effects on the time-varying efficient market framework. Without a VIX index from 1988 to 1990, an impulse-response study was performed on 03.01.1990.

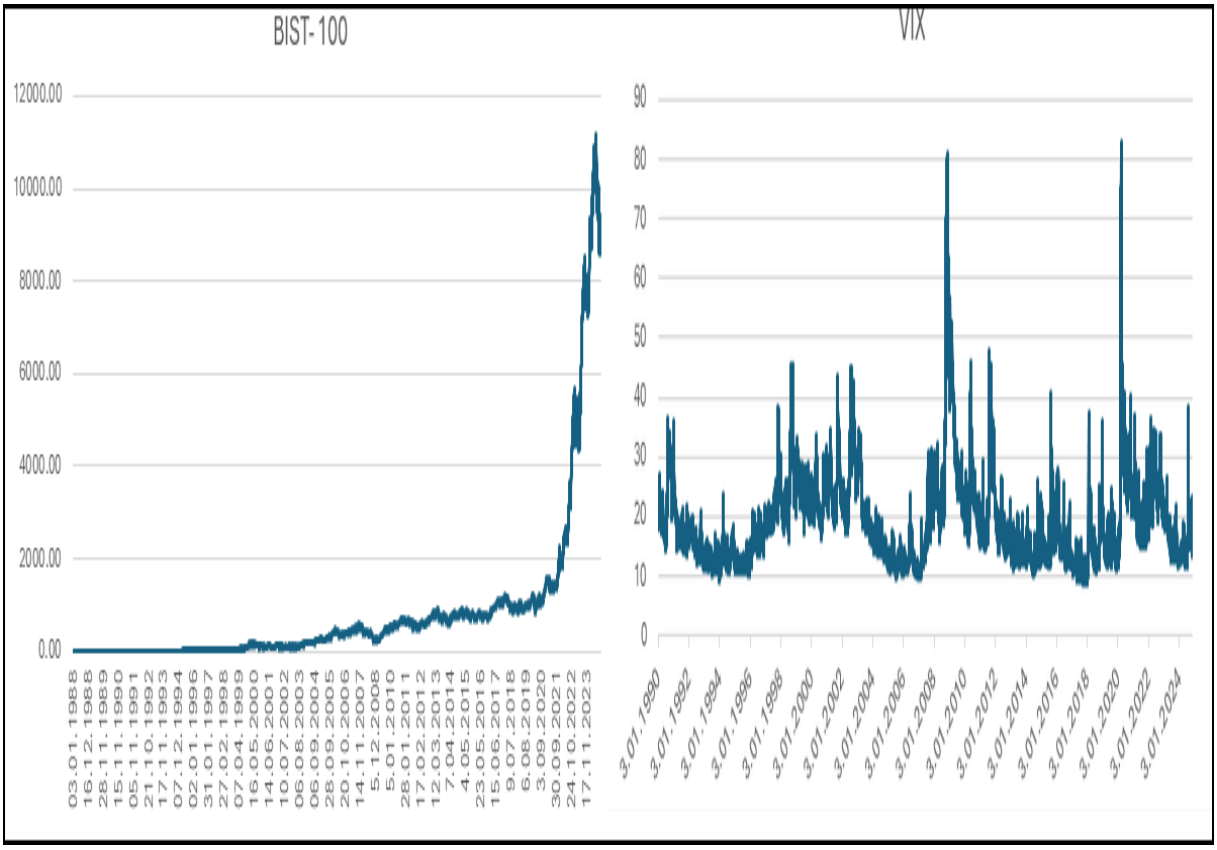
Bist-100 exhibits high variability and extreme non-normality due to significant skewness and kurtosis, likely influenced by outliers or dramatic market shifts: Rolling Variance Ratio, the most stable variable with minimal skewness and kurtosis closer to normal.VIX shows signs of extreme market volatility, reflected in its high skewness and kurtosis (See Table 1).

Table 1: Data Set and Descriptive Statistics

VARIABLES	BIST_100	VIX	ROLLING VARIANCE RATIO
FREQUENCY	Daily	Daily	Daily
PERIOD	03.01.1988-15.11.2024	3.01.1990-15.11.2024	03.01.1988-15.11.2024
SOURCE	investing.com	investing.com	Calculated by the Author
MEAN	9451954.00	1951505.00	2012107.00
MEDİAN	4319000.00	1769000.00	2030000.00
MAXİMUM	11172.75	8269000.00	3400000.00
MİNİMUM	0.23	9140000.00	0.24

STD. DEV.	1888179.00	7873927.00	0.48
SKEWNESS	3560529.00	2206062.00	-0.16
KURTOSİS	1558735.00	1168591.00	2755660.00
JARQUE-BERA	70283.38	31894.35	5395034.00
PROBABİLİTY	0.00	0.00	0.00
SUM	7623001	16227.64	157388.9

Figure 2: Variables

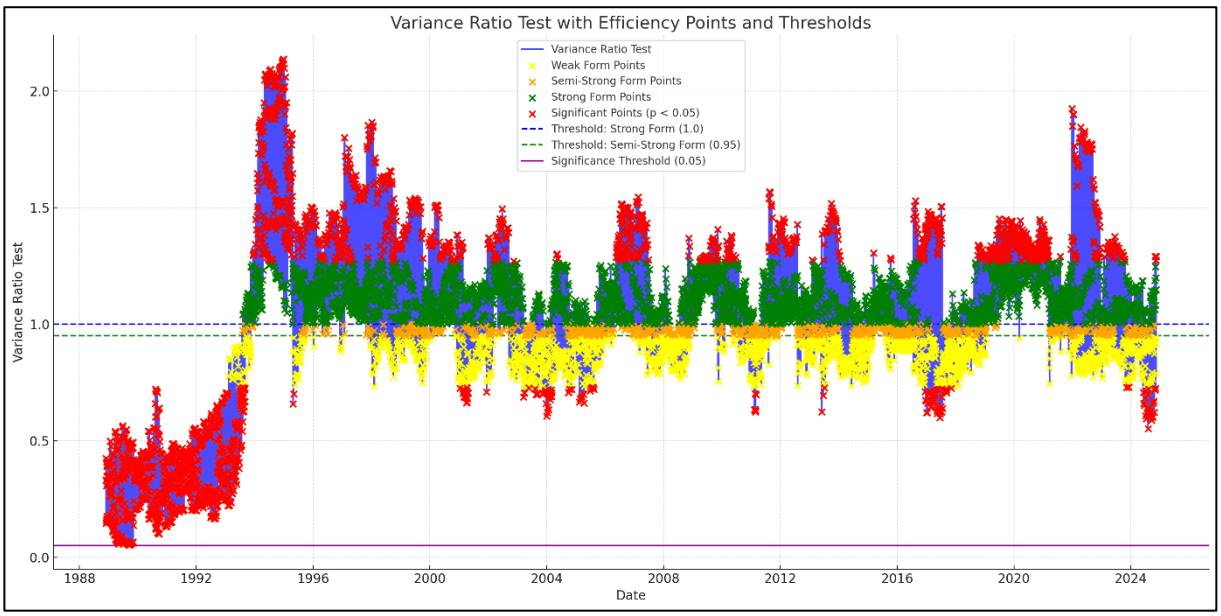


Source: investing.com database

5. FINDINGS OF THE RESEARCH

The established methodological framework utilizes the variance ratio test to evaluate the time-varying efficiency of the market structure. Additionally, the Z-statistic indicates the periods during which the variance ratio test is statistically significant. The computations were executed in Excel, and the results were transposed to a graph. This graph depicts the periods during which Borsa Istanbul showed weak, semi-strong, and strong efficiency. The cutoff or threshold value for the variance test is 1. Values exceeding 1 signify market efficiency; values ranging from 0.95 to 1 denote a semi-efficient form, while values below 1 represent a weak form. The significance level for the probability value is 0.05 (See Figure 3).

Figure 3: Time-Varying Effective Market Structure Analysis Heat Map Results



The efficiency form and significance findings should be analyzed about the relevant periods. The interval from 1995 to 1998 is typically marked by diminished market efficiency. Nonetheless, the outcomes are generally statistically significant at the 0.05 threshold. The results from this era suggest that historical prices inadequately represent market prices, potentially enabling investors to achieve excessive returns via fundamental and technical analysis.

From 1995 to 2002, Borsa Istanbul underwent a notable transformation in market efficiency, progressing from a weak to a semi-efficient state. The significance of the findings increased concurrently. The previous result indicates that publicly available information has begun to be incorporated into prices. Nevertheless, it implies that information-acquisition methods could produce significant benefits, encompassing basic research, technical analysis, and insider trading.

Between 2002 and 2010, although there was a broad transition to the strong form, the market had a variable structure, intermittently oscillating between the semi-efficient and weak forms. It can be argued that the 2008 global financial crisis precipitated this unpredictable structure. Moreover, the results are mostly significant. On the other hand, throughout this time span it become more difficult to get excess returns.

Over the decade from 2010 to 2020, the market showed a statistically significant movement towards the triple efficient model. Diminished market efficiency from the Federal Reserve's gradual cut of its bond-buying program in 2013 and growing financial instability in emerging market nations complicated the creation of excess anomalous returns.

From 2020 until the present, Borsa Istanbul's market efficiency has shown a several-sided structure. During this period, frequent shifts among strong, semi-strong, and weak forms of efficiency have been noted, with the semi-strong type being the most dominant. The importance levels have been less pronounced compared to other periods. These observations yield the subsequent conclusions as follows:

From 1988 to 1995, the era was marked by inefficiency in form and an unstable market structure.

A semi-efficient form marked the interval from 1995 to 2002, resulting in the attainment of market equilibrium.

The interval from 2002 to 2010 was the emergence of strong-form efficiency and a partially chaotic market structure.

The decade from 2010 to 2020 was defined by the subsequent characteristics: The era marked by the highest prevalence of information efficiency was defined by strong form efficiency.

The timeframe from 2020 until the present is a unique era. The structure is intricate, demonstrating shifts between semi-efficient and strong-form efficiency.

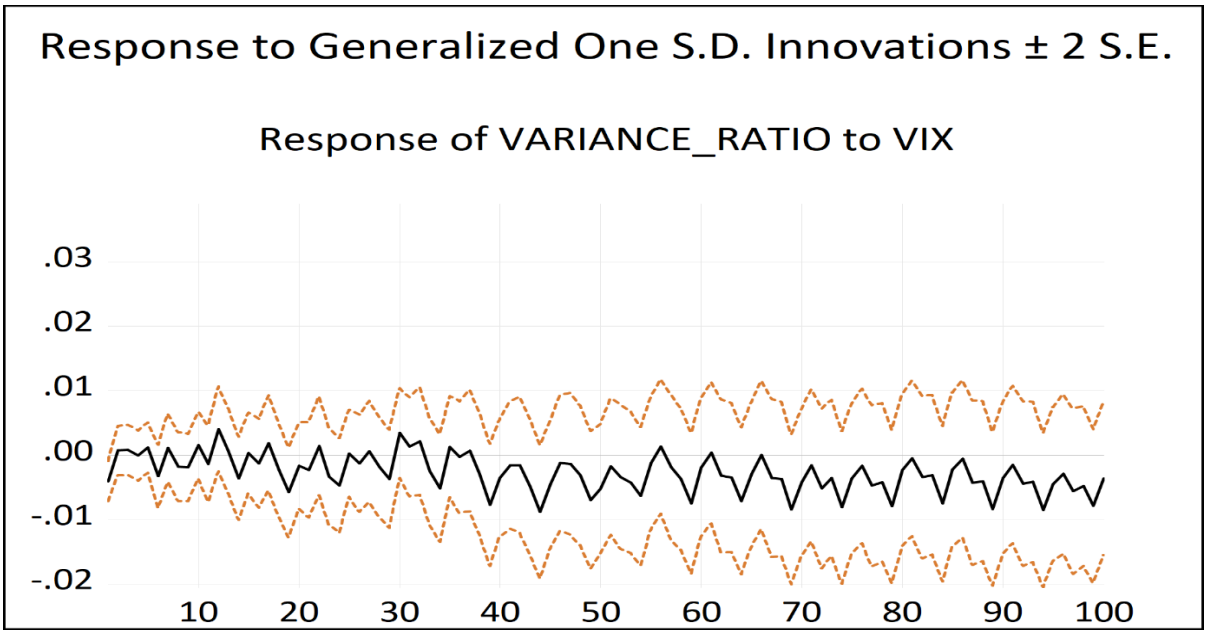
This section analyzes the structural impacts of risk appetite on establishing an efficient market structure. A vector autoregression (VAR) model was developed to analyze the relationship between the time-varying variance ratio test and the Chicago Board Options Exchange (CBOE) Volatility Index (VIX) from 1990 to 2024. The model structure was examined up to the 55th lag to fulfill the assumptions associated with the VAR model. The analysis using Eviews 12 reveals that the model remains stable at lag 50, exhibiting no autocorrelation or variance problems (See Table 2). Considering that the dataset

comprises daily observations, the lag length is justifiable, with lag 55 equating to roughly lag two at the monthly frequency. Given the existing theoretical framework, it is prudent to dismiss the premise of normality. Lütkepohl (2005) asserts that the assumption of normality in VAR models is not essential for the efficiency of estimators and the precision of confidence intervals, provided that the model parameters are consistently estimated using the least squares approach. Departures from the normality of error terms generally exert a negligible impact on the outcomes of the impulse-response analysis. According to Stock and Watson (2001), for high sample sizes, the accuracy of parameter estimations and derivative analyses (e.g., impulse-response functions) is preserved even in the absence of the normalcy requirement for error terms impulse-response functions) is preserved even in the absence of the normalcy requirement for error terms.

Table 2: İmpluse-Response Test Results

TEST	VALUE	RESULT
AR Test	0,99-0,79	Model is stabil
Oto-Correlation	0,2683	No oto-correlation at 0,05
Heteroscedasticity	0,2277	No Heteroscedasticity at 0,05

Figure 4: Impulse- Response Resutulr (VIX Shocks for Variance Rate)



The findings of the impulse-response study demonstrate that the market efficiency structure's positive reactions to risk appetite shocks persistently oscillate between days 2 and 66. In contrast, the reactions persist in declining after day 66. The days demonstrating affirmative reactions are days 2, 3, 5, 7, 10, 12, 13, 15, 17, 22, 25, 27, 30, 31, 32, 35, 37, 56, 61, and 66. The findings suggest that the risk pricing by investors in Borsa Istanbul is not rational nor consistent, exhibiting knowledge asymmetry. This illogical pricing disrupts the efficient market framework and aligns the stock market more closely with a weakly efficient model. This outcome typically corresponds with the results of efficient market analysis for other emerging market economies.

6. CONCLUSION AND IMPLICATIONS

This research analyzes the dynamic, efficient market framework of the Borsa Istanbul (BIST-100) index from 1988 to 2024. Furthermore, it examines the impact of structural shocks on market efficiency, as represented by the risk appetite index (VIX). This study utilizes the time-varying variance ratio test and impulse-response functions developed from the vector autoregression (VAR) model.

The study's findings indicate the existence of varied weak, semi-strong, and strong-form efficient market systems in Borsa Istanbul over different times. Between 1988 and 1995, the weak form of market efficiency increased the probability of investors obtaining excess profits by exploiting past price variations. Following 1980, economic liberalization initiatives began, driven by the ascendance of right-wing ideology, a novel public administration approach, and the advent of supply-side economics, resulting in the deregulation of financial markets.

With the 1994 economic crisis, the depreciation of the Turkish lira, rising inflation, and limited access to financial information, the market remained superficial and volatile due to weak regulation, lack of strict financial laws, and diminished investor confidence.

The 1994 economic crisis, the declining value of the Turkish lira, rising inflation, and limited access to financial information all made the market shallow and unstable because of weak regulation, a lack of strict financial laws, and a lack of trust from investors. Borsa Istanbul changed from an inefficient market to a semi-efficient market between 1995 and 2002. This was due to more publicly available information being used to set index prices. The 1999 Marmara Earthquake and the 2001 Turkish Banking Crisis caused the efficient market system to be unstable at times during this time.

From 2002 to 2007, the capital finance account, bolstered by strong economic development and increased short-term portfolio inflows, was essential in the market's evolution towards a resilient state. From 2002 to 2010, although the market approached a robust form, the systematic and systemic risks stemming from global financial changes led the stock market to revert to a semi-efficient and weak form structure at some intervals. The crisis led to the formation of a volatile structure. The economic reforms implemented under Türkiye's relative political stability enhanced market efficiency; external shocks, such as the 2008 Global Financial Crisis, adversely impacted the market's efficiency framework. The period from 2010 to 2020 was characterized by the following attributes: The period characterized by the greatest prevalence of information efficiency was defined by significant form efficiency. The period from 2020 until the present is a distinctive term. The structure is complex, illustrating transitions between semi-strong and strong-form efficiency.

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FACTORS THAT INFLUENCE THE QUALITY OF COOPERATIVE FINANCIAL REPORTS IN OGAN KOMERING ILIR REGENCY, INDONESIA

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ABSTRACT

Purpose- The factor that can encourage cooperatives to become better is good quality financial reports. The quality of financial reports is the extent to which the financial reports presented show correct and honest information. The quality of financial reports is useful as a basis for making economic decisions for interested parties. This research aims to determine the influence of education level, understanding of accounting, internal control systems, coaching methods, and information technology on the quality of cooperative financial reports in Ogan Komering Ilir Regency, South Sumatra.

Methodology- This type of research is quantitative research. Data obtained through a survey of the Management and Management of the Maju Jaya Cooperative, Mekar Abadi Mandiri Cooperative, Sido Makmur Cooperative, Tanjung Gading Cooperative, and Senuling Jaya Cooperative. The data analysis techniques used are Validity Test, Reliability Test, Multiple Linear Regression Test and Hypothesis Test.

Findings- The results of the research show that the level of education, understanding of accounting, use of information technology, internal control structure, and cooperative management influence the quality of cooperative financial reports in OKI Regency.

Conclusion- Based on the results of analysis and testing regarding the influence of education level, understanding of accounting, use of information technology, internal control, and cooperative management on the quality of cooperative financial reports in OKI district, it can be concluded that all the factors mentioned above have positive effects on the quality of cooperative financial reports.

Keywords: Education level, internal control systems, use of information technology, quality of financial reports.
JEL Codes: G32

1. INTRODUCTION

A cooperative is a business entity consisting of people or cooperative legal entities that bases its activities on cooperative principles as well as being a people's economic movement based on the principle of kinship (RI Law No. 25 of 1992 Article 1). Indonesian Cooperatives are people's economic organizations with a social character, consisting of people or cooperative legal entities which constitute an economic structure as a joint venture based on the principle of kinship. Cooperatives are one of the oldest financial institutions in Indonesia. According to Law Article 3 No. 9 of 2019 Cooperatives aim to advance the welfare of members in particular and society in general and participate in building regional economic order in order to create an advanced, just and prosperous society based on Pancasila and the 1945 Constitution of the Republic of Indonesia. Cooperatives are growing in Ogan Komering Regency Ilir (OKI) South Sumatra has quite a large number of cooperatives, as data from the Department of Cooperatives, SMEs and Industry recorded as many as 543 units, with 395 active units (72.74%). This cannot be separated from the role of the regional head, namely the Regent of OKI, who was given an award because he was considered successful and consistent in encouraging cooperatives and MSMEs in OKI to advance in class. In the online news Sumatra Bisnis.com on Monday, August 14, 2023, it was written that several programs implemented by Iskandar, namely One Village One Cooperative, revitalization of smallholder oil palm plantations reached 21,000 hectares since 2017, and the highest realization of KUR distribution in South Sumatra reached 92.8 percent or worth IDR 1,425 billion. Not only that, the OKI Regency Government also opens access to cooperative and MSME products to enter the modern retail market, through the support of halal products for MSMEs to move up in class. The one village, one cooperative program, which was initiated in 2014 by the Regent of OKI, is an original innovation that aims to support the people's economy. However, the successful development of cooperatives in OKI district requires financial structuring and management of cooperatives so that they can be stable and survive.

Table 1: Data on Active and Inactive Cooperatives in OKI Regency for the Current Year 2022

Districts in Ogan Komering Ilir Regency	Number of Active Cooperatives by District		
	2020	2021	2022
Air Sugihan	22	22	22
Cengal	13	13	13
Jejawi	19	19	19
Kabupaten Ogan Komering Ilir	396	395	395
Kayu Agung	69	69	69
Lempuing	26	26	26
Lempuing Jaya	22	22	22
Mesuji	23	23	23
Mesuji Makmur	25	25	25
Mesuji Raya	22	22	22
Pampangan	22	22	22
Pangkalan Lampam	16	16	16
Pedamaran	12	13	13
Pedamaran Timur	10	10	10
Sirah Pulau Padang	21	21	21
Sungai Menang	20	19	19
Tanjung Lubuk	17	17	17
Teluk Gelam	17	16	16
Tulung Selapan	20	20	20

Source: Department of Cooperatives, SMEs and Industry, Ogan Komering Ilir Regency

The factor that can encourage cooperatives to become better is good quality financial reports. Financial reports are the final process in the accounting process which has an important role in measuring and assessing a company's performance. Financial Accounting Standards Guidelines (PSAK) no. 1 of 2015 explains that Financial Reports are a structured presentation of the financial position and financial performance of an entity. A complete financial report usually includes a balance sheet, profit and loss statement, reports on changes in financial position, notes and other reports as well as explanatory material which is an integral part of the financial report. The quality of financial reports is the extent to which the financial reports presented show correct and honest information so that they are useful as a basis for decision making. Because financial reports are used as a guide in decision making, these financial reports must have information value. So that users of financial reports can make decisions effectively (Ngakil, 2020). Rosdiani (2013) stated that the quality of financial reports is the extent to which the financial reports presented show correct and honest information. The quality of financial reports is useful as a basis for making economic decisions for interested parties. The quality of financial reports, with its various measurements, is generally used in investment decisions, compensation agreements, debt terms and contract decisions based on the quality of financial reports.

Much research has been conducted on education levels and shows that employee education levels are one of the factors that influence the quality of financial reports. Sukarini's research (2018) found that the level of employee education influences the quality of financial reports. The same results were found by Wardani (2014) and Muzahid (2014) who found that the level of education influenced the quality of financial reports. Several researchers found consistent results regarding the level of education on the quality of financial reports (Setyowati, 2020).

Another factor that supports the good quality of financial reports is understanding accounting. Poerwadarminta (2006) said that understanding accounting is a process, a way of making sense or comprehending. The role of Human Resources (HR) in the development of the business world, which is currently increasingly rapid, is very important for every company. The quality of human resources in every company organization determines success in achieving every company goal. This means that people who understand accounting are smart and really understand accounting. Someone who is said to understand accounting means understanding and being clever about how the accounting process is carried out to produce a financial report guided by the principles and standards for preparing quality financial reports. In general, the qualitative criteria for financial reports are explained in SAK 2012. There are 4 components that must be fulfilled so that financial cooperatives can be presented in a quality manner, namely understandable, relevant, reliable and comparable.

Cooperatives as organizations in the economic sector are very vulnerable to the risk of loss or other risks arising from misappropriation and fraud in financial reports by employees. To maintain the quality of financial reports and prevent these risks, a good Internal Control System is needed. Research conducted by Sari (2016) states that the Internal Control System influences the quality of financial reports. Cooperatives are currently facing big challenges, especially from rapidly developing

technology. The use and utilization of technology can help accounting employees in the process of preparing financial reports and can minimize the risk of misstatements in financial reports. Optimal applications of information technology will have an impact on more accurate and faster transaction processing because through the use of information technology it can reduce material errors and save processing time (Sunsari, 2019). Research conducted by Zubaidi (2019) stated that information technology influences the quality of financial reports.

In the development and improvement of cooperatives' ability to prepare financial reports, coaching, education and training efforts are carried out. These three efforts are interrelated. Operationally, it can be formulated that coaching is a process that includes a series of efforts carried out deliberately in the form of providing assistance to cooperative management carried out by professional staff with the aim of increasing the effectiveness of productivity in a cooperative. The concept of providing assistance in this case is in the form of direction, guidance, facilities and delivery of information. Factor in the cooperative management's work experience as a bookkeeping officer, you will learn a lot about the accounting information needed. (Holmes and Nicholas). Because cooperative management will require more information to be prepared and used in decision making. The more experienced the cooperative management is, the easier it will be to prepare reliable financial reports. The objective to be achieved in this research is to determine the influence of education level, understanding of accounting, internal control systems, information technology and cooperative management on the quality of financial reports.

2. THEORY, LITERATURE REVIEW AND HYPOTHESIS

Grand's theory is the basis of agency theory and stewardship theory. Donaldson and Davis, (1991) quoted by Anton, (2010) stated that Stewardship theory explains that management (Cooperative administrators and management) are motivated and prioritize achieving the goals set by the organization rather than their own goals. Stewardship theory is a theory that can describe the condition of administrators and cooperative management who are more motivated to realize shared targets and goals rather than focusing on their own goals. So, this theory has a psychological and sociological basis which is designed so that leaders and management can achieve their organizational goals (Sanjaya, 2017).

Whereas in the case of this research, Cooperative Management and Management are able to produce good quality financial reports, so that they can be held accountable to all members. According to Gietsh & Davis, quoted by Tjiptono and Chandra (2016), quality is a dynamic state related to products, services, human resources and processes that meet expectations. In PSAK No.1 (2015:1) "financial reports are a structured presentation of the financial position and financial performance of an entity". Financial reports are reports that show the company's current financial condition or in a certain period (Kasmir, 2017:7). The quality of financial reports is the results of reports that show the company's financial condition which is presented in accordance with existing regulations. Individuals are said to understand accounting if they can carry out the accounting process until it takes the form of a financial report that is based on financial reporting principles and standards (Aniftahudin, 2019).

Holmen and Nicholaz said that management education has a relationship with the level of users of accounting information. The higher the educational level of the cooperative manager, the easier it will be to absorb accounting knowledge and mechanisms in producing financial reports. This is because they have broader knowledge and insight compared to managers who have only completed basic or advanced level education. Educational background also influences the success of cooperatives. Cooperatives that have administrators and management with a higher educational background will be able to bring the Cooperative towards better progress. The rate of progress will be faster if the Cooperative has resources with high education and the ability to manage the Cooperative. . Based on the thoughts and explanation above, the first hypothesis is:

H_1: Education level influences the quality of cooperative financial reports

Individuals are said to understand accounting if they can carry out the accounting process to form financial reports that are based on financial reporting principles and standards (Aniftahudin, 2019). Study results from Aniftahudin (2019) and Dewi and Ernawatiningsih (2019) show that understanding accounting has a positive effect on the quality of financial reports. This indicates that the more someone understands how to prepare accounting, the better quality their financial reporting results will be. If a person's understanding of accounting is lacking, then the financial report results will not be of high quality. This is due to a lack of understanding of accounting, so the financial reports are of low quality and do not comply with specified standards. Based on the thoughts and explanation above, the hypothesis is:

H_2: Understanding accounting influences the quality of cooperative financial reports

According to Cita and Kusumawati (2020) internal control is a way to direct, control and assess organizational resources. Sukmaningrum (2012) quoted by Chodijah and Hidayah (2018) stated that internal control is part of risk management that must be carried out by each agency in order to realize the agency's goals. Implementing good internal control can ensure the results of financial reports, as well as increasing the trust of those in power. The internal control system is a general way to regulate actions and activities carried out continuously by the leadership and all employees in achieving organizational goals through various effective and efficient activities, reliability of financial reporting, monitoring of state assets, and compliance with applicable regulations (Mene et al., 2018). Previous research by Cita and Kusumawati (2020) shows that internal control has a

positive effect on the quality of financial reports. Previous research by Dewi and Ernawatiningsih (2019) found that internal supervisory bodies have a positive effect on the quality of financial reporting. The internal control system is a general way to regulate actions and activities carried out continuously by the leadership and all employees in achieving organizational goals through various effective and efficient activities, reliability of financial reporting, monitoring of state assets, and compliance with applicable regulations (Mene et al., 2018). The results of studies from Mene, et al (2018) and Chodijah and Hidayah (2018) show that the internal control system has a positive and significant influence on the quality of financial reports, meaning that the better the implementation of the elements of the internal control system, the better the financial report results. Based on the thoughts and explanation above, the hypothesis is:

H_3: The Internal Control System influences the quality of Cooperative financial reports

Technology includes a system that functions to facilitate the work of workers in completing their tasks, where this system can be in the form of hardware and software, while information is the result of processing, manipulating and organizing some data that can provide information and knowledge for its users (Sutabri 2014:2, in Mene et al, 2018). Information technology is the study, design, development, implementation, support or management of computer-based information systems, especially software and hardware applications (Aniftahudin, 2019). Previous research by Chodijah and Hidayah (2018), resulted in the conclusion that information technology and internal control systems have a significant influence on the quality of financial reporting. Previous research by Hasnidar (2016) shows that computer-based accounting information systems have no effect on financial quality. The research results of Aniftahudin (2019), Mene, et al (2018) and Chodijah and Hidayah (2018) show that information technology has a positive and significant influence on the quality of financial reports, indicating that the better the use of information technology, the better the quality of financial reports. Information technology plays an important role to optimize the quality of financial reports. Based on the thoughts and explanation above, the first hypothesis is:

H_4: Information technology influences the quality of cooperative financial reports

To develop and improve the ability of cooperatives to prepare financial reports, coaching, education and training efforts are carried out. These three efforts are interrelated. Operationally, it can be formulated that coaching is a process that includes a series of efforts carried out deliberately in the form of providing assistance to cooperative management carried out by professional staff with the aim of increasing the effectiveness of productivity in a cooperative. The coaching method factor applied must be effective in order to implement healthy cooperative management which is reflected in the Cooperative Financial Report. Edwin B. Filipo stated that training is an action to improve a person's skills to carry out a job. According to Tohardi (2002) training methods play an important role in implementing coaching methods. Likewise with cooperatives, the more frequently implementing accounting training in practice means the more effective the method of fostering cooperative accounting implementation is implemented and the easier it is for cooperative management to provide accounting information. Management must combine the skills, experience, personality and motivation of each leader. Therefore, accepting a leader's instructions or requirements is very dependent on the expectations of their followers (Ivancevich, 2001). The better the leadership ethics of a chairman, the better the quality of financial reporting. (Desak Ayu, 2021). Based on the thoughts and explanation above, the hypothesis is:

H_5: Cooperative management influences the quality of cooperative financial reports

3. RESEARCH METHODS

This research uses quantitative research methods. In this study, the research population was all cooperative administrators and management in 18 sub-districts in OKI Regency, South Sumatra. The sample in this research is the administrators and management of the OKI Regency sub-district cooperative with the criteria of administrators and management who are actively involved in the management and management of the cooperative. Of the 543 cooperatives recorded at the OKI Regency SME and Industrial Cooperatives Service, there are 395 cooperatives that are active and can be used as samples in this research. Data collection was carried out during training for cooperative administrators and management organized by the UKM and Industrial Cooperatives Service, namely in August 2023 by distributing questionnaires to the 87 cooperative administrators and management who attended. The quality variable of Cooperative financial reports is measured using the same instruments as those used by Brandy Septo Nugroho (2018) with indicators that are relevant, reliable, timely, comparable and understandable. According to Riana Nugrah Wardani, the educational level of Cooperative management can be measured through indicators of formal education, non-formal education and informal education. Accounting understanding is measured using the same instrument as that used by Juni Wismawati (2020) with indicators of understanding the accounting cycle, carrying out accounting processes, and being able to read financial reports. The use of information technology in cooperatives is measured using the same instruments as those used by Raga Solihantara (2021) with indicators of computer use, internet use and data processing software. According to Sulfiana (2019) internal control can be measured by indicators of compliance with regulations, separation of responsibilities and supervision. Cooperative management is measured by the process of planning, organizing, activating and controlling (George R. Terry).

Table 2: **Instrument Grid**

Variable	Indicator	Question Items
Level of Education (Riana Nugrah Wardani, 2014)	Formal Education	1
	Non-Formal Education	2
	Informal Education	3
Understanding Accounting (Ni Komang Juni Wismawati, 2020)	Understanding The Accounting Cycle	1
	Understand the Accounting Process	2,3,4,5
	Able to Read Financial Reports	6
Utilization of Information Technology (Riana Nugrah Wardani, 2014)	Computer Use	1,4
	Data Processing Software	2
	Internet Use	3
Internal Control System (Sulfiana, 2019)	Control Environment	1
	Risk Assessment	2
	Control Activities	3
	Communication Information	4
	Monitoring	5
Cooperation management (George R. Terry, 1993)	Planning	1
	Organization	2
	Activating	3
	Controlling	4
Quality of Financial Reports (Riana Nugrah Wardani, 2014)	Relevant	1
	Reliable	2
	Timely	3
	Comparable	4
	Understandable	5

This research is associative research that is causal or cause and effect in nature. According to Sugiyono (2014) associative research is research carried out with the aim of finding out the relationship between two or more variables. The test results will be used as a basis for drawing conclusions, whether they support or reject the hypothesis developed from theoretical studies. The population in this study consisted of Cooperative administrators and management in OKI Regency. Sampling used a random probability sample method. The data used in this research is primary data with data collection techniques using questionnaires. The form of questionnaire used is a closed questionnaire. The measurement of variables in this research is by using attitude measurement using the Likert method. The Likert method with an interval measurement scale uses five assessment numbers, namely with a score of 1 to 4, where score 4 (SS= Very Appropriate), score 3 (S= Appropriate), score 2 (TS= Not Appropriate) and score 1 (STS= Very Suitable). It is not in accordance with). The analytical method used in this research is multiple linear regression analysis. This research data was processed using the Statistical Package for Social Science (SPSS) program. The data analysis technique using data quality tests carried out in this research is the Validity Test and Reliability Test. The testing of linear regression assumptions or also known as classical assumption testing includes the normality test, multicollinearity test and heteroscedasticity test (Latan, 2013). The analysis used in this research uses multiple linear regression analysis using test tools including the Simultaneous Test (F), t Test (Partial) and Determinant Coefficient (R2).

4. RESULTS AND DISCUSSION

Validity testing in this research uses a significant level of α = 5%. Questionnaire questions are said to be valid if the calculated r is greater than the table r and the significance value is smaller than alpha (α) 0.05. On the other hand, questionnaire questions are said to be invalid if the calculated r is smaller than the table r and the significance value is greater than alpha (α) 0.05.

Table 3: Validity Test

Variable	Corrected Item-Total Correlations	Description
Level of Education 1	0,831	Valid
Level of Education 2	0,859	Valid
Level of Education 3	0,866	Valid
Understanding Accounting 1	0,600	Valid
Understanding Accounting 2	0,703	Valid
Understanding Accounting 3	0,652	Valid

Understanding Accounting 4	0,700	Valid
Understanding Accounting 5	0,624	Valid
Understanding Accounting 6	0,733	Valid
Utilization of Information Technology 1	0,589	Valid
Utilization of Information Technology 2	0,730	Valid
Utilization of Information Technology 3	0,650	Valid
Utilization of Information Technology 4	0,768	Valid
Internal control 1	0,870	Valid
Internal control 2	0,841	Valid
Internal control 3	0,883	Valid
Internal control 4	0,880	Valid
Internal control 5	0,838	Valid
Cooperation management 1	0,720	Valid
Cooperation management 2	0,753	Valid
Cooperation management 3	0,686	Valid
Cooperation management 4	0,755	Valid
Quality of Financial Reports 1	0,791	Valid
Quality of Financial Reports 2	0,814	Valid
Quality of Financial Reports 3	0,809	Valid
Quality of Financial Reports 4	0,823	Valid
Quality of Financial Reports 5	0,896	Valid

Source: SPSS version 25 processed

Reliability Test is a test tool used to measure question items in a questionnaire which is a variable measuring tool. This reliability test is used to test the extent to which the instrument can be relied upon or trusted in measuring variables. A variable is said to be reliable if the Cronbach Alpha value is greater than 0.60.

Table 4: Data Reliability Test

Variable	Cronbach Alpha Value	Description
Level of Education (X_1)	0,811	Reliable
Understanding Accounting (X_2)	0,751	Reliable
Utilization of Information Technology (X_3)	0,623	Reliable
Internal Control (X_4)	0,914	Reliable
Cooperation Management (X_5)	0,710	Reliable
Quality of Financial Reports (Y)	0,882	Reliable

Source: SPSS version 25 processed

Table 5: Normality Test

Descriptive Statistics

	N	Skewness			Kurtosis		
	Statistic	Statistic	Std. Error	Zskew	Statistic	Std. Error	Zkur
Unstardardized Residual	87	-.301	.258	-1.146	-.909	.511	-1.731
Vslid N	87						

a. Dependent Variable: Quality of Financial Reports

Source: SPSS version 25 processed

Based on the results of table 5, it can be concluded that the results of the normality test by calculating the Z value for the five variables above are normally distributed. The Z value calculation can use the following formula.

$$Zskewness = \frac{Statistic}{\sqrt{6/N}}$$

$$Zkurtosis = \frac{Statistic}{\sqrt{24/N}}$$

Table 6: Multicollinearity Test

Coefficients[a]

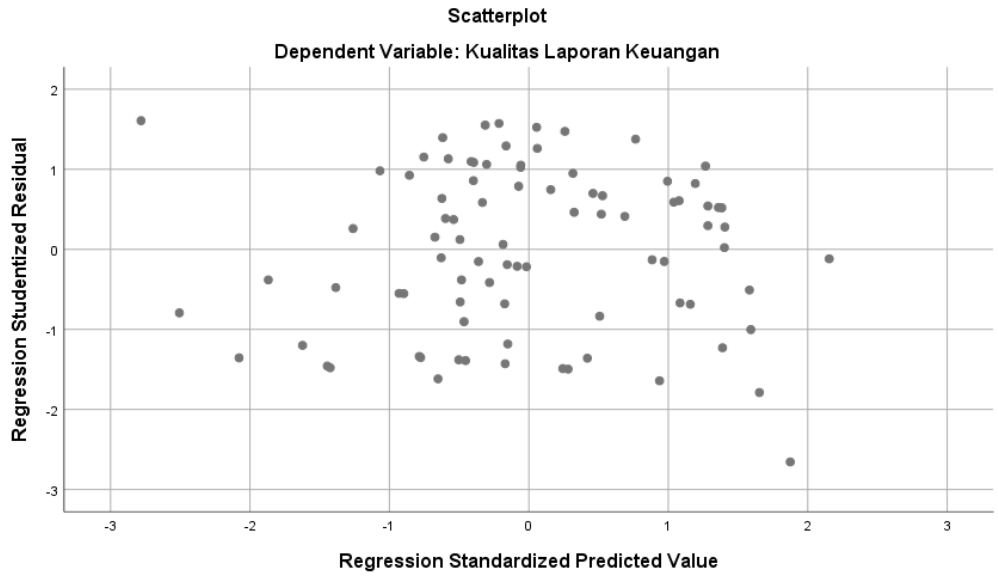
Model		Collinearity Statistics	
		Tolerance	**VIF**
1	(Constant)		
	Level of Education	.986	1.014
	Understanding Accounting	.980	1.020
	Utilization of Information Technology	.943	1.060
	Internal Control	.953	1.049
	Cooperation Management	.990	1.010

a. Dependent Variable: Quality of Financial Reports

Source: SPSS version 25 processed

Based on the results of table 6 above, the results of calculating the Tolerance value show that there are no independent variables that have a Tolerance value of less than 0.10 (Tolerance < 0.10), which means there is no correlation between the independent variables. The results of calculating the Variance Inflation Factor (VIF) value also show the same thing, there is not a single independent variable that has a VIF value of more than 10 (VIF > 10). So it can be concluded that there is no multicollinearity between each independent variables.

Table 7: Heteroscedasticity Test



Source: SPSS version 25 processed

Based on the results from table 7 of the Scatterplot graph above, it can be seen that the points are spread randomly and are spread both above and below the number 0 on the Y axis. This can be concluded that there is no heteroscedasticity in this model.

Table 8: Multiple Linear Regression Analysis Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	10.817	3.759		2.877	.005		
	Level of Education	.087	.173	.055	.502	.004	.986	1.014
	Understanding Accounting	.166	.108	.170	1.536	.003	.980	1.020
	Utilization of Information Technology	-.039	.173	-.026	-.229	.002	.943	1.060
	Internal Control	-.003	.102	-.004	-.032	.001	.953	1.049
	Cooperation Management	.021	.153	.015	.136	.003	.990	1.010

a. Dependent Variable: Quality of Financial Reports

Source: SPSS version 25 processed

Multiple linear regression analysis is carried out with the aim of testing or measuring the influence of the relationship between two or more variables and showing the direction of the relationship between the independent variable (independent) and one fixed variable (dependent). This research analyzes the influence of independent variables, namely education level, understanding of accounting, use of information technology, internal control systems, and cooperative management on the dependent variable, namely the quality of financial reports in OKI district. Based on the results of the table above, of the five independent variables included in the regression model, all variables were declared significant. This can be seen from the probability of significance being below 0.05. So the mathematical equation is:

Quality of Financial Reports = 10.817 + 0.087 LE + 0.166 UA – 0.039 UIT – 0.003 IC + 0.021 CM.

Table 9: Coefficient of Determination Test Results

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.179[a]	.032	-.028	4.13763

a. Predictors: (Constant), Level of Education, Understanding Accounting, Utilization of Information Technology, Internal Control, Cooperation Management

b. Dependent Variable: Quality of Financial Reports

Source: SPSS version 25 processed

Model R, R Square, Adjusted R Square, Std. Error of the Estimate 0,179[a] 0.032 -0,028 4,13763.

Based on Table 9, the adjusted R square value is 0.032 or 32%. This shows that the variable quality of financial reports can be explained by the variables of education level, understanding of accounting, use of information technology, and internal control, and cooperative management of 32%, while the remaining 68% was caused by other factors not examined in this study.

5. DISCUSSION

5.1. The Influence of Education Level on the Quality of Cooperative Financial Reports

Based on table 8, it shows that the level of education has a positive effect on the quality of the Cooperative's financial reports or H1 is accepted. This means that the higher the educational level of the Cooperative management and management, the more skilled they will be in making financial reports, so that they can improve the quality of the Cooperative's financial reports. The results of this research are in line with research by Luh Sukarini and Made Arie Wahyuni (2018) which states that the level of education has a positive and significant effect on the quality of financial reports. An adequate level of formal education with a background in financial or accounting education will make it easier for Cooperative administrators and management to carry out their work in producing financial reports. In this research, Cooperative administrators and management who have an educational background appropriate to their placement are able to produce quality financial reports. This is because in general the management and management of cooperatives have an adequate level of education, so they have good reasoning to be able to learn new things and attend training or seminars related to financial reports. For example, the board and management of the Tanjung Gading Cooperative are mostly dominated by high school graduates and once a month coaching is held regarding

Cooperative management. Cooperative administrators and management who have a high school education level will find it easier to process their thoughts and learn new things in this coaching, so that the higher the level of education possessed by cooperative administrators and management, the higher the quality of the financial reports produced by the cooperative.

5.2. The Influence of Accounting Understanding on the Quality of Cooperative Financial Reports

Based on table 8, it shows that understanding accounting has a positive effect on the quality of cooperative financial reports or H2 is accepted. This means that Cooperative administrators and management who have a good understanding of accounting, such as having an understanding of the accounting cycle, carrying out the accounting process well, and being able to read financial reports, will find it easier for the Cooperative administrators and management to make quality financial reports. The results of this research are in line with research by Riyadi et al., (2021) which states that understanding accounting has a positive and significant effect on the quality of financial reports. To be able to produce quality financial reports, the quality of the people who carry out the task of preparing financial reports must be the main concern, namely the administrators or managers of BUMDes who are involved in preparing financial reports must understand and understand how the accounting process and implementation is carried out, guided by the provisions stipulated. applies. For example, the preparation of the financial reports of the Senuling Jaya cooperative is carried out by administrators who have an educational background in accounting and have a good understanding of accounting, so that the better understanding of accounting that the administrators and management of the cooperative have, the easier it will be to prepare quality cooperative financial reports.

5.3. The Effect of Using Information Technology on the Quality of Cooperative Financial Reports

Based on table 8, it shows that there is a positive influence of the use of information technology on the quality of Cooperative financial reports or H3 is accepted. This means that information technology that is used effectively will help Cooperative administrators and management to access the information needed via the internet network and can make it easier to prepare financial reports using data processing software, so that the resulting financial reports are of high quality. These results are in line with research by Luh Sukarini and Made Arie Wahyuni (2018) which states that the use of information technology has a positive and significant effect on the quality of cooperative financial reports. The relationship between the use of information technology and the quality of financial reports is that the greater the use of information technology, the better the quality of the resulting financial reports. Timely information is part of the information value that can be achieved with the role of technology components. Information technology plays a role in providing useful information for decision makers within the organization, including in terms of reporting, thereby supporting the decision making process more effectively. Computers, networks and data processing applications are information technology used in preparing financial reports. For example, the preparation of financial reports at the Mekar Abadi Mandiri Cooperative has been carried out computerized using Microsoft Excel software and the available internet network is used to search and send the required information, so that the Cooperative administrators and management can utilize information technology effectively and efficiently, thus enabling the quality of the reports. The resulting finances will be better.

5.4. The Influence of Internal Control on the Quality of Cooperative Financial Reports

Based on table 8, it shows that there is a positive influence of internal control on the quality of Cooperative financial reports or H4 is accepted. This means that if the management and management of the Cooperative implement an internal control system properly, characterized by compliance with regulations, separation of responsibilities, and supervision carried out by the management and management of the Cooperative, then fraud or material errors in financial reports can be prevented so that the quality of the financial reports produced by the Cooperative will improve. Good. The results of this research are in line with research by Ahmad Faishol (2016) which states that internal control has a positive and significant effect on the quality of financial reports. In preparing financial reports, the management and management of the Cooperative must comply with the regulations that have been set, this is implemented to prevent fraud in preparing financial reports and protect the assets owned by the Cooperative. Apart from that, proper separation of responsibilities must also be implemented so that each administrator and management of the Cooperative has responsibilities according to their respective expertise and it is necessary to monitor if errors or violations occur by the management and management of the Cooperative because this can guarantee the presentation of quality financial reports. For example, at the Maju Jaya Cooperative, sanctions have been implemented for those who violate the regulations, this can increase the compliance of the Cooperative administrators and management with the regulations. Apart from that, responsibilities have been separated in several areas so that no management holds concurrent positions and a supervisory body has been formed to supervise the management and management of the Cooperative during its work, so that the better the internal control system implemented by the Cooperative, the higher quality the financial reports produced will be.

5.5. The Influence of Cooperative Management on The Quality of Cooperative Financial Reports

The cooperative management process has a positive impact on the quality of cooperative financial reporting in OKI district. These results are in accordance with the hypothesis expressed based on a significance value of 0.021 <0.05 and the hypothesis can be

accepted. The existence of a process of planning, organizing, mobilizing or staffing and controlling cooperative activities and operations means that the goal of establishing a cooperative as a means of helping to create prosperity for its members can be achieved. This is reflected in the good quality of the financial reports produced. The financial reports prepared by the cooperative will not be manipulated as long as the cooperative management process is running well. Cooperative management is very important in determining the quality of the financial reports. The better the management process, the better the quality of the financial reports presented. Research supported by Ho *et al*., (2019); Mabil (2019) ; and Yanti (2019).

6. FINDINGS AND CONCLUSION

Based on the results of analysis and testing regarding the influence of education level, understanding of accounting, use of information technology, and internal control, cooperative management on the quality of cooperative financial reports in OKI district, it can be concluded that the level of education has a positive effect on the quality of cooperative financial reports. This means that the higher the level of education of cooperative administrators and management, the better the quality of the cooperative's financial reports. Understanding accounting has a positive effect on the quality of cooperative financial reports. This means that the higher the accounting understanding possessed by the management and management of the cooperative, the better the quality of the cooperative's financial reports. The use of information technology has a positive influence on the quality of cooperative financial reports. This means that the more cooperative administrators and management can utilize information technology effectively and efficiently, the higher quality the financial reports produced by the cooperative will be. Internal control has a positive effect on the quality of cooperative financial reports. This means that the better the internal control system implemented by the cooperative, the better the quality of the financial reports produced by the cooperative.

7. IMPLICATIONS, LIMITATIONS AND SUGGESTIONS

Based on the research results, there are limitations, namely that the sample used in this research is only limited to administrators and management who actively participate in training organized by the OKI Regency Cooperative, SME and Industry Service, making it possible for differences in results and conclusions to occur if the research is conducted in other areas. There are limitations to research using questionnaires, namely that sometimes the answers given by respondents do not show the real situation. The number of respondents totaling 82 people is certainly still insufficient to describe the actual situation. Based on the research results, suggestions for future research agendas for further research should be carried out using observation and interview methods in order to get a true picture according to conditions in the field. For further research, researchers should add other variables such as the application of accounting information systems (Wulan Riyadi, 2020), HR competency (Tengko et al., 2022); (Ismunawan & Septyani, 2020); (Mahmud et al., 2021), and the function of the Supervisory Body (Bhegawati & Ni Nyoman Ari Novarini, 2021)

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SOMALIA'S ECONOMIC INTEGRATION INTO THE EAST AFRICAN COMMUNITY: TRADE DYNAMICS, OPPORTUNITIES AND CHALLENGES (2012–2023)

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ABSTRACT

Purpose- This study examines Somalia's economic integration into the East African Community (EAC) from 2012 to 2023, focusing on trade dynamics, regional opportunities, and challenges. The objective is to assess Somalia's trade performance within the EAC, identify barriers to integration, and provide insights on how Somalia can enhance its regional trade relations and overall economic participation.
Methodology- The study uses secondary data obtained from sources such as the World Bank and UN COMTRADE statistics, to examine the trade flows and economic performance of Somalia from 2012 to 2023. It further assesses the economic integration to the East African Community (EAC) by identifying prevalent trade patterns, key opportunities, and challenges associated with successful regional integration.
Findings- The total trade value of Somalia between 2012 and 2023 increased steadily from $3.8 billion to $10.17 billion. Despite this growth, the country still has a huge trade deficit with exports valued at $2.16 billion and imports valued at $8 billion in 2023. Somali business exports are strongly biased towards Kenya, which implies minimal diversification and minimal engagement with other EAC member states. Besides, the GDP per capita of the country has remained quite stable at around $350.26 during the time under review, signifying continued economic woes. Current political instability, lack of good infrastructure, and inadequate institutional settings are the major impediments to regional integration by Somalia.
Conclusion- Somalia's accession to the East African Community (EAC) is a significant step towards regional integration but challenges such as a large trade deficit, low export diversification, political instability, and poor infrastructure hinder full economic participation.

Keywords: Somalia's Economy, economic integration, trade dynamics, trade opportunities & challenges, Somalia and East African Community (EAC).
JEL Codes: F15, F63, 024

1. INTRODUCTION

Regional integration refers to the process of cooperation among neighbouring states to increase the level of joint frameworks, institutions, and policies in a quest for shared purposes. Regional integration plays a vital role in boosting economic growth, political coordination, and social integration through the removal of trade barriers, increased infrastructure connectivity, and enhanced regional cooperation (AfDB, 2022). In Sub-Saharan Africa, integration efforts are not only economic but also social and political. Initiatives have focused on enhancing regional peace and security, enabling the free movement of people, goods, and services, and creating regional value chains. The African Continental Free Trade Area, launched in 2021, has further reinforced these efforts by providing a continent-wide framework for reducing tariffs and promoting intra-African trade, with regional economic communities like the EAC acting as building blocks (World Bank,2016). Through initiatives like the East African Community (EAC), countries enjoy access to wider markets, foreign direct investment, and greater voice in global economic governance (UNCTAD, 2021). Regional integration is especially important for African nations in overcoming constraints of small domestic markets, enabling diversification of trade, and building resilience to global economic shocks like the COVID-19 pandemic and climate-related shocks (UNECA, 2023). The EAC continues to be a regional vehicle for strategic advancement, which provides its member states with access to harmonized trading regimes, transboundary infrastructure investments, and instruments for conflict resolution and peace-making (EAC Secretariat, 2024).

In the late 1800s, railway lines were built to connect Kenya, Uganda, and Tanganyika, and it started. The project was operated by the East African Railways Cooperation (1897–1901) that increased trade and provided the ground for increased cooperation. As Mombasa port emerged as a major outlet for exports destined for Uganda, the establishment of the Customs Union in 1917 marked a significant institutional milestone in regional integration (World Bank, 2021). Regional cooperation was further promoted by the establishment of institutions such as the Postal Union (1905–1940) and the East African Currency Board. The East African High Commission (EACH) was a transitional coordinating agency between 1948 and 1961, dealing with customs union, common external tariffs, currency, postage, and common services in research, education, transport, and communications. East African Common Services Organization (EACSO) emerged after the post-independence era reforms in 1961. Anticipated to pave the way for political federation, among the challenges involved were economic domination by Kenya, political ideological differences, and a lack of planning and fiscal policy cooperation (Mohamed, 2024).

In addition, attempts to set up a central bank were founded in 1965. Plans to introduce a common market proved difficult to implement. Yet there was still strong interest in regional cooperation, and so in 1967, the first East African Community was founded. The three member states of Kenya, Tanzania and Uganda agreed to cooperate on a wide range of economic and social issues. The first EAC, and the extensive integration which it achieved, was hailed a success, but the project nevertheless collapsed in 1977. The failure of the first East African Community can be attributed to four main factors: firstly, its lack of steering functions; secondly, the unequal distribution of benefits; thirdly, the purely intergovernmental – i.e. inter statal structure; and, fourthly, the irreconcilable differences of opinion between leading players, especially between the Ugandan dictator Idi Amin and the Tanzanian president Julius Nyerere. After the collapse of the first EAC, the former member states managed their economic affairs through individual multilateral agreements. Significant progress toward re-establishing the community occurred during summits in 1993 and 1997. In 1993, the Permanent Tripartite Commission for Cooperation was created, which later drafted a treaty for the new EAC in 1998. Security cooperation also began during this time. In November 1999, Uganda, Kenya, and Tanzania signed the Treaty for the Establishment of the East African Community, which came into effect on 7th July 2000. Rwanda and Burundi joined the EAC in 2007, (Reith and Boltz,2011). South Sudan became a full member of the East African Community in 2016. Later, in 2022, the Democratic Republic of Congo (DRC) joined as the 7th member of the community, (Hassan, 2022).

Somalia's membership in the East African Community (EAC) began in 2012 when it first applied for membership. However, the application was delayed after questions about Somalia's adherence to the EAC's admission requirements, which involve good governance, democracy, rule of law, and compatibility of social and economic policies with the Community. In 2019, Somalia had made another request, but it was still pending until the efforts were doubled after President Hassan Sheikh Mohamud's election in 2022. The EAC officially launched a verification mission to assess Somalia's readiness to join the Community in January 2023. Following the assessment, Somalia was invited to join the EAC on November 24, 2023, at the 23rd Ordinary Summit of the Heads of State (EAC, 2023).

The accession process was capped on March 4, 2024, when Somalia deposited ratification instruments with the EAC Secretary General, Dr. Peter Mutuku Mathuki, at the EAC Headquarters in Arusha, Tanzania, thereby becoming a member Somalia's membership into the EAC opens chances for greater regional cooperation, economic development, and market opportunities in the block, (Xinhua,2024).

The aim of this paper is to examine Somalia's economic integration into the East African Community (EAC) using an analysis of the opportunities it can capitalize on, challenges it faces, and trade trends it has experienced between the years 2012-2023. By analyzing Somalia's economic statistics, trade relations, and relative performances when compared with other EAC member countries, the research aims to observe how Somalia's membership in the EAC can influence its economic development and regional trade membership. The article also points out areas where Somalia can improve its contribution to yield the most benefits from regional integration.

2. TRADE DYNAMICS (2012–2023)

2.1. Economic Indicators of Somalia-Other EAC Member Nations

From the outset, the East African region consists of countries that are relatively homogeneous in terms of economic and political dimensions. However, there are significant gaps in their levels of development. The economic structure of these countries is outlined as follows:

Table 1: GDP of East African Community Countries (Billion USD)

Year	Somalia	Tanzania	Congo	Uganda	Rwanda	Kenya	Burundi	South Sudan
2012	4.36	39.65	29.31	27.31	7.65	56.40	2.33	11.93
2013	5.06	45.65	32.68	28.92	7.82	61.67	2.45	18.43
2014	5.73	49.99	35.91	32.61	8.24	68.29	2.71	13.96

2015	6.15	47.41	37.92	32.39	8.54	70.12	3.10	12.00
2016	6.61	49.77	37.13	29.20	8.70	74.82	2.64	NA
2017	7.62	53.27	38.02	30.74	9.25	82.04	2.72	NA
2018	7.87	57.00	47.57	32.93	9.64	92.20	2.67	NA
2019	8.66	61.03	51.78	35.35	10.35	100.38	2.58	NA
2020	8.63	66.07	48.72	37.60	10.17	100.66	2.65	NA
2021	9.48	70.66	55.33	40.53	11.07	109.7	2.78	NA
2022	10.20	75.77	65.80	45.57	13.32	114.45	3.34	NA
2023	10.97	79.06	66.38	48.77	14.10	108.04	2.64	NA

Sources: World Development Indicators, 2024

Kenya boasts the biggest economy in the EAC countries, with GDP standing at approximately USD 108.04 billion in 2023, followed by Tanzania (USD 79.06 billion), Congo DR (USD 66.38 billion), and Uganda (USD 48.77 billion). Rwanda's GDP was USD 14.10 billion, while Somalia's economy, though steadily increasing, and is still lower at USD 10.97 billion. Burundi had the smallest GDP at USD 2.64 billion in 2023.

The last decade has seen decent economic growth in most EAC countries, albeit with huge inter-country variations, from the best performing, Kenya, to the worst performing, Burundi. To reach middle-income status (GDP per capita of USD 1,000), most of these countries need to sustain high growth of more than 8% a year, as they have set out in their targets.

Table 2: GDP Per Capita of East African Community Countries (USD)

Year	Somali	Keyna	Uganda	Tanzania	Congo	Rwanda	Burundi	South Sudan
2012	350.26	1285.01	795.22	861.97	400.06	706.82	231.69	1109.26
2013	350.26	1370.88	818.29	963.06	431.19	704.92	234.84	1650.19
2014	350.26	1482.82	896.05	1022.75	458.00	724.96	250.54	1242.73
2015	350.26	1489.12	862.93	939.13	467.91	734.00	280.97	1080.15
2016	350.26	1554.13	752.70	953.01	442.31	729.52	235.29	NA
2017	350.26	1667.48	765.22	986.67	436.58	758.30	236.69	NA
2018	350.26	1836.45	792.17	1023.11	528.26	771.77	224.90	NA
2019	350.26	1960.41	822.06	1063.32	557.04	810.05	210.24	NA
2020	350.26	1927.66	845.77	1117.42	507.52	778.70	210.01	NA
2021	350.26	2061.36	882.79	1159.86	558.03	828.83	214.09	NA
2022	350.26	2109.56	963.07	1207.85	642.61	975.47	250.63	NA
2023	350.26	1952.30	1002.31	1224.49	627.50	1010.27	193.01	NA

Source: World Development Indicators, 2024

The GDP per capita values show large differences between East African Community (EAC) countries from 2012 to 2023. Kenya experienced steady growth, rising from $1,285 in 2012 to $2,109 in 2022 before falling slightly to $1,952 in 2023. Somalia's GDP per capita remained steady at $350.26 from 2012 to 2023 with no rise during the period. This indicates continued economic problems, such as political instability, poor infrastructure, and a lack of proper investments. Despite being a member of the East African Community, the economy of Somalia has lagged the development of the region. To improve, Somalia must concentrate on stabilizing its government, investment attraction, and the development of key sectors such as agriculture and infrastructure. Rwanda and Tanzania registered consistent gains, rising from $706.82 and $861.97 in 2012 to $1,010.27 and $1,224.49 in 2023 through innovation and utilization of resources. The GDP per capita of Uganda also increased gradually from $795.22 in 2012 to $1,002.31 in 2023 but, at faster rates, modernized key sectors will be needed. The GDP per capita for Burundi fell from $231.69 in 2012 to $193.01 in 2023 with economic problems being the result of political instability. Congo increased from $400.06 in 2012 to $642.61 in 2022 but fell to $627.50 in 2023 due to government problems. South Sudan experienced a history of early peaks and declines, going as high as $1,650.19 in 2013, with interruptions in the following years.

Table 3: Population of East African Community Countries (Million)

Year	Somalia	Kenya	Uganda	Tanzania	Congo	Rwanda	Burundi	South Sudan
2012	12.46	43.89	34.34	47.37	73.25	10.83	10.07	10.76
2013	12.87	44.99	35.34	48.82	75.79	11.09	10.44	11.17
2014	13.34	46.05	36.4	50.35	78.4	11.36	10.8	11.24
2015	13.81	47.09	37.53	52.02	81.04	11.64	11.05	11.11
2016	14.35	48.14	38.8	53.82	83.96	11.92	11.24	10.83

2017	14.92	49.2	40.18	55.65	87.08	12.2	11.51	10.26
2018	15.45	50.21	41.57	57.44	90.05	12.49	11.86	10.12
2019	16.03	51.2	43.00	59.17	92.95	12.78	12.26	10.42
2020	16.65	52.22	44.46	60.97	95.99	13.07	12.62	10.7
2021	17.27	53.22	45.91	62.83	99.15	13.36	12.97	10.87
2022	17.8	54.25	47.31	64.71	102.4	13.65	13.32	11.02
2023	18.36	55.34	48.66	66.62	105.79	13.95	13.69	11.48

Source: World Development Indicators, 2024

East African Community (EAC) country population statistics from 2012 to 2023 show consistent growth in the region, with some of the countries experiencing higher growth rates of the population compared to others. On average, the population of the EAC has increased from approximately 243 million in 2012 to 334 million in 2023. The population growth in the region has resulted from the high birth rates. The annual rate of growth varies, with some countries experiencing higher population growth compared to others.

The Somali population stands at 18.36 million as of 2023, whereas that of the remaining member states of the East African Community (EAC) combined is much greater. Including Kenya, Uganda, Tanzania, Congo, Rwanda, Burundi, and South Sudan populations for the year 2023 amounts to approximately 315.53 million. Joining the East African Community (EAC) will subject Somalia to a wider regional market. It would ease free trade with immediate neighboring countries such as Kenya, Uganda, Tanzania, and so on by eliminating trade barriers like tariffs as well as non-trade barriers. It could increase exports from Somalia, stimulate local business, and advance economic growth.

2.2. General Trade Trends of Somalia and Other EAC countries

From the beginning, Somalia's economic structure has been marked by notable developments and fluctuations in trade over the years, as illustrated in the table below:

Table 4: Trends of Somalia's Trade

Year	Value of Trade (Million USD)			Growth of Trade (%)		Trade in GDP (%)
	Export	Import	Total	Export	Import	
2012	853.40	3012.55	3865.95	–	–	88.57
2013	942.60	3276.86	4219.46	10.45	8.77	83.34
2014	1097.73	3582.44	4680.16	16.46	9.33	81.70
2015	1037.96	3667.16	4705.12	-5.44	2.36	76.48
2016	1067.19	3850.89	4918.08	2.82	5.01	74.36
2017	994.34	4239.78	5234.12	-6.83	10.10	68.68
2018	1119.00	4693.24	5812.24	12.54	10.70	73.82
2019	1131.00	4954.40	6085.40	1.07	5.56	70.31
2020	1178.00	5352.64	6530.64	4.16	8.04	75.69
2021	1532.00	5969.20	7501.20	30.05	11.52	79.09
2022	1804.05	7455.98	9260.02	17.76	24.91	90.76
2023	2164.49	8001.81	10166.30	19.98	7.32	92.69

Source: World Development Indicators, 2024

From 2012 to 2023, Somalia's exports increased on average by 8.83% annually to reach USD 2.16 billion in 2023 (see the table4). Exports also increased in the same trend with an average annual growth of 9.29 % to reach USD 8.00 billion by 2023. The total trade volume increased steadily, with a trade deficit that rose over the years due to higher values of imports compared to exports. For instance, the trade deficit in 2023 was USD 5.84 billion.

Somalia's commerce activity remained a significant component of its GDP, and the trade-to-GDP ratio throughout the period averaged nearly 80%. Diversification of trade remains narrow, with significant partners holding sway over exports and imports. Erratic growth rates of imports and exports indicate Somalia's challenge in maintaining stable trade patterns, although steady growth in trade volumes signals positive signals in economic performance. The high trade-to-GDP ratio reflects Somalia's heavy dependence on foreign trade, which is a central factor in its economy.

The table indicates the trend of trade in Somalia between 2012 and 2023, showing steady growth in total trade, exports, and imports. Total trade increased from USD 3,865.95 million in 2012 to USD 10,166.30 million in 2023, reflecting a rising volume

of trade over the period. Exports rose from USD 853.40 million in 2012 to USD 2,164.49 million in 2023, recording impressive growth rates of 16.46% in 2014, 30.05% in 2021, and 19.98% in 2023. Imports rose significantly from USD 3,012.55 million in 2012 to USD 8,001.81 million in 2023, registering its highest growth rate of 24.91% in 2022.

Trade as a share of GDP was fluctuating but high, reflecting the heavy reliance of Somalia on trade. In 2012, the rate was 88.57%, dropping to 68.68% in 2017 but increasing to 92.69% in 2023, reflecting the crucial role played by trade in the economy. Such trends reflect both progress and challenges in the trade sector in Somalia, where there was continuous growth despite export and import growth rates fluctuating in some years.

2.3. Exports and Imports of other members EAC's Trends (2012-2023)

The Other East African Community (EAC) member countries have demonstrated notable variations in their trade patterns over the years. The table below provides an overview of the exports and imports of EAC countries from 2012 to 2023, reflecting the growth and shifts in trade within the region. **Imports of Other Members of EAC**

Table 5: Exports and Imports of Other Members EAC's Trends (2012-2023)

Year	Exports of Other Members of EAC							
	Kenya	**Uganda**	**Burundi**	**Tanzania**	**Rwanda**	**Congo**	**South Sudan**	**Total Export**
2012	11203.18	4230.16	226.24	8870.63	918.13	9027.202	5110.49	39586.03
2013	10972.69	4774.87	222.98	8679.12	1055.11	11910.41	1794.88	39410.06
2014	11248.59	4874.97	235.30	9032.21	1142.63	13226.09	5360.32	45120.11
2015	10608.34	4170.60	199.19	8110.11	1130.49	10512.9	4397.36	39128.99
2016	9912.82	3629.23	168.84	8138.10	1340.97	8896.177	NA	32086.14
2017	10448.71	5122.38	164.14	8344.71	1899.46	13401.99	NA	39381.39
2018	11564.08	4967.72	151.65	8401.86	2034.37	15485.13	NA	42604.81
2019	11471.24	6047.74	133.26	9786.70	2258.78	13393.2	NA	43090.92
2020	9705.26	5796.02	120.54	8921.84	1966.30	13935.46	NA	40445.42
2021	11814.62	6396.01	138.80	9976.59	2160.64	22344.87	NA	52831.53
2022	13953.58	5477.86	165.97	11678.96	2993.21	29938.36	NA	64207.94
2023	12625.50	5658.03	139.07	13595.12	3583.75	29371.94	NA	64973.41
Year	**Imports of Other Members of EAC**							**Total Import**
2012	17910.89	7648.50	793.55	12686.87	2185.17	11004.11	3434.80	55663.89
2013	18299.43	7690.48	919.57	13520.66	2283.50	13405.26	7567.84	63686.74
2014	20279.3	6870.19	928.06	13639.78	2474.50	15030.79	3664.09	62886.71
2015	17669.41	8035.90	509.71	11214.71	2731.46	11984.6	3467.36	55613.15
2016	16171.5	5485.15	440.55	9492.23	2961.88	11871.54	NA	46422.85
2017	19080.38	6202.98	441.59	9295.99	3067.03	14843.05	NA	52931.02
2018	20167.35	7096.22	557.82	10205.64	3342.05	17774.43	NA	59143.51
2019	20408.41	7865.67	614.61	10363.46	3741.29	15205.26	NA	58198.7
2020	17711.64	8116.38	588.87	9552.97	3648.74	14559.94	NA	54178.54
2021	22000.77	10510.44	661.15	11160.17	3887.43	22184.22	NA	70404.18
2022	24605.58	10244.59	779.40	14843.14	5148.96	31736.56	NA	87358.23
2023	22046.33	10602.36	642.83	16616.23	5718.53	31210.29	NA	86836.57

Source: World Development Indicators, 2024

Kenya consistently posted the largest exports, starting at $11,203.18 million in 2012 and rising to $12,625.50 million in 2023. This reflects Kenya's dominance of the EAC's export market. Uganda and Tanzania both showed steady increases, with Uganda's exports from $4,230.16 million in 2012 to $5,658.03 million in 2023, while Tanzania's exports went from $8,870.63 million in 2012 to $13,595.12 million in 2023. Burundi and Rwanda had lower and more modest export levels, indicative of smaller-scale export industries for those countries. Congo DRC showed strong growth in exports with a value of $29,371.94 million in 2023 from $9,027.20 million in 2012, reflecting its tremendous natural resources. Data for South Sudan were missing for a couple of years and therefore it is difficult to know its export trend accurately.

Kenya also reported the highest imports, starting at $17,910.89 million in 2012 and increasing to $22,046.33 million in 2023. This indicates a high demand for products in Kenya. Uganda and Tanzania experienced an increase in imports year after year, indicating growing economies and consumption needs. Congo DRC and Rwanda reported a significant increase in imports, showing a growing market for foreign goods. South Sudan reported high imports in 2013 and 2014 but lacked data for a few years.

3. COMPARATIVE ANALYSIS OF TOTAL TRADE TRENDS IN SOMALIA AND OTHER EAC COUNTRIES

Historically, Somalia's economic structure, Somalia's trade dynamics have evolved in comparison to the broader trends within the East African Community (EAC). The table below provides a comparative analysis of the total trade (exports + imports) in Somalia and other EAC countries from 2012 to 2023, highlighting the growth and changes in trade activity within the region.

Table 6: Comparative Analysis of Total Trade Trends in Somalia and other EAC Countries

Year	Total Trade (Exports + Imports) (USD Million)					
	Somalia's Total Trade			Other Members of EAC's Total Trade		
	Exports	Imports	Total Trade	Exports	Imports	Total Trade
2012	853.40	3012.55	3865.95	39586.03	55663.89	95249.92
2013	942.60	3276.86	4219.46	39410.06	63686.74	103096.8
2014	1097.73	3582.44	4680.16	45120.11	62886.71	108006.8
2015	1037.96	3667.16	4705.12	39128.99	55613.15	94742.14
2016	1067.19	3850.89	4918.08	32086.14	46422.85	78508.99
2017	994.34	4239.78	5234.12	39381.39	52931.02	92312.41
2018	1119.00	4693.24	5812.24	42604.81	59143.51	101748.3
2019	1131.00	4954.40	6085.40	43090.92	58198.7	101289.6
2020	1178.00	5352.64	6530.64	40445.42	54178.54	94623.96
2021	1532.00	5969.20	7501.20	52831.53	70404.18	123235.7
2022	1804.05	7455.98	9260.02	64207.94	87358.23	151566.2
2023	2164.49	8001.81	10166.30	64973.41	86836.57	151810

Source: World Development Indicators, 2024

The data also reflect a clear disparity in the overall trade of Somalia compared to the other countries of the East African Community between the periods of 2012 to 2023. Trade volumes of Somalia, even as they are always increasing, are relatively low compared to the remainder of the EAC states. For instance, Somalia's total trade rose from $3,865.95 million in 2012 to $10,166.30 million in 2023, while the trade among the rest of the EAC countries rose from $95,249.92 million in 2012 to $151,810 million in 2023. This indicates that although Somalia has progressed, its trade activity is still much lower than in the larger region.

Somalia's exports also posted notable growth, rising from $853.40 million in 2012 to $2,164.49 million in 2023, though still well behind the rest of the EAC countries, whose combined exports went up from $39,586.03 million in 2012 to $64,973.41 million in 2023. Similarly, Somalia's imports posted consistent growth, from $3,012.55 million in 2012 to $8,001.81 million in 2023. Compared to the region, though, whose imports went up from $55,663.89 million to $86,836.57 million during the same period, it's clear that Somalia's economic activities are not as integrated into regional and global trade. In general, although Somalia has made strides, it is severely challenged to catch up with the trade patterns of other EAC nations, in which case specialty strategies are needed to bolster its trade capabilities.

EAC membership would enable Somalia to access a market of over 300 million people, increasing its exports, especially in agriculture, livestock, and fish. It would open up new markets and avenues for trade to increase exports. Somalia would get less expensive imports, which would be convenient for business and consumers. EAC membership would increase infrastructure and attract more investment, with Somalia being able to develop. Also, Somalia's location can draw more foreign investment and grow its position in global trade.

3.1. Trade Patterns Between Somalia and the East African Community (EAC): Somalia's Export to Other Members of EAC Countries

The table below presents the export trends from Somalia to other East African Community (EAC) countries over the period from 2012 to 2023. It illustrates the fluctuating export values, with notable changes in the volume and distribution of exports to EAC members.

Table 7: Total Export of Somalia to Other Members of EAC Countries (USD)

Year	Somalia's Export share to other members of EAC Countries							
	Kenya	Uganda	Burundi	Tanzania	Rwanda	Congo	South Sudan	Total Export
2012	205,000	298,000	1,000	7,000	0	NA	NA	511,000
2013	3,411,000	16,000	0	0	0	NA	NA	3,427,000
2014	1,709,000	4,000	0	52,000	0	NA	NA	1,765,000
2015	293,000	497,000	0	426,000	0	0	NA	1,216,000
2016	521,000	671,000	0	0	0	0	NA	1,192,000
2017	911,000	229,000	0	0	1,000	39,000	NA	1,180,000
2018	8,645,000	265,000	0	0	39,000	9,000	NA	8,958,000
2019	4,329,000	785,000	0	0	0	17,000	NA	5,131,000
2020	507,000	76,000	0	2,000	0	9,000	NA	594,000
2021	895,000	36,000	0	3,000	2,000	90,000	NA	1,026,000
2022	772,000	511,000	0	30,000	0	36,000	NA	1,349,000
2023	348,000	180,000	0	64,000	NA	146,000	NA	738,000
TOTAL	**22,546,000**	**3,568,000**	**1,000**	**584,000**	**42,000**	**346,000**	**NA**	**27,087,000**

Source: ITC calculations based on UN COMTRADE statistics since January 2021.

Somalia exports very little to the EAC nations compared to imports. Between 2012 and 2023, total exports were around $27 million. Kenya is the top export destination of Somalia, making up about 83% of all the exports to the EAC nations. Exports to Kenya were highest in 2018, reaching $8.65 million, but reduced after that. Kenya remains the main nation that Somalia exports to. Uganda ranks second in importing Somalia's exports, but the percentage is extremely low, about 13% of total. Exports to Uganda were highest in 2012 but declined afterwards. Tanzania only imports a negligible portion of Somalia's exports, with higher figures in 2014 and 2015. Burundi, Rwanda, and Congo DR import very little of Somalia's exports. Exports to Rwanda are zero in recent years. No export is also on display by South Sudan at the moment, i.e., there are no exports between South Sudan and Somalia.

Somalia's exports to the EAC were highest in 2018 when they were at $8.96 million, mainly to Kenya. The exports have since then decreased and only hit $738,000 in 2023. This could signal that there is a decrease in demand or there are issues of trade.

Exports in Somalia are heavily dependent upon Kenya. If Kenya reduces the demand for Somali goods, it could have a direct impact on Somalia's total exports. Exports to Uganda, Tanzania, and Rwanda are very small, so Somalia is not tapping the full potential of these markets. Somalia could try to increase exports to Uganda, Tanzania, and Rwanda to make the trade more regionally balanced.

3.2. Somalia's Imports from Other Members of EAC Countries

The table below highlights the import trends of Somalia from other East African Community (EAC) countries between 2012 and 2023. It provides an overview of how the volume of imports has evolved over time.

Table 8: Somalia Import from Other Members of EAC Countries (USD)

Year	Somalia's imports from Other Members of EAC Countries							
	Kenya	Uganda	Burundi	Tanzania	Rwanda	Congo	South Sudan	Total Import
2012	227,883,000	13,710,000	0	1,049,000	0	NA	NA	242,642,000
2013	196,689,000	7,780,000	0	586,000	0	NA	NA	205,055,000
2014	150,117,000	4,475,000	0	6,681,000	23,000	NA	NA	161,296,000
2015	155,285,000	2,255,000	0	2,794,000	0	0	NA	160,334,000
2016	176,746,000	2,793,000	0	387,000	0	0	NA	179,926,000
2017	190,177,000	1,484,000	0	1,490,000	201,000	0	NA	193,352,000
2018	148,777,000	1,241,000	0	1,041,000	38,000	0	NA	151,097,000
2019	116,023,000	556,000	2,891,000	2,344,000	1,616,000	0	NA	123,430,000
2020	106,941,000	676,000	0	1,552,000	157,000	0	NA	109,326,000
2021	122,532,000	1,457,000	113,000	558,000	749,000	0	NA	125,409,000

2022	129,983,000	3,271,000	364,000	1,070,000	400,000	0	NA	135,088,000
2023	155,229,000	2,748,000	175,000	1,029,000	NA	1,000	NA	159,182,000
TOTAL	**1,876,382,000**	**42,446,000**	**3,543,000**	**20,581,000**	**3,184,000**	**1,000**	NA	**1,946,137,000**

Source: ITC calculations based on UN COMTRADE statistics since January 2021.

Most of Somalia's imports from the EAC members are from Kenya, representing about 96% of the total imports over the years. Kenya's imports to Somalia were the highest in 2012 at $227.88 million and have remained high compared to other EAC members. Uganda is the second largest source, but its share is small, representing only 2% of the total imports. Imports from Uganda were highest in 2012 at $13.71 million but declined subsequently. Imports from Tanzania are insignificant at $20.58 million during the period and show no pattern of growth. Rwanda, Burundi, and Congo DR Imports from Rwanda, Burundi, and Congo DR are insignificant, often less than $1 million annually, with very little trade activity.

The overall imports from EAC nations by Somalia were highest in 2012 ($242.64 million) but declined over the years and ended at its lowest $109.33 million in 2020. This can be due to hard economic times or trade preference change.

There is almost no record of import from South Sudan, which means very little or no trade relationship between the two countries.

3.3. Somalia's Trade Imbalance with the EAC: Exports and Imports (2012-2023)

The table 9 illustrates the persistent trade imbalance between Somalia and the East African Community (EAC) from 2012 to 2023. Despite fluctuations in export figures, Somalia's imports from the EAC consistently outpaced its exports, underscoring the nation's reliance on the region for goods and the limited development of its export capacity.

Table 9: Somalia's Trade Imbalance with the EAC: Exports and Imports (2012-2023)

Year	Somalia's Export to EAC	Somalia's imports from EAC
2012	511,000	242,642,000
2013	3,427,000	205,055,000
2014	1,765,000	161,296,000
2015	1,216,000	160,334,000
2016	1,192,000	179,926,000
2017	1,180,000	193,352,000
2018	8,958,000	151,097,000
2019	5,131,000	123,430,000
2020	594,000	109,326,000
2021	1,026,000	125,409,000
2022	1,349,000	135,088,000
2023	738,000	159,182,000
TOTAL	**27,087,000**	**1,946,137,000**

Source: ITC calculations based on UN COMTRADE statistics since January 2021.

Between 2012 and 2023, Somali's exports to the East African Community (EAC) were significantly lower in value than imports. Somali's exports to the EAC in total were valued at $27.1 million, with a maximum of $8.96 million in the year 2018. In total, Somali imports from the EAC amount to $1.95 billion, which accounts for a significantly large trade disparity. The import values have also been higher consistently annually, with the largest import value in 2013 amounting to $205 million. The imbalance is an indication that Somalia relies greatly on the EAC for imports but has an underdeveloped ability to export to the region. The imbalance necessitates Somalia to boost its exports in a bid to balance the trade interaction and enjoy the advantage of the regional market.

Table 10: Main Products Traded Between Somalia and Other EAC Countries

Main Products Exported to EAC	Main products imported form EAC
Aircraft, spacecraft, and parts thereof	Aircraft, spacecraft, and parts thereof
Articles of iron or steel	Articles of iron or steel
Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television	Coffee, tea, maté and spices
Fish and crustaceans, molluscs and other aquatic invertebrates	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere
Furniture; bedding, mattresses, mattress supports, cushions and similar stuffed furnishings; . . .	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television

Miscellaneous edible preparations	Electrical machinery and equipment and parts thereof; sound recorders and reproducers, television
Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof	Essential oils and resinoids; perfumery, cosmetic or toilet preparations
Railway or tramway locomotives, rolling stock and parts thereof; railway or tramway track fixtures	Mineral fuels, mineral oils and products of their distillation; bituminous substances; mineral . .
Ships, boats and floating structures	Miscellaneous edible preparations
Vehicles other than railway or tramway rolling stock, and parts and accessories thereof	Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof
	Cocoa and cocoa preparations
	Other made-up textile articles; sets; worn clothing and worn textile articles; rags
	Pharmaceutical products
	Plastics and articles thereof
	Preparations of cereals, flour, starch or milk; pastrycooks' products
	Preparations of vegetables, fruit, nuts or other parts of plants
	Tobacco and manufactured tobacco substitutes; products, whether or not containing nicotine
	Vegetable plaiting materials: vegetable products not elsewhere specified or included
	Wood and articles of wood; wood charcoal

Source: ITC calculations based on UN COMTRADE statistics since January 2021.

3.4. Geographic Proximity and Regional Accessibility

Proximity in geography plays a significant role in deciding trade relationships and integration prospects. Samad et al. (2023) believe that geographic proximity leads to higher trade flows due to the reduced costs of transportation and transit time. Countries or regions with border crossings or linked by sea and land transport will be more likely to engage in cost-effective trade. Ali (2017) also restates this same feeling by stating that proximity induces regional trading blocs and promotes the building of value chains whereby companies leverage the strengths of other companies within adjacent states.
The following table holds the distances (Km) from Mogadishu to the capitals of East African Community (EAC) member states, indicating the relative accessibility and logistically located Somalia within the region:

Table11. Distances from Mogadishu to Capital Cities of EAC Member States

Country	Capital City	Distance in KM
Kenya	Nairobi	1015.44
Tanzania	Dodoma	1402.74
Uganda	Kampala	1429.81
South Sudan	Juba	1553.93
Rwanda	Kigali	1753.68
Burundi	Bujumbura	1873.78
Democratic Republic of Congo	Kinshasa	3409.05

Source: Distance Between Cities on Map https://www.distancefromto.net/

The table clearly shows that Somalia is geographically closer to large EAC members such as Kenya (1,015 km), Uganda (1,429 km), and Tanzania (1,402 km), thus enhancing its prospects of having affordable trade and transport connections in the region. The relatively shorter distances enable Somalia to integrate logistically into regional value chains. Conversely, countries like the Democratic Republic of Congo (3,409 km), Burundi (1873.78) and Rwanda (1753.68) are farther away, representing higher trade costs and logistics challenges. These trends highlight the necessity for targeted infrastructure development and trade facilitation interventions with Somalia's nearest EAC neighbors in order to maximize integration benefits.

3.5. Somalia's Entry into Regional Opportunities

Somalia's accession to the East African Community (EAC) in 2023 offers a transformative opportunity for Somalia's political, social, and economic development. The EAC's eighth member, Somalia will benefit from regional integration platforms that aim at deepening liberalization of trade, infrastructure development, investment promotion, and political stability among

member states (EAC Secretariat, 2023). Somalia's geopolitical location, at the Horn of Africa, and geographical location, at the coast of the Indian Ocean, confer on it a comparative regional maritime trade and logistics advantage (World Bank, 2020; Mohamed,2021).

Membership of the East African Community (EAC) provides Somalia with a regional market of over 300 million consumers and a GDP of over $305 billion (East African Community [EAC], 2023). The integration offers enormous potential for export expansion, particularly where Somalia enjoys comparative advantages such as livestock, fishery, agriculture, and light manufacturing. Through reducing tariffs and non-tariff barriers between member countries, Somalia will be able to increase its trade competitiveness, improve its foreign exchange earnings, and stimulate its development of SMEs. Besides, participation in regional value chains enables Somalia to connect its agriculture and manufacturing outputs to broader East African production and export networks, which results in economic diversification and resilience (African Development Bank Group, 2024; Rift Valley Institute, 2024).

Another imperative benefit linked to regional membership is infrastructure development. Through connectivity to EAC projects such as the Northern Corridor Integration Projects and Central Corridor projects, Somalia can enjoy increased road, rail, and port connections that can enhance intra-regional trade as well as border trade (Mohamed, 2024). These initiatives, which maximize the effectiveness of transport and minimize the cost of doing business, are vital to Somalia's landlocked trading partners, and thereby Somalia becomes a significant logistics gateway linking Africa, Asia, and the Middle East (Xinhua, 2024).

In addition, EAC membership also brings Somalia political and security advantages. Joining regional peace and security frameworks such as the East African Standby Force (EASF) can stabilize Somalia. Regional economic integration frameworks can also enhance harmonization of policy in customs administration, investment regulation, and public governance, improving Somalia's institutional capacity (Reith and Boltz, 2011).

Despite these advantages, Somalia must overcome several internal challenges to benefit most. Political volatility, weak institutional mechanisms, fragile infrastructure, and weak industrial capabilities now undermine Somalia's ability to be a proactive actor in regional trade and investment (Hassan, 2022). Lacking daring policies towards better governance, modernization of productive sectors, diversification of exports, and improving the investment climate, Somalia will remain a peripheral actor in the EAC. Strategic investments and focused reforms must be made if Somalia is to leverage the regional platform to its fullest potential for long-term economic development and sustainable growth.

Finally, Somalia membership in the EAC is a gateway to regional infrastructure, security, investment, and trade opportunities. Implemented effectively, EAC membership can be the catalyst to propel Somalia to a more developed, more integrated, and a more stable economy.

3.6. Challenges Hindering Somalia’s Regional Integration into the EAC

While Somalia's membership in the East African Community (EAC) presents immense opportunities, the country has immense challenges that can bar its full integration and ability to benefit from regional integration. Their recognition and solving are critical for effective membership of Somalia in the EAC and for achieving maximum benefits of regional integration.

Political instability and insecurity are immense challenges that have so far plagued Somalia.

Despite recent progress, Somalia continues to face conflict, weak governance systems, and the presence of militant groups continue to detract from the country's ability to enjoy stable economic policies and uphold the rule of law (Mohamed, 2024). Stability is a pre-condition for regional integration because it creates investor confidence, encourages cross-border trade, and enables full participation in regional programs. Without enduring political stability, Somalia becomes susceptible to being seen as a weak partner in the EAC model.

Poor infrastructure is the other significant obstacle. Somalia's transport networks, port facilities, energy facilities, and communication networks are worse off compared to other EAC member countries (African Development Bank Group, 2024). Efficient infrastructure is needed to reduce trade costs, promote industrialization, and enhance competitiveness. Somalia's weak road and railway networks, weak port upgrading, and erratic energy supply restrict its ability to engage optimally in intra-regional trade and to receive foreign direct investment.

Limited export diversification also restrains Somalia's integration possibilities. The country's exports remain focused, predominantly in livestock products, bananas, and fish commodities, with Kenya being the top trade partner (ITC-UN COMTRADE, 2021). Lack of a diversified export base makes Somalia vulnerable to higher external shocks as well as reduces its ability to export a broader range of goods to EAC markets. Further, the current volume of Somalia's exports to EAC countries is relatively small compared to its imports, hence perpetuating a persistent trade deficit (World Development Indicators, 2024).

Regulatory and institutional weaknesses further complicate Somalia's regional integration efforts. The country faces challenges in aligning its trade, investment, and customs regulations with EAC standards. Effective regional integration requires harmonized policies on tariffs, non-tariff barriers, technical standards, and dispute resolution mechanisms (UNECA, 2016). Somalia's limited institutional capacity and bureaucratic inefficiencies delay the implementation of such reforms, limiting its ability to fully participate in the EAC's economic programs.

Shortages of human capital and low industrial productivity also hinder integration. Somalia's education system, though improving, is still not adequate to support the economy of a contemporary period. Low technical competence, inadequate access to training, and low productivity levels in key sectors limit Somalia's competitiveness in regional and global markets (World Bank, 2020). In the absence of significant investments in education, vocational training, and technology innovation, Somalia will find it difficult to become part of regional value chains and to benefit from knowledge and technology transfer within the EAC.

Facilitation bottlenecks of trade and non-tariff barriers remain to be obstacles. Even though Somalia is an EAC member, delays in customs, corruption at borders, and bureaucratic inefficiencies could still limit the unhindered movement of goods and services between Somalia and other EAC countries (EAC Secretariat, 2023). Such obstacles can be addressed by well-recommended reforms in customs modernization, efforts in transparency, and more cross-border cooperation.

Another significant impediment to Somalia's regional integration is its underdeveloped digital environment and low rates of participation in regional digital economies. Under the new EAC configuration, digital connectivity—specifically cross-border e-commerce, digital trade facilitation, and financial integration—is at the center of regional economic action. Somalia lags behind in digital readiness with low internet penetration, low cross-border mobile money interoperability, and weak cybersecurity frameworks. These digital divides hinder Somalia from engaging effectively in regional digital spaces, which are increasingly vital for trade, innovation, and inclusive growth. According to the (World Bank, 2024). It is essential to develop digital infrastructure and regulatory alignment in Africa to enable countries such as Somalia to reduce transaction costs and enable increased participation in regional value chains through digital channels.

Lastly, while Somalia's entrance into the EAC is a positive achievement, some challenges—political instability, infrastructural deficits, absence of export diversification, weak institutions, human capital deficits, and trade barriers—pose great risks to its success of regional integration. Overcoming these challenges through harmonized national reforms and regional support facilitations is still paramount to Somalia achieving the full potential of EAC membership.

4. CONCLUSION

Somalia's accession to the East African Community (EAC) is a landmark step in its journey towards economic recovery, regional integration, and sustainable development. The study found that while Somalia's total trade has expanded considerably between 2012 and 2023, Somalia continues to face severe structural challenges like a chronic trade deficit, low export diversification, political instability, and inadequate infrastructure. Somalia's trade is still dominated by imports, especially from Kenya, and exports to the rest of the EAC countries are negligible, pointing to an imbalance that should be addressed urgently.

The opportunities for EAC membership are enormous. Somalia has access to a large regional market, investment inflows, infrastructure development initiatives, and regional security arrangements. Agriculture, fisheries, and manufacturing are some of the sectors with great potential for growth if supported by selective reforms. Insertion into EAC regional value chains and cross-border operations could also help Somalia diversify the economy, attract investment, and create jobs.

However, accessing these opportunities requires Somalia to address the numerous challenges which hinder its smooth integration into the region. Political stability, infrastructure modernization, export base diversification, institutional reforms, and human capital development are essential if Somalia is to integrate into the EAC successfully. Furthermore, harmonization of Somalia's regulatory frameworks with those of the EAC and trade facilitation mechanisms will be crucial in enhancing competitiveness and ensuring equitable participation in the regional economy.

In conclusion, Somalia's accession to the EAC is a positive step, but its benefits will be maximally exploited through a concerted and integrated national effort, supported by aid from regional partners. By strategic planning and focused investment in priority areas, Somalia is able to reverse its economy, boost regional relations, and contribute meaningfully to the East African Community's goals of higher integration and common prosperity.

Recommendations

To maximize the benefits of accession to the East African Community (EAC) and address its major challenges, the following measures are recommended for Somalia:

1. Diversify Export Products

It is recommended that Somalia expand its export base beyond livestock and fish, incorporating products such as processed foods, textiles, and manufactured goods to enhance competitiveness and reduce vulnerability to market fluctuations.

2. Improve Roads, Ports, and Electricity Infrastructure

It is recommended that Somalia invest substantially in the restoration and development of its transport networks, port facilities, and energy distribution systems. Enhancing infrastructure will reduce transaction costs and facilitate smoother trade flows.

3. Enhance National Security

It is recommended that Somalia prioritize the establishment of political stability and public safety. A secure environment is essential for attracting foreign investment, supporting domestic enterprises, and sustaining economic development.

4. Promote Small and Medium-Sized Enterprises and Industrialization

It is recommended that Somalia promote the development of small factories and enterprises, particularly in the agricultural and manufacturing sectors, to reduce reliance on imports and stimulate local production.

5. Align with EAC Regulatory Standards

It is recommended that Somalia harmonize its legal frameworks and institutional structures with EAC standards to facilitate trade, investment, and labor mobility within the region.

6. Expand Trade Relations within the EAC

It is recommended that Somalia broaden its trade partnerships beyond Kenya to include other EAC member states such as Uganda, Tanzania, and South Sudan in order to achieve a more balanced and diversified trade profile.

7. Invest in Human Capital Development

It is recommended that Somalia strengthen investments in education, vocational training, and workforce development to enhance labor productivity and support economic growth.

8. Support Export Promotion Initiatives

It is recommended that Somalia establish dedicated government agencies or support offices to assist businesses in accessing EAC and international markets, providing advisory services, logistical support, and market information.

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EXCHANGE RATE VOLATILITY, STOCK MARKET DYNAMICS AND FOREIGN DIRECT INVESTMENT IN NIGERIA (2002–2023)

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ABSTRACT

Purpose - The study tests the interactive and causal relationship among exchange rate volatility (ERV), foreign direct investment (FDI), and stock market performance (SMP) in Nigeria from 2003–2022. Specifically, it investigates the long-run effect of ERV on SMP as well as the interactive effect of ERV and SMP on FDI.
Methodology - The research follows an explanatory time series design and relies on secondary data gathered from the World Bank database. Econometric techniques, including the Autoregressive Distributed Lag (ARDL) model, Granger causality tests, and multiple regression analysis, are employed to examine both short- and long-run relationships among the variables.
Results - The long-run ARDL specification and bounds test reveal the presence of a large inverse relationship between lagged and current FDI, which indicates an adjustment process towards equilibrium. Exchange rates have a positive and significant effect on long-run FDI, but the dynamics of short-run exchange rate movements and stock market performance are not significant. More volatility of exchange rates is also associated with low FDI, which reflects the adverse effect of exchange rate uncertainty on foreign investment.
Conclusion - The evidence supports the supreme role played by exchange rate dynamics in determining FDI inflows. The long-run negative impact of exchange rate volatility on FDI supports the need for policy measures to ensure exchange rate stability for a more conducive investment climate in Nigeria.

Keywords: Exchange rate volatility, stock market performance, foreign direct investment, ARDL model.
JEL Codes: F31, F21, G15, O55

1. INTRODUCTION

What relationship exists amongst stock market performance (SMP), exchange rate volatility (ERV) and foreign direct investment (FDI) flows? This opening question seeks to examine the interconnections amongst fluctuations in exchange rate (ER) and two key financial outcomes—SMP and FDI—investigating the degree to which instability in exchange rates may influence investor confidence, capital inflows, and the performance of stock markets. This initial question can lead to further sub-questions, such as: To what extent does ERV deter or attract FDI flows? In what ways does SMP respond to changes in exchange rate stability? Are certain sectors or types of FDI more sensitive to exchange rate volatility? These set of questions will provide a nuanced view of the associations among ERV, stock market dynamics, and FDI. They would enable the research to capture both indirect and direct effects, which can be valuable for investors, financial analysts and policymakers. Previous empirical studies either in developed and developing economies had made attempts to provide empirical information on how ERV impact SMP and FDI flows.

For instance, the study carried out by Odili (2015) examined how ERV and SMP influence FDI inflows to Nigeria, by means of data ranging from 1980 to 2013. It applied a model known as error correction mechanism (ECM) as well as ordinary least squares (OLS) method and observed that ERV substantially and negatively impacts FDI inflows for the long- and short-terms, indicative of the fact that unstable currency deters foreign investors. Conversely, stock market performance, represented by

market capitalization, has a statistically positive substantial effect on FDI, suggesting that a robust and stable capital market can attract more foreign investment. Also, Kilicarslan (2018) examined, in Turkey, the association that exits betwixt ERV and FDI, using datasets from 2005 to 2018. It used a GARCH model as well as Toda-Yamamoto test of causality, in which the discoveries showed one-way causality from FDI to ERV, indicating that FDI inflows may impact currency stability by influencing capital flows. In another attempt, Uzoma-Nwosu and Orekoya (2020) discovered that FDI contributed to productivity growth, job creation, and technological advancements, particularly in sub-Saharan Africa (SSA) and that exchange rate fluctuations, especially currency depreciation led to increased production costs, reduced FDI inflows, and broader economic issues like poverty, inequality, and trade imbalances. Sharfi-Renani and Mirfatah (2012) probed the determinants of FDI in Iran, concentrating particularly on ERV and they used the Johansen and Juselius cointegration model with data from 1980Q2 to 2006Q3 to obtain the findings that revealed that openness, Gross Domestic Product (GDP) as well as exchange rates (ER) have a favourable connection with FDI, whereas world crude oil prices and ERV negatively affect FDI inflows. Also, Havi (2021) investigated the ERV- FDI relationship in Ghana and reported that economic openness and exchange rate depreciation do not encourage FDI while the size of the economy and exchange rate volatility positively influence FDI inflows.

Still on the previous attempts to answer the opening research question, the study by Fapetu, Adeyeye, Seyingbo, and Owoeye (2017) analysed the influence of ERV on SMP in Nigeria by means of monthly data and ARCH-family models (ARCH, GARCH, EGARCH, TARCH) and discovered a favourable association between market capitalization and exchange rate but highlighted differences in variance residuals across models. Osinubi and Amaghionyeodiwe (2009) studied the ERV-FDI relationship in Nigeria (1970–2004) using error correction and OLS methods and discovered a favourable connection between Naira depreciation and FDI inflows but highlighted the adverse impact of the Structural Adjustment Programme on FDI due to heightened ERV. A study by Ullah, Haider and Azim (2012) studied the connection betwixt FDI, ER and its volatility in Pakistan (1980–2010) and discovered that FDI increases with currency depreciation but is deterred by exchange rate volatility while trade openness boosts FDI but the inflation is insignificant, with causality analysis showing that volatility influences FDI but not vice versa. The influence of real ERV on FDI inflows within Sub-Saharan Africa (SSA) was the focus of an investigation carried out by Suliman, Elmawazini and Shariff (2015) and they found that currency depreciation attracts more FDI but ER instability deters it while the use of pegged exchange rates exacerbated price instability, complicating FDI inflows. A contrary finding was reported by Dewenter (1995) on the connection between ER and foreign acquisitions of U.S. firms between 1975 and 1989 as it revealed no significant relationship when considering relative corporate wealth and overall investment levels. A study by Froot and Stein (1991) investigated the association betwixt ER fluctuations and FDI through informational imperfections in global capital markets and discovered that currency depreciation reduced domestic wealth, prompting foreign acquisitions of domestic assets due to the higher cost of external financing compared to internal funds. Another contrary finding was also reported by Ignatius, Ogbonna and Maduka (2019) in a study that examined how ERV affects FDI in Nigeria via time series data (1986 -2016) and discovered a negative significant influence of ERV on FDI. Similarly, Hanusch, Nguyen and Algu (2018) studied the connection betwixt ERV and FDI inflows in 80 nations (1990-2015) and discovered that reducing ERV by 10% could increase FDI inflows, with South Africa potentially boosting its FDI by 0.25 percentage points of GDP by reducing volatility of rand to that of other developing nations.

However, the need for a novel study on ERV, SMP and FDI in Nigeria can be justified by several gaps in the existing literature. For instance, there is limited exploration of the interaction amongst ERV, SMP and FDI as prior studies investigated ERV's association with FDI (Odili, 2015; Ullah et al., 2012) and the influence of stock market performance on FDI (Fapetu et al., 2017), few have analysed the combined effects of all three variables in a single framework showing that the unique interaction amongst ER fluctuations, SMP and FDI in Nigeria remains underexplored, especially in light of Nigeria's complex foreign exchange regime. Also, there were mixed findings on exchange rate volatility's impact because some studies, such as Odili (2015), had discovered a negative influence of ERV on FDI, while others (like Havi, 2021and Hanusch et al., 2018) showed that volatility might have a mixed or even positive effect on FDI inflows depending on context and methodology justifying the call for more context-specific studies that could provide clearer insights into Nigeria's unique economic conditions. The need for this study was established by contradictory results in stock market-FDI relationship as Fapetu et al. (2017) reported a favourable relationship amongst ERV and market capitalization, some studies (e.g., Osinubi & Amaghionyeodiwe, 2009) highlighted adverse effects of structural adjustments and currency depreciation on FDI suggesting that while stock market performance can potentially attract FDI, it may not be robust enough in the face of currency instability, which requires further investigation specific to Nigeria’s financial landscape.

Another justification stemmed from the role of exchange rate systems as the study by Suliman, Elmawazini and Shariff (2015) revealed the complexity of pegged exchange rates and their effect on FDI vis-a-vis Nigeria’s multiple exchange rate system could be driving instability, complicating the association connecting ERV to FDI because studies concentrating on this peculiarity in Nigeria are scarce, and a deeper examination of this aspect is necessary to understand its true impact on foreign investments. Although cross-country studies like Hanusch et al. (2018) discovered that decreasing ERV could increase FDI inflows in other developing countries, the specific institutional and economic realities of Nigeria, such as the effect of oil

prices on the Naira, demand localized insights as the study by Osinubi and Amaghionyeodiwe (2009) on Nigeria's historical exchange rate volatility and FDI inflows hints at structural issues, which are critical for policy decisions. Many studies, such as those by Froot & Stein (1991) and Dewenter (1995) explored the dynamics of exchange rate fluctuations and FDI over specific periods or focus on individual aspects, like foreign acquisitions. A comprehensive longitudinal analysis of both SMP and ERV on FDI in the context of Nigeria's economic evolution (1980–2023) is yet to be undertaken, providing a clear gap for future research. In a nutshell, while there is a rich body of work examining ERV, SMP and FDI individually, a novel study integrating all three within the Nigerian context—especially considering the unique macroeconomic and policy challenges facing the country—could provide more vigorous as well as actionable insights for policymakers and investors alike.

Foreign direct investment (FDI) enables investors to establish control over enterprises in foreign countries, driving economic growth globally, especially in developing nations with capital and technological gaps. However, FDI inflows to Nigeria have sharply declined in recent years, dropping from $3.31 billion in 2021 to $0.19 billion in 2022, and further falling by 26.7% to $3.9 billion in 2023. Contributing factors include naira depreciation, political risks, and high production costs. Midway into 2023, FDI inflows were valued at $86.03 million, representing 3.53% of total capital imports. As of July 2024, for instance, the exchange rate is ₦1584/USD, showing economic instability and problems that deter foreign investments (NBS, 2024). This recent colossal drop in FDI inflows to Nigeria, therefore, underscores the need to study the combined effects of ERV and SMP on FDI. Whilst some researchers have studied the effect of ERV on FDI, such as Odili (2015) and Ignatius et al. (2019), relatively few have studied the joint effects of ERV and SMP on FDI inflows. It is, therefore, essential to investigate the nexus in Nigeria's current economic situation so that specific measures can be formulated that could stabilise the ER, provide resilience to the stock market and consequently attract more FDI. This study intends to bridge that gap and provide insights into economic reform as well as investors' confidence.

Hence, the study adopted an explanatory time series design to translate the dynamics between variables over some time into quantitative measurements. The study focused on the Nigerian Stock Exchange, covering ERV, SMP, and FDI data for 22 years between 2002 and 2023. This period was purposively selected to capture the different economic conditions that would affect the different variables in the study. Secondary data were retrieved from the World Bank database, which can be relied upon regarding its relevance to the data for the analysis. This methodological approach is utilised to thoroughly analyse the dynamic interactions among the critical economic indices. This empirical investigation adds to the emerging literature in the field by offering an understanding of the nuances of how ERV interact with SMP in Nigeria as factors impacting FDI. Unlike other studies that consider only the direct influencing of ER variations on FDI, the present investigation acknowledges short-term dynamics as well as long-term relationships by using the ARDL in a way that underscores a significant mechanism for error correction that adjusts FDI deviations translating over time.

2. LITERATURE REVIEW

2.1. Exchange Rate Volatility (ERV)

The exchange rate (ER) represents the worth of a nation’s money when compared to that of others. It is composed of two currencies and can be cited indirectly or directly. When quoted directly it shows the worth of the overseas’ money with regard to the domestic money, whereas quoting indirectly shows the worth of home currency regarding overseas money. An ER that without the home money as one of the two components of the currency is called cross state or cross currency. Three types of ER have been established in literature. These are real ER, nominal ER and real effective ER but Olisadebe (1991) discovered two other ERs and they are equilibrium ER and nominal effective ER. ERs can either fluctuate freely, be influenced by market dynamics or remain fixed where the currency value is tied to another currency such as the US dollar. According to Khan and Sajid (2005) the ER is the most substantial component in a free-market economy because its direct influence on macro-economic indicator like FDI. Policy maker and investors must keep an eye on a nation’s ER before committing their fund in that country. When a nation’s ER increase, domestic export commodities become inexpensive, and request for export increase as well. This implies that international demand for commodities rises, while import fall. It has influence on FDI, and all of the consequence have an influence on the nation’s monetary success. ERV can have far-reaching consequences, including affecting trade balances, investment flows, and the overall economic performance of countries. Exchange rate volatility is influenced by various macroeconomic factors. Interest rates, for instance, can impact exchange rates and heighten volatility, particularly in emerging markets. Inflation rates also correlate with exchange rate volatility, as high inflation can lead to currency depreciation. A country's trade balance affects ER dynamics via its influence on currency demand and supply. Furthermore, political stability is crucial for maintaining currency stability, while political uncertainty can lead to increased volatility. Comprehending these relationships is essential for investors and policymakers seeking to traverse the intricacies of global capital markets (Frankel, 1983; Branson, Halttunen & Masson, 1977).

2.2. Stock Market Performance (SMP)

SMP refers to the behaviour of equity prices and market indices over time. It is shaped by a innumerable factors, ranging from macroeconomic indices to company specific occurrences, and involves the interaction of various market participants.

Understanding SMP is imperative for investors, policymakers, and economists for making educated decisions and predict future trends. The stock market is a quintessential to organisational transformation in any economic system, from rigid, customary and insecure bank-based to an economic system that is more secure, more flexible and immune to shocks, volatilities and absence of stockholder's trust (Stapley, 1986). On their part, Patrick and Wai (1973) submitted that stock markets are institutions dealing with capital, in long- and short-terms, where firms trade equities so as to make long-standing capital that can be funnelled into their options that are profitable. The tasks of purchasing and vending shares and stocks on the stock market are tremendously substantial for the sharing of assets within the economic systems. Even though, when prices of share are at historically high-rankings or increasing, this shows trust amongst stockholders and may impact the trust of investors and, invariably their asset. Also, the stock market is a vital determinant in making decision on business investments as the shares price influence the quantity of capitals that can be raised by vending stocks newly issued to fund spending on investment. SMP is influenced by several factors, including technological innovations, market sentiment, geopolitical events, and corporate governance. Technological advancements can drive long-term growth and value creation but also introduce volatility and speculation. Market sentiment, shaped by various factors, can propel stock prices beyond fundamental values, leading to bubbles and crashes. Geopolitical events can induce sudden shifts in markets, affecting investor confidence and risk tolerance. Finally, effective corporate governance practices, such as transparency and risk management, can foster investor confidence, drive up demand for stocks, and contribute to broader market stability (Fiorillo, Meles, Pellegrino & Verdoliva, 2024).

2.3. Foreign Direct Investment (FDI)

FDI represents the movement of capital across borders on an international scale, granting a transnational entity or parent firm authority over its overseas affiliates or subsidiaries (Goldberg and Charles 2005). FDI is a class of substantial degree of impact on a foreign enterprise management. FDI involves a long-term interest and control over an enterprise in a foreign country, often through equity ownership. This sets it apart from portfolio investment, where investors may hold stocks or bonds but typically don't have significant control over the company. FDI impact can be shaped by the political system of the host country. For instance, a favourable trade policy can attract FDI, leading to increased domestic population growth. FDI is the allocation of overseas resources into local equipment, structures and organizations. FDI is not part of foreign investment into stock market. FDI is typically considered more beneficial to a nation compared to investment in its company's stocks. This is because equity investments are often viewed as volatile, susceptible to quick withdrawal at the slightest hint of instability, whereas FDI is more stable and valuable regardless of the economic circumstances (Bilawal, 2014). In the same vein, Huchet-Bourdon and Korinek (2011) opined that FDIs play a vital role in nurturing growth in emerging economies. Overseas investors are driven to invest in the host nation when they observe obvious prospects for enduring profitability via contribution to the domestic production capabilities of that nation. FDI is essential for emerging nations as it contributes significantly to capital formation. Additionally, FDI serves as a channel of transference of technology and ground-breaking skills to emerging from developed economies. FDIs are impacted by several factors, notably tax policies, market size/growth potentials, quality infrastructural development, economic stability as well as trade policies. A big market size with favourable tax policies coupled with high growth potentials attract FDI, whilst infrastructural development and economic stability provide a robust business environment. Similarly, trade policies catering to a stable and predictable regulatory environment can also stimulate FDI. In contrast, heavy tax burdens, restrictive trade policies and economic instability put FDI on the back foot. These factors need to be understood by policymakers attempting to attract FDI for sustainably promoting growth and development.

2.4. Exchange Rate Volatility-Foreign Direct Investment Relationship

The crucial factors impacting FDI decisions have included ERV. The relationship between ERV and FDI has been extensively studied across different countries, and empirical investigations have shown that ERV has adverse effects on FDI inflows. For instance, Ignatius et al. (2019) discovered that ERV has a significant adverse influence on Nigeria's FDI. It is also observed by Sakli, Boubker, Mrad, and Nafti (2021) that an increase in ERV negatively affects FDI inflow in Tunisia in the long run. Similarly, Kenneth, Muniu, and Kosgei (2017) showed that ERV has a negative effect on FDI in Kenya. Nonetheless, a number of previous empirical findings have reported a positive association between ERV and FDI. For instance, Bilawal et al. (2014) discovered that fluctuations in ER positively affected FDI inflows in Pakistan. Osinubi et al. (2009) also found a significant positive relationship between inward FDI and the exchange rate in Nigeria. Findings are mixed in the literature due to many factors, including different nation-specific characteristics, conditions of economies, and methodological approaches. The study of Akinlo and Onatunji (2021) found significant differences in the impact of ERV on FDI in different ECOWAS countries. The theoretical underpinning of the link betwixt ERV and FDI can be described via the Imperfect Market Theory. As per this theory, investment flows (including FDI) are greatly affected by market imperfections like ER fluctuations, asymmetric information as well as investors' uncertainty. Thus, the relationship betwixt ERV and FDI is multi-faceted and can be affected by many variables. While some of the earlier studies reported a negative influence of ERV on FDI, others have reported a

positive association. Therefore, more research would be necessary in order to understand the complexity of this relationship and to guide policy direction.

2.5. Exchange Rate (ER) and Stock Market Performance (SMP)

Many studies have investigated the relationship between exchange rates (ERs) and stock markets, generating mixed results. Some of the studies have proved that ERV negatively affects SMP (Lawal & Ijirshar, 2013; Olugbenga, 2012), whereas other studies found that they are positively related (Fapetu et al., 2017). GARCH, ARDL, and VECM methodologies have been used to reveal long- and short-term dynamics of this association. The results seem not to be consistent and therefore bring in complexity in association between ERs and stock markets (Raja, Zehra, Chhapra & Makhija, 2019; Mroua, 2019; Zubair & Aladejare, 2017). Moreover, the empirical studies indicate that the specified relationship between ERs and stock markets is different across countries and within regions due to factors such as economic conditions, trade relationship and monetary policies (Mroua, 2019). Other determinants that can also compete with this relationship are inflation, interest rate and global economy incidents (Lawal & Ijirshar, 2013). All in all, the relationship between ERs and stock markets is very complex and multi-factorial and would require extensive research for understanding.

2.6. Exchange Rate Volatility, Stock Market and Foreign Direct Investment

The inter-relationships between ERV, SM and FDI have been widely studied, often with mixed findings. Some studies found that ERV affects FDI inflow negatively (Odili, 2015; Omolola and Adefemi, 2018; Abdullahi, 2023), while others found a positive relationship between SMP and FDI (Omodero and Ekwe, 2016). Different techniques, namely ARDL, NARDL, and VAR, have been used to shed some light on the long- and short-term dynamic forces behind this association. However, findings remain inconsistent, demonstrating the complexity of the association among the ERV, SM and FDI (Sokang, 2018; Vanapruk, 2021). Moreover, it is also suggested that the among ERV, SM and FDI can vary transversely to several countries and regions by determinants such as economic conditions, trading relationships, and monetary policies (Abdullahi, 2023). Besides, inflation, interest rates, and global economic happenings also affect the relationship (Odili, 2015). All in all, the relationship among ERV, SMP and FDI is rather intricate and multifactorial and warrants further examination to understand its nuanced dynamics.

2.7. Theoretical Justification

The imperfect market theory also called the imperfect market hypothesis, was developed in the ‘70s and ‘80s when economists began questioning the assumptions of perfect competition and efficient markets. The theory secured great prominence in the 1990s with the contributions of economic theorists like George Akerlof, Joseph Stiglitz, and Michael Spence, who won the Nobel Prize in Economics (2001) for their empirical work on asymmetric information and market imperfections (Stiglitz, 2000; Akerlof, 1970). The theory discusses how market frictions such as transaction entry or exit costs, tariffs, and regulations create inefficiencies that affect ERV, SMP, and FDI. The theory pins its view on imperfect market factors like government intervention, information asymmetry, and barriers to capital flow that interrelate with fluctuating exchange rates affecting stock market performance and FDI. This highlights an intricate web of inter-dependence whereby ERV, SMP and FDI influence each other.

In analysing the connections among ERV, SM, and FDI, imperfect market theory provides the most suitable theoretical base. According to this theory, market imperfections like ER fluctuations, asymmetric information and investors' uncertainty also largely determine FDI (Gorg & Greenaway, 2004; Blonigen, 2005). FDI is expected to remain less volatile than portfolio investments, which are readily responsive to market conditions and investors' sentiments, although it may still be affected by market inefficiencies in the form of exchange rate fluctuations.

3. METHODOLOGY

This study examined the interactions among FDI, SMP and ERV. It specifically studied a 22-year period from 2002 to 2023. The basis for choosing this period was to capture varying economic conditions over time. These years witness varying economic conditions, including periods of growth, recession and volatility. All of these are great for understanding the dynamic interactions among the variables being studied. Focusing on such periods enables the study to generate insights that are directly relevant to the particular historical period in question and provide an in-depth understanding of the wider economic implications of the variables.

3.1. Research Design

An explanatory time series design is utilised in this study. This quantitative approach evaluates and explains the time-based dynamic interactions of variables over time. This design elaborates on variables' short- and long-term effects and causation via econometric analyses. The method allows for a clear understanding of the way variables impact one another via an analysis of time-ordered data in order to highlight trends, patterns and interactions within a specified period. Dynamic

interrelationships among ERV, SMP and FDI in Nigeria were studied over the period from 2002 to 2023 with this design in mind. The explanatory time series research design is appropriate as it serves the purposes of the study, and the characteristics of the data used. This design deals with interactions across a variety of economic variables and permits investigation into the dynamic and causal relationships among the study's variables over 22 years. Moreover, this approach resonates with previous financial and economic research that examines time-dependent variables (Pesaran, Shin, and Smith, 2001; Narayan, 2005), making it a perfect alternative for studying the economic dynamics of Nigeria.

Secondary data were used in the work, which were sourced from the World Bank database, with focus on the selected variables from 2002 to 2023, aligning with the study's timeframe. Consequently, the research is confined to this 22-year period, reflecting the economic conditions and trends during this span.

The summary of variable measurements, including control variables, is provided in Table 1.

Table 1: Variables Measurements

Variable	Abbreviation	Measurement	Source
Dependent Variable			
Foreign Direct Investment	FDI	The total of equity capital, profits reinvestment, other long-term capital, as well as short-term capital as found in the balance of payments.	Yabu and Kimolo (2020), Sharmin and Khandaker. (2015)
Independent Variables			
Exchange Rate Volatility	ERV	Measured using GARCH applied to the natural logarithm of exchange rate data.	Asmah and Andoh (2013)
Stock Market Performance	SM	The turnover ratio, which is determined by dividing the value of domestic shares traded by their market capitalisation.	Yabu and Kimolo (2020)
Control Variables			
Market Capitalizations	MC	Stock market capitalization as reported by world bank	Olabisi and Akeju (2024)
Gross Domestic Product	GDP	Value of gross domestic income	Olabisi and Akeju (2024); Yabu and Kimolo (2020)

3.2. Model Specification

The model for examining the interrelationship among ERV, SMP and FDI in Nigeria is expressed in the following econometric equation as follows:

Dynamic and Causal Relationship

A Vector Autoregression(VAR) model was utilise to capture the dynamic interrelationships betwixt ERV, SMP and FDI as adapted from Sudipta et al. (2017):

$$ER_t = a_0 + a_1 ER_{t-1} + a_2 SM_{t-1} + a_3 FDI_{t-1} + \varepsilon_{1t}$$

$$SM_t = b_0 + b_1 ER_{t-1} + b_2 SM_{t-1} + b_3 FDI_{t-1} + \varepsilon_{2t}$$

$$FDI_t = c_0 + c_1 ER_{t-1} + c_2 SM_{t-1} + c_3 FDI_{t-1} + \varepsilon_{3t}$$

Where t is the time period, ER is the Exchange Rate Volatility, SM is the Stock Market Performance, FDI is the Foreign Direct Investment, a_0, b_0, c_0 are constants, a_1, a_2, a_3, b_1, b_2, b_3, c_1, c_2, c_3 are the coefficients and e_{1t}, e_{2t}, e_{3t} are error terms.

Long-term Implications of ERV on FDI Sustainability

An Error Correction Model (ECM) was be used to capture both short-run and long-run relationships as adapted from Stock and Watson (2016):

$$\Delta FDI_t = \alpha_0 + \alpha_1 \Delta ER_t + \alpha_2 \Delta ERV_t + \beta ECT_{t-1} + \varepsilon_t$$

Where Δ represents the difference operator, ECT is the error correction term, α_0, α_1, α_2, β are coefficients, ε_t is the error term. The ECM equation incorporates the long-run interrelationship betwixt FDI, ER, and ERV through the error correction term.

Interactive Effects of ERV and SMP on FDI

$$FDI_t = \alpha_0 + \alpha_1 ER_t + \alpha_2 SM_t + \alpha_3 MC_t + \alpha_4 GDP_t + \varepsilon_t$$

Where FDI_t = log of FDI, ER_t = ERV, SM_t = SMP, MC_t=market capitalization, GDP= gross domestic product, α_0, α_1, α_2, α_3, and α_4 are coefficients, ε_t is the error term.

Different data analysis techniques were used in this study to find the relationships among the key economic variables. How ERV, SMP, and FDI influence each other over time was analysed with the help of a vector auto-regression (VAR) model, which captured the dynamic interaction. The model helps in uncovering causal linkages and feedback loops in the data. In order to understand long-term consequences, particularly the influence of ERV on sustainable FDI, an Error Correction Model (ECM) was used. The approach outlines short-run dynamics and long-run equilibrium associations as adjustments happen through deviations. Finally, a multiple regression analysis was carried out to explain complex relationships involving latent variables so we can obtain direct and indirect pathways systemwide.

4. RESULTS AND INTERPRETATION

4.1. Descriptive Analysis

The descriptive statistics (Table 2) show variables like ER (LN_ER), FDI (LN_FDI), market capitalization (LN_MC), stock market index (LN_SM), and GDP (LN_GDP). The mean value shows the average levels of the variables across the sample period. LN_ER has an average of 5.27, LN_FDI at 21.58, LN_MC is equal to 24.32, LN_SM average 6.05 while LNGDP has a very high mean value of 31.79. The median values, which indicate the middle point of the data distribution, are close to the means, suggesting that these distributions are not too skewed except for LN_SM, which has a significantly lower median compared to its mean, showing that it may be asymmetrical.

Maximum and minimum values give the range of data for each variable. LN_ER ranges from 4.78 to 6.05, while LN_FDI varies from 18.60 to 22.81. LN_MC has a range from 21.59 to 25.72, LN_SM from 0.19 to 25.24, and LNGDP from 30.07 to 33.09. LN_SM has the largest range, showing extensive variations of stock market values during the sample period. Standard deviations give a measure of data's dispersion around their mean. The standard deviation in LN_SM is 8.89, the highest of all variations, indicating a substantial variation compared to other variables. In contrast, both LNGDP and LN_ER are characterised by relatively low standard deviations, indicating they are much more stable series compared to the former.

The skewness values reflect symmetry in data distributions. The skewness estimates for LN_ER and LNGDP are moderate with values of 0.57 and negative with -0.44, respectively. While LN_FDI and LN_MC have left skewness with values of -1.41 and -1.65, respectively, a positive skewness value of 1.63 indicates a right-skew distribution where the bulk of the data points are collected on the lower range while few extreme values are on the upper range. The kurtosis values show "tailedness"- to the distribution. The result shows a leptokurtic distribution with heavier tails than the normal distribution since the highest value of kurtosis is seen in LN_MC, which is 5.47. The distributions for LN_FDI and LN_SM also have kurtosis values above 3, implying the existence of more outliers than a normal distribution. In contrast, LN_ER and LNGDP exhibit kurtosis values below 3, which would imply a more platykurtic distribution with lighter tails.

The Jarque-Bera test checks for the normality of distributions. The Jarque-Bera statistics for LN_ER and LNGDP were found to be low at 0.26 and 0.51, respectively. This shows that these variables do not significantly deviate from normality. However, LN_FDI, LN_MC, and LN_SM have Jarque-Bera statistics that are statistically significant at conventional levels (p-values of 0.0065, 0.0004, and 0.0061, respectively), suggesting that these variables' distributions deviate from normality.

Table 2: Descriptive Statistics Output

	LN_ER	LN_FDI	LN_MC	LN_SM	LNGDP
Mean	5.274924	21.57875	24.32180	6.048740	31.79367
Median	5.058827	21.65713	24.55072	2.233746	31.96907
Maximum	6.054390	22.80574	25.72251	25.23894	33.08816
Minimum	4.775475	18.60074	21.58782	0.190295	30.07349
Std. Dev.	0.457541	1.061589	1.019369	8.890851	0.878261
Skewness	0.567555	-1.407012	-1.654652	1.629351	-0.438651
Kurtosis	1.704454	4.747587	5.471946	3.711818	2.167819
Jarque-Bera	2.719672	10.05839	15.64018	10.19868	1.340333
Probability	0.256703	0.006544	0.000402	0.006101	0.511623
Sum	116.0483	474.7325	535.0797	133.0723	699.4608
Sum Sq. Dev.	4.396222	23.66638	21.82140	1659.992	16.19820
Observations	22	22	22	22	22

4.2. Preliminary Analysis

4.2.1. Correlation Analysis

Significant correlations betwixt the variables are revealed by the the results in Table 3, which also highlights the negative relationships betwixt the stock market index, market capitalisation and GDP, as well as betwixt ER and FDI. Different levels of relationship are shown betwixt the exchange rate (LN_ER) and the other variables. With a very significant p-value of 0.0004, LN_ER and foreign direct investment (LN_FDI) exhibit a strong negative association of -0.687. This implies that FDI tends to decline as ER rises, and vice versa. With a p-value of 0.0256 and a favourable correlation of 0.475, the association betwixt LN_ER and market capitalisation (LN_MC) shows statistical significance. However, the association betwixt LN_ER and the stock market index (LN_SM) is -0.419, and the p-value is 0.0521. This is marginally significant, inferring a tendency for the ER to decrease as the stock market index rises.

Foreign direct investment (LN_FDI) is negatively correlated with market capitalization (LN_MC) at -0.043 and with gross domestic product (LNGDP) at -0.442. The p-value for the correlation with LN_MC is 0.8496, indicating a very weak and statistically insignificant relationship. In contrast, the correlation between LN_FDI and LNGDP is more substantial and statistically significant, given the p-value, which is 0.0393, suggesting that upsurges in GDP are connected to decreases in FDI, or vice versa. The stock market index (LN_SM) exhibits a moderate negative correlation with market capitalization (LN_MC) at -0.549, given the significant p-value, which is 0.0082, this signifies that as the stock market index rises, market capitalization tends to decrease. This relationship is statistically significant and suggests an inverse relationship between these two financial indicators. LN_SM also has a negative correlation with gross domestic product (LNGDP) at -0.468, given the p-value, which is 0.0282, establishing that higher GDP is associated with lower stock market index values, and the relationship shows statistical significance.

Finally, the correlation between market capitalization (LN_MC) and gross domestic product (LNGDP) is strongly positive at 0.765, give the highly significant p-value which is 0.0000. This indicates a strong positive connection where increases in GDP are associated with increases in market capitalization.

Table 3: Correlation Analysis Output (Ordinary)

Correlation Probability	LN_ER	LN_FDI	LN_MC	LN_SM	LNGDP
LN_ER	1.000000				
LN_FDI	-0.686971 0.0004	1.000000			
LN_MC	0.474804 0.0256	-0.042912 0.8496	1.000000		
LN_SM	-0.419267 0.0521	0.159798 0.4775	-0.548840 0.0082	1.000000	
LNGDP	0.874255 0.0000	-0.442356 0.0393	0.765362 0.0000	-0.467618 0.0282	1.000000

4.2.2. Cointegration Test

The tests results presented in Table 4 examined if the study's variables share a long-term equilibrium association. Variables analysed include the exchange rate (LN_ER), foreign direct investment (LN_FDI), market capitalization (LN_MC), stock market index (LN_SM), and gross domestic product (LNGDP). The test applied the Schwarz criteria to ascertain the proper lag length, with a maximum lag of 4, and the null hypothesis asserts that the data sets are not cointegrated.

Each variable has its respective tau-statistics, z-statistics and p-values according to MacKinnon's approach. The p-values obtained with respect to LN_ER, LN_MC and LNGDP are above the normal significance levels, which suggests a failure to reject the null hypothesis concerning the variables. Specifically, the values for LN_ER and LN_MC are 0.4553 and 0.5425, respectively, indicating, therefore, no evidence of cointegration. Likewise, the p-value for LNGDP is 0.7589, suggesting further that there is no cointegration of these variables within the long run. Conversely, LN_FDI and LN_SM showed lower p-values, with LN_FDI a respective value of 0.0033 for the tau-statistic and 0.0017 for the z-statistic. This signifies the rejection of the null hypothesis at normal levels of significance, implying LNF-DI being cointegrated with other variables. The stock market index (LN_SM) also shows significant evidence of cointegration, with p-values of 0.2107 and 0.0000 for the tau-statistic and z-statistic, respectively. The highly significant z-statistic for LN_SM, in particular, implies a strong long-term relationship between this variable and the others.

Table Hata! Belgede belirtilen stilde metne rastlanmadı.**: Cointegration Test Output**

Series: LN_ER LN_FDI LN_MC LN_SM LNGDP
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministic: C
Automatic lags specification based on Schwarz criterion (maxlag=4)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
LN_ER	-3.405293	0.4553	-15.95545	0.4019
LN_FDI	-6.766333	0.0033	-29.93284	0.0017
LN_MC	-3.203480	0.5425	-14.01273	0.5510
LN_SM	-4.120329	0.2107	-34.48839	0.0000
LNGDP	-2.690939	0.7589	-11.10238	0.7673

*MacKinnon (1996) p-values.
Warning: p-values may not be accurate for fewer than 25 observations.

**Number of stochastic trends in asymptotic distribution

4.3. Dynamic and Casual Relationship between ER and FDI

The analysis presented in Table 5 explores the dynamic and causal relationship betwixt ER and FDI using the ARDL model. The ARDL Long Run Form and Bounds Test output indicates that the conditional error correction regression reveals a significant relationship betwixt the lagged value of FDI and its current value. Specifically, the coefficient of the lagged FDI (FDI (-1) is negative, and it shows statistical significance ($\beta = -0.499$, $t = -2.676$, $p < 0.05$), suggesting a correction mechanism where previous deviations from equilibrium are adjusted in subsequent periods. ER also shows a positive impact and statistical significance on FDI ($\beta = 8347335$, $t = 0.000$, $p < 0.01$), implying that an upsurge in ER positively influences the inflow of FDI.

In the level's equation, which assumes a restricted constant and no trend, ER demonstrates a positive relationship and shows statistical significance with FDI ($\beta = 16721167$, $t = 2.709$, $p < 0.05$). The constant term is negative and highly significant ($\beta = -7.11E+09$, $t = -4.708$, $p < 0.01$), indicating a strong intercept effect when no changes in the independent variables are considered. The error correction term (EC), derived from the long-run equilibrium association betwixt FDI and ER, is presented as FDI - (16721167 * ER - 7114908351). This term captures the movement away from the long-term equilibrium, and it reinforces the significance of ER in determining FDI flows.

The F-Bounds test, which was done to determine whether a long-run relationship exists betwixt the variables, show the test statistic (F-statistic = 2.441) which was compared against critical values for different significance levels. However, the F-statistic drops below the lower bound at all conventional significance levels, including 10%, 5%, and 1%, both in the asymptotic case (with n=1000) and finite samples (n=30 and n=35). This result infers that the null hypothesis, which asserts no long-run relationship, cannot be rejected, indicating that while short-run dynamics are evident, the proof for a long-term equilibrium association betwixt ER and FDI is not feasible within the sample analysed.

Table 5: ARDL Long Run Form and Bounds Test Output

ARDL Long Run Form and Bounds Test
Dependent Variable: D(FDI)

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.55E+09	1.44E+09	0.000000	0.0000
FDI(-1)*	-0.499208	0.186575	-2.675635	0.0154
ER**	8347335.	4046650.	0.000000	0.0000

* P-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z (-1) + D (Z).

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ER	16721167	6172921.	2.708793	0.0144
C	-7.11E+09	1.51E+09	-4.707615	0.0002
EC = FDI - (16721166.6806*ER -7114908351.3778)				
F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	2.440572	10%	3.02	3.51
K	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58
Actual Sample Size	21		Finite Sample: n=35	
		10%	3.223	3.757
		5%	3.957	4.53
		1%	5.763	6.48
			Finite Sample: n=30	
		10%	3.303	3.797
		5%	4.09	4.663
		1%	6.027	6.76

4.4. Long-Term Impacts of ERV on the Overall Performance of a Country's Stock Market (SM)

4.4.1. ARDL Error Correction Regression Analysis

The ARDL error correction regression analysis in Table 6 investigates the short-term dynamics and the adjustment process towards long-term equilibrium for the FDI (LN_FDI), using ER (LN_ER) and SM index (LN_SM) as explanatory variables. In the ECM, the coefficient of the change in ER (D (LN_ER)) is 0.9636, but not significant, with a t-statistic which is of 0.736 and p-value 0.474. This suggests that the short-term fluctuations in the ER exert no significant influence on short-term variations FDI. Similarly, the coefficient for the change in stock market index (D (LN_SM)) is 0.02278, with a t-statistic = 1.377 and p-value = 0.1918, which signifies those short-term variations in SM index exerts no significant influence on FDI in the short-run.

The key result in this regression is the coefficient of the lagged EC term (CointEq (-1)), which is -1.5602, t-statistic = -7.385, and p-value = 0.000. The significant and negative coefficient confirms the presence of an error correction mechanism, indicating that approximately 156% of any digression from the long-term equilibrium in the foreign direct investment is corrected in each period. This suggests that when the foreign direct investment diverges from its long-run equilibrium level, it adjusts back towards equilibrium in the following period.

The R^2, which is 0.7786, indicates that the model explains 77.86% of the variations in (D (LN_FDI)). The adjusted R^2 value is somewhat lower at 0.737, accounting for the number of predicting variables within in the model. Additional model diagnostics are provided, including the Akaike Information Criterion (AIC) and the Schwarz Criterion (SC), which are measures of the goodness-of-fit of the model, with the AIC at 2.035997 and the SC at 2.2351. The Durbin-Watson statistic is 2.531, signifying no significant autocorrelation exists within the residuals. In summary, ARDL error correction model confirms that while short-term changes in ER exerts no significant influence on FDI, a there is a significant error correction mechanism driving the foreign direct investment back towards its long-term equilibrium.

Table 6: ARDL Error Correction Regression Output

Dependent Variable: D(LN_FDI)
Selected Model: ARDL (1, 1, 2)
Case 2: Restricted Constant and No Trend

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LN_ER)	0.963555	1.307891	0.736724	0.4744
D(LN_SM)	0.022784	0.016549	1.376762	0.1918
D(LN_SM(-1))	0.041573	0.017949	2.316232	0.0375
CointEq (-1)*	-1.560200	0.211252	-7.385474	0.0000

R-squared	0.778585	Mean dependent var	-0.010772
Adjusted R-squared	0.737070	S.D. dependent var	1.195502
S.E. of regression	0.613014	Akaike info criterion	2.035997
Sum squared resid	6.012570	Schwarz criterion	2.235144
Log likelihood	-16.35997	Hannan-Quinn criter.	2.074873
Durbin-Watson stat	2.530796		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	11.07950	10%	2.63	3.35
K	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

4.4.2. Granger Causality Test

To ascertain if one time series may predict another one, Granger causality tests was carried out, the result of which is presented in Table 7. The first test looks at if the SM index (LN_SM) is Granger caused by the ER (LN_ER). With a p-value of 0.4357 and an F-statistic of 0.8786, it can be concluded that LN_ER is not significantly predicting LN_SM. Similarly, an F-statistic of 0.3457 and a p-value of 0.7132 are obtained from the reverse causality test, which determines if LN_SM Granger causes LN_ER. Additionally, this finding does not disprove the null hypothesis, indicating that the ER is not significantly predicted by the SM index. The second set of tests analyses the relationship between FDI (LN_FDI) and the SM index (LN_SM). The F-statistics to check if LN_FDI Granger causes LN_SM to show 1.5077, with a p-value of 0.2531. This suggests that LN_FDI has no significant power over LN_SM. In contrast, for LN_SM being able to Granger-cause LN_FDI, the F-statistic came to 0.0256, with the p-value at 0.9748. This again suggests no predictive association between the SM index and FDI.

The other pair of tests analysed the connection between LN_ER and LN_FDI. The F-statistic for checking if LN_FD1 Granger causes LN_ER shows 0.6653 with a p-value of 0.5287, which means that it is not a significant causality. On the contrary, the test that checks whether LN_ER Granger caused LN_FDI produced an F-statistic of 6.1968 with a p-value of 0.0109. This has significance under conventional levels, proving that the ER has a significant predictive ability to predict FDI.

In sum, the Granger causality test shows that the ER is a strong predictor of FDI out of all the variables tested, with no other significant causal action observed among the ER, SM index, and FDI. It is then concluded that a unidirectional causality exists, where variations in exchange rates are good predictors of future changes in foreign direct investment and not vice versa.

Table 7: Granger Causality Test Output

Pairwise Granger Causality Tests
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LN_ER does not Granger Cause LN_SM	20	0.87864	0.4357
LN_SM does not Granger Cause LN_ER		0.34567	0.7132
LN_FDI does not Granger Cause LN_SM	20	1.50765	0.2531

LN_SM does not Granger Cause LN_FDI		0.02561	0.9748
LN_FDI does not Granger Cause LN_ER	20	0.66527	0.5287
LN_ER does not Granger Cause LN_FDI		6.19682	0.0109

4.5. Interactive Effects of ERV and SMP on FDI

The results of regression analysis, as shown in Table 8, which seek to investigate ERV and SMP's effect on FDI while controlling for GDP and market capitalisation, provide quite useful insight into the relationship among these variables. This analysis employs the least squares method to estimate coefficients with FDI as the dependent variable.

The coefficient for ER (LN_ER) is statistically significant negative (β=-2.6516, t=-2.6481, p< .01). This means that when ERV increases, FDI tends to decrease in FDI; higher ER uncertainty hinders FDI. The coefficient for SMP (LN_SM) is negative but not statistically significant (β = -0.0043, t = -0.1836, p = 0.8565). This suggests that SMP exerts no meaningful influence on FDI within the context of this model. Market capitalization (LN_MC) shows a positive but non-significant coefficient (β = 0.1676, t = 0.4659, p = 0.6472), indicating that market capitalization, while positively associated with FDI, does not have a statistically significant impact on it. Similarly, GDP (LNGDP) has a positive coefficient (β = 0.5036, t = 0.7202, p = 0.4812), but this relationship is also not statistically significant, signifying that GDP does not have a strong influence on FDI in this model. The overall model explains a moderate amount of the variance in FDI, with an R^2 of 0.5881, meaning that about 59% of the variability in FDI is accounted for by the independent variables included in the model. The adjusted R^2 is somewhat lower at 0.4912, reflecting some reduction when adjusting for the number of predictors. The F-statistic of 6.0678 is significant (p < .01), indicating that the model is statistically significant and that the independent variables, taken together, are useful predictors of FDI.

Thus, the assertion that ERV negatively impacts FDI is supported by the significant negative coefficient for LN_ER. However, the hypotheses regarding the impacts of stock market performance, market capitalization, and GDP on FDI are not supported, as these variables do not exhibit statistically significant relationships with FDI in this model.

Table 8: Regression Analysis Output

Dependent Variable: LN_FDI
Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.50256	11.29722	1.372246	0.1878
LN_ER	-2.651594	1.001331	-2.648070	0.0169
LN_SM	-0.004319	0.023527	-0.183589	0.8565
LN_MC	0.167624	0.359786	0.465898	0.6472
LNGDP	0.503634	0.699286	0.720211	0.4812
R-squared	0.588090	Mean dependent var		21.57875
Adjusted R-squared	0.491170	S.D. dependent var		1.061589
S.E. of regression	0.757256	Akaike info criterion		2.478485
Sum squared resid	9.748415	Schwarz criterion		2.726449
Log likelihood	-22.26333	Hannan-Quinn criter.		2.536898
F-statistic	6.067790	Durbin-Watson stat		2.729371
Prob(F-statistic)	0.003191			

4.6. Discussion of Findings

Using the ARDL technique, the dynamic and causal link betwixt ER and FDI is examined, yielding numerous significant findings. The short-run conditional error correction regression results show a statistically significant negative lagged value for FDI (FDI (-1)) (β= -0.499, p<0.05). This demonstrates the existence of a corrective mechanism in which departures from the previous equilibrium are compensated in subsequent periods. The ER exerts a positive significant impact on FDI (β=8347335, p < 0.01), indicating that in the short run, increased exchange rate (a decline of local currency) results in higher foreign direct investment inflows. The short-run findings indicate that policymakers can use exchange rate modifications to attract FDI in the short term. For example, initiatives that preserve competitive currency rates may provide beneficial conditions for international investors. These findings are consistent with Campa and Goldberg's (1999) argument that exchange rate volatility and depreciation can attract FDI by lowering the relative cost of investment for foreign enterprises.

Furthermore, the positive association betwixt ER and FDI supports the findings of Asmah and Andoh (2013), who discovered similar evidence in developing economies where competitive exchange rates increase investment inflows. The ARDL model shows that the ER exerts positive significant influence on FDI in both short and long run, emphasising the significant role of ER changes in influencing foreign investment decisions.

However, in the long-run relationship, the F-Bounds test results show that the F-statistic (2.441) is less than the critical lower bounds at all significance levels, indicating that a long-term equilibrium interaction betwixt exchange rates and FDI could not be established within the sample examined. This infers that, though short-run dynamics are seeming, the variables may not have a constant long-term relation. The lack of a long-run equilibrium relationship emphasises the need of addressing the structural factors that drive FDI, like stability in the economy, infrastructures as well as institutional quality. These findings contradict studies by Sharmin and Khandaker (2015) and Yabu and Kimolo (2020), which found long-term connections between currency exchange rates and FDI. The differences can be attributed to changes in period, method or sample size, accentuating complexities of the nexus between ER and FDI and the necessity for more studies to explore long-term effects.

Additionally, an implication is that the long-standing effects of persistent ER volatility on SM show from the ARDL error correction regression results that both short-term fluctuations in ER (D(LN_ER) and that of the SM index (D(LN_SM) do not significantly influence changes in short-term FDI. D(LN_ER) and D(LN_SM) have coefficients of 0.9636 and 0.02278, respectively, which are both not statistically significant ($p > 0.05$). However, the lagged error correction term (CointEq (-1) has high significance ($\beta = -1.5602$, $p < 0.01$), implying a robust adjustment mechanism that corrects departures from the long-term equilibrium in FDI at a rate of 156% per period. This emphasises the importance of long-term processes in determining FDI dynamics above short-term market volatility. Furthermore, the Granger causality tests show a unidirectional connection betwixt the exchange rate (LN_ER) and FDI (LN_FDI), with an F-statistic of 6.1968 ($p=0.0109$). This means that ER fluctuations exert predictive effects on FDI flows. However, no significant causal correlations were found betwixt the SM index (LN_SM) and other variables. The significance of ER movements in affecting FDI emphasises the relevance of stable and predictable ER policies in attracting long-term foreign investment. Policymakers should strive to prevent excessive exchange rate volatility, as it might generate uncertainty for investors. The absence of strong short-term effects from stock market performance implies that domestic capital market expansion may not be sufficient to stimulate rapid FDI inflows. Additional macroeconomic reforms may be required to boost long-term investor confidence.

The results align with the theoretical framework of the error correction model (Engle & Granger, 1987), which emphasises the importance of adjustment mechanisms in re-establishing equilibrium in long term. The significant error correction term shows that macroeconomic factors impacting FDI are more effective over longer time periods. Furthermore, the result that exchange rates Granger-cause FDI corresponds with previous research by Asmah and Andoh (2013), who discovered that exchange rate alterations impact investment decisions by modifying the cost structure for foreign investors. The lack of significant causation betwixt FDI and stock market index contrasts with the findings of Yartey and Adjasi (2007), who found a bidirectional association betwixt stock market performance and FDI in various emerging nations. This disparity might be due to structural differences across the economies studied or to the current study's small sample size.

Ultimately, the impact of EVR and SMP on FDI shows that ERV had a statistically significant negative impact. This supports the theory that an increase in exchange rate uncertainty acts as a disincentive for foreign investment by imparting a sense of risk to investors. With the significant negative influence of EVR on FDI, the implications for the necessity of stability in exchange rate policies could not be over-emphasised. Hence, policymakers should focus on promoting a predictable investment climate by effectively reducing volatility through monetary and fiscal means. Thus, the negative coefficient on exchange rate volatility corroborates other studies, namely, Okwuchukwu (2015) and Omolola and Adefemi (2018), wherein ERV was shown to influence FDI both in the short and long run negatively. This gives more impetus for existing arguments that stable exchange rate policies are very important for attracting and retaining foreign investments because volatility could lead to diminished investor confidence and consequently reduced capital flows.

Conversely, the study revealed that stock market performance had a non-significant statistical effect on FDI, thereby implying that as crucial as stock market performance may be for the well-being of an economy, it may not be the leading predictor of foreign investments in this case. This finding is somewhat unexpected since earlier studies, for instance, by Sokang (2018), have discovered a positive correlation between stock market performance and economic development. However, the current study's nonsignificant outcome regarding stock market performance could reflect those other factors, such as political stability or market regulations, exert more effect than stock market performance on FDI. Moreover, that there is no significant connection between market capitalisation and GDP with FDI demonstrates the complexities of these relationships and indicates that, while they may be potentially related to FDI, their actual impact may be obscured by other variables unaccounted for in the model.

Nonetheless, market capitalisation (LN_MC) and GDP (LNGDP) display a positive correlation with FDI; however, the relationship is not statistically significant ($p>0.05$). This positive outcome is consistent with theoretical expectations that an increase in market capitalisation implies capital markets development and GDP represents national economic stability, both

being incentives for FDI. The lack of significance on the other hand may be because of interactions with numerous other factors, including political stability and institutional quality in an emerging economy such as Nigeria.

5. CONCLUSION

This study analysed the connection among ERV, SMP and FDI, using GDP and market capitalisation as control variables. These results make fresh contributions derived from advanced econometric techniques for analysis, including ARDL modelling, error correction regression, and Granger causality testing.

Based on the findings, it is concluded that ER affects FDI inflows. The existence of an error correction mechanism confirms that deviations from the FDI are corrected with time and underscores the need for the maintenance of stable exchange rates to attract significant FDI. Yet, the fact that there is no long-run equilibrium relationship does indicate that while exchange rates may be import in the short run, there are other important factors that define the long-run association between FDI and exchange rates.

Moreover, it was found that while short-term stimuli do not affect FDI, exchange rates exert predictive power over FDI in the long run, justifying the requirement for the formulation of policies to combat ERV to provide a conducive environment for investment. Finally, it is concluded that ERV is a significant deterrent to foreign investment. While the stock market performance may not significantly sway FDI, the findings reinforce exchange rate stability as a significant factor for foreign investment attraction and retention. The lack of significance in the association among market capitalization, GDP, and FDI suggests that, although these factors are relevant, they are completely overshadowed by the perception of risk posed by exchange rate volatility.

6. RECOMMENDATIONS

Because of its findings, this study offers the following recommendations:

I. Government and other policy makers should endeavour to make exchange rates stable by establishing prudent monetary and fiscal policies to ensure a advantageous environment for FDI.

II. It is important to implement policies which ensures that volatility in exchange rate is reduced to barest minimum, as it has been shown to exert predictive influence on FDI, which indirectly affects stock market performance.

III. The investors' confidence needs to be enhanced by maintaining a stable exchange rate policy, as volatility is a key deterrent to attracting foreign investment.

7. THEORETICAL IMPLICATIONS

The one-way causation from exchange rates to FDI lends potency to the proposition that currency rates serve as a cost variable affecting host country choices of foreign investors, in line with Dunning's (1980) eclectic paradigm. Nevertheless, the result indicating no relationship between FDI and stock market index means that in this case, boosting FDI may not necessarily be through enhancing the functioning of capital market as it may be directed to non-market sectors like infrastructure or manufacturing. In addition, results confirm the explained postponement or cancellation of investments subjected to exchange rate uncertainty (Cushman, 1985), reinforcing the risk-averse characteristic in foreign investors. This kind of stock market performance would support the idea expressed by Yartey and Adjasi (2007) that in developing or less developed countries, the inflow of FDI is less affected by financial market movements.

8. LIMITATIONS AND FUTURE RESEARCH

The study's sample size and variable scope are limited, which may have an impact on the reliability of the F-Bounds test results. Future study should broaden the dataset and include additional control variables including political stability, institutional quality, and trade openness to better explain FDI trends.

Furthermore, the study focused on Nigeria, which may restrict the findings' generalisability to other settings. Thus, future study may include a comparison investigation of many African nations, which could show wider trends and provide a better understanding of the mechanisms at work.

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DIGITAL ECONOMY AND TAX COMPLIANCE: EXPLORING THE RELATIONSHIP BETWEEN E-COMMERCE ADOPTION AND TAX PAYMENT MOTIVATION IN DIYARBAKIR

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ABSTRACT

Purpose- This study investigates the relationship between e-commerce usage and tax payment motivation in Diyarbakır, Türkiye, focusing on how digital payment methods, income levels, and tax fairness perceptions influence tax compliance. It addresses regional challenges in aligning digital economic practices with tax policies, aiming to provide insights into reducing informal economic activities through enhanced e-commerce transparency.

Methodology- A cross-sectional quantitative survey of 675 participants was conducted, selected via Cochran's formula to ensure representativeness. Non-parametric analyses (Chi-square, Cramér's V) and regression models were employed to test hypotheses. Data reliability was confirmed by Cronbach's Alpha of 0.91, and ethical standards were maintained through informed consent and anonymization.

Findings- e-Commerce frequency positively correlates with tax motivation (β=0.42, p<0.01), while cash-on-delivery users exhibited 2.15 times higher tax evasion tendencies than digital payment adopters. Higher income levels strengthened tax compliance (β=0.37, p<0.01), though tax fairness perceptions only weakly influenced digital payment adoption (ρ=0.28, p<0.05). Regional disparities in digital infrastructure and socio-economic factors further shaped compliance behaviors.

Conclusion- Digital payment integration and tax literacy campaigns are critical for improving tax compliance in developing regions like Diyarbakır. Policymakers should prioritize digitalization of SMEs, incentivize non-cash transactions, and strengthen audit mechanisms for cash-based e-commerce. Future research should explore longitudinal impacts of digital transformation on tax behaviors across diverse socio-economic contexts.

Keywords: Tax compliance, e-commerce, digital payments, informal economy, regional economics
JEL Codes: H26, O17, L81

1. INTRODUCTION

The digital economy has profoundly transformed global trade dynamics, necessitating the adaptation of traditional tax systems. While the expansion of e-commerce is widely believed to enhance financial transparency and tax compliance, this relationship presents a paradox in developing regions where cash-based payment methods remain dominant. This study addresses this very paradox by examining the case of Diyarbakır, a region characterized by a technologically adept young population yet facing risks of informality. By doing so, it critically investigates the net impact of digitalization on tax motivation and compliance in a context where its benefits are not guaranteed.

e-Commerce, by shifting conventional trade models to digital platforms, ostensibly improves the traceability of economic activities. However, despite the increasing prevalence of digital payment systems, reliance on cash-on-delivery (COD) can lead to tax revenue losses, thereby complicating efforts to combat the informal economy (Schneider, 2004). The taxation of the digital economy in Turkey has been shaped by regulatory measures such as the Digital Services Tax (GİB, 2021). Nonetheless, regional economic structures significantly influence tax compliance dynamics. In Diyarbakır, where traditional commerce remains dominant, the extent of e-commerce adoption and preferred payment methods provide a distinctive research framework for assessing tax compliance.

Tax compliance is shaped by a confluence of economic, psychological, and sociological factors. Key determinants include income level (Alm & Torgler, 2011), perceived tax fairness (Wenzel, 2002; Kirchler, 2007), and education level (Richardson, 2006), all of which influence individuals' willingness to comply with tax regulations. Diyarbakır's economy, largely driven by

agriculture and SMEs, exhibits a relatively slow adaptation to digitalization, potentially increasing the risk of informality. Moreover, e-commerce usage among younger demographics may correlate with tax awareness, yet the mechanisms underpinning this relationship remain insufficiently explored.

This study examines the impact of e-commerce adoption on tax payment motivation in Diyarbakır through four core hypotheses:

H1: A higher frequency of e-commerce usage is associated with increased tax motivation.
H2: Individuals using cash-on-delivery payment methods demonstrate a greater propensity for tax evasion.
H3: Income level positively correlates with tax motivation.
H4: Individuals with a strong perception of tax fairness are more likely to prefer digital payment methods.

This research contributes to the tax compliance literature in three key areas: (1) it provides empirical data from a developing region, testing macro-level theories in a specific socio-economic context; (2) it is one of the first studies to quantitatively model the relationship between payment methods (COD vs. digital) and tax evasion propensity; and (3) it reveals the limited impact of socio-psychological factors, such as perceived tax fairness, on technology adoption, thus offering a new perspective for policymakers.

2. LITERATURE REVIEW

2.1. Factors Influencing Tax Compliance

2.1.1. Economic Factors

Tax compliance is traditionally associated with individuals' income levels, tax rates, and tendencies toward participating in the informal economy. Alm and Torgler (2011) argue that tax compliance tends to increase as income levels rise; however, they also note that in certain high-income brackets, the motivation for tax evasion may become more pronounced. Slemrod (2007) further highlights that wealthier individuals have greater access to tax planning mechanisms, enabling them to engage in more sophisticated tax avoidance strategies.

In developing economies such as Turkey, the prevalence of the informal economy exacerbates tax revenue losses and negatively impacts tax compliance. Although the widespread adoption of digital payment systems facilitates the monitoring of taxable transactions, the continued reliance on cash-on-delivery (COD) perpetuates the risk of tax evasion (Schneider, 2004).

2.1.2. Psychological Factors

Tax compliance is closely linked to individuals' trust in the tax system and their confidence in governmental institutions (Kirchler, 2007). The perception of tax fairness is a key psychological determinant of compliance. Feld and Frey (2007) demonstrate that when individuals perceive the tax system as fair, they are more likely to voluntarily comply. Similarly, Torgler (2005) finds that in societies with high levels of trust in government policies, the inclination toward tax evasion is significantly lower.

2.1.3. Sociological Factors

Educational attainment and societal norms play a crucial role in shaping tax compliance behavior. Richardson (2006) asserts that as education levels increase, individuals develop a stronger awareness of taxation, leading to higher compliance. Additionally, digital literacy has emerged as a significant factor; individuals proficient in using e-commerce platforms and online payment systems are more likely to recognize and fulfill their tax obligations (McKinsey, 2021). In this context, the growing level of digital literacy fostered by e-commerce is widely regarded as a positive contributor to tax compliance.

2.2. The Impact of e-Commerce on the Tax System

The expansion of the digital economy has prompted a fundamental reassessment of traditional tax regulations. e-Commerce necessitates the development of new regulatory frameworks across various tax categories, including consumption taxes (such as VAT and SCT) and corporate income tax.

2.2.1. Global and National Academic Studies

Studies conducted in Germany and the United States highlight the potential of the digital economy to enhance tax collection while also emphasizing the necessity of adapting tax regulations to align with emerging technologies (Goolsbee, 2000). Research in Turkey suggests that the increasing adoption of digital payment methods could contribute to higher tax revenues. However, it is also noted that persistent consumer habits, such as cash-on-delivery, may continue to pose risks for informality (Schneider, 2004; McKinsey, 2021).

2.2.2. The Tax Potential of e-Commerce and Taxation Models in Turkey

In Turkey, transactions conducted via e-commerce primarily fall within the scope of Value Added Tax (VAT) and the Digital Services Tax (GİB, 2020). While cash-on-delivery provides convenience for consumers, it also presents a potential risk for increasing informality. In contrast, the widespread implementation of electronic invoicing and online documentation systems has proven effective in curbing tax evasion. Furthermore, supporting local e-commerce enterprises can contribute to broadening the tax base by increasing the number of officially registered businesses (T.C. Ministry of Trade, 2024a).

2.3. e-Commerce Taxation Models in Turkey

2.3.1. VAT Policies and the Digital Services Tax

In 2015, the European Union (EU) introduced a regulation that restructured the taxation of digital goods and services, aligning it with the consumer's country of residence. Similarly, Turkey implemented the Digital Services Tax in 2020, designed to impose tax obligations on e-commerce platforms operating within the country's borders (GİB, 2020).

2.3.2. OECD and EU Digital Tax Regulations

One of the key regulations proposed by the OECD for the digital economy involves requiring large technology firms to be subject to taxation in the countries where they generate revenue (Doksat, Sürücü, Coşkun, Ertem, & Ünlü, 2025; Topyıldız, 2025). While EU member states employ varying criteria for taxing revenues from digital services, they continue to develop unified policies aimed at enhancing tax compliance (Avrupa Birliği Bakanlığı, 2023; European Commission, n.d.).

2.4. The Relationship Between e-Commerce and the Informal Economy

2.4.1. The Prevalence of Cash-on-Delivery and Its Impact on Informality

The widespread use of the cash-on-delivery (COD) method in Turkey can undermine the transparency that e-commerce inherently provides. Schneider (2004) argues that invoice issuance rates tend to be low in COD transactions, which may contribute to the expansion of informal economic activities. Particularly, the preference for cash in high-value purchases complicates tax monitoring and enforcement efforts.

2.4.2. The Role of Online Payment Systems in Tax Audits

The increasing adoption of online payment methods, including credit cards and digital wallets, facilitates the digital recording of transactions (OECD, 2020). This, in turn, enhances the efficiency of data collection and tracking for tax audit purposes (BKM, 2017). In Turkey, the widespread implementation of online invoicing systems and electronic documentation is expected to play a significant role in reducing unregistered transactions (T.C. Ministry of Trade, 2024a).

2.5. Tax Awareness and Digital Transformation

Digitalization presents an opportunity to enhance voluntary tax compliance. The formation of tax awareness is influenced not only by educational and awareness programs but also by the extent to which digital platforms are utilized (McKinsey, 2021). The increased visibility of tax components in online transactions can positively influence consumer perceptions of their fiscal responsibilities (GİB, 2020).

3. DATA AND METHODOLOGY

3.1. Research Design

This study employs a quantitative research design that integrates both descriptive and relational analytical approaches. The descriptive analysis aims to identify prevailing trends in e-commerce adoption rates, payment preferences, and tax compliance behavior in Diyarbakır. The relational analysis investigates the statistical associations between variables such as e-commerce usage frequency, income level, and tax awareness with tax motivation and tendencies toward tax evasion.

3.2. Sample and Data Collection

According to data from the Turkish Statistical Institute (2024a), the population of Diyarbakır stands at 1,818,133. The minimum required sample size was calculated using Cochran's (1952) formula, yielding a threshold of 384 participants. However, to improve the robustness and representativeness of the analysis, data were collected from a total of 675 participants. To reflect the demographic structure of Diyarbakır (age, gender, education), a stratified sampling approach was targeted; however, due to practical constraints in fieldwork, convenience sampling was also utilized to reach participants. The data collection process was conducted over a 60-day period using a dual-method approach of online and face-to-face surveys to ensure a representative dataset. Participation was voluntary and anonymous, and the data were cleaned for analysis using IBM SPSS Statistics 30.0.

3.3. Data Analysis and Hypothesis Testing

The data were analyzed using various statistical techniques to address the research questions. Descriptive statistics were used to outline participant profiles and usage patterns. To test the hypotheses, several relational methods were employed. The relationship between scale-based variables (H1, H3) was assessed using Pearson Correlation and Linear Regression Analysis. The association between categorical variables (H2) was examined with the Chi-Square Test and Odds Ratio. Finally, the relationship between ordinal and categorical variables (H4) was analyzed using Spearman Correlation. This methodological framework (Field, 2018) enables the empirical evaluation of the hypotheses, which are detailed in Table 1. All statistical tests were conducted using a significance level of $p < 0.05$.

Table 1: Research Hypotheses and Statistical Methods Utilized for Testing

Hypothesis	Statistical Methods Utilized
H1: Increased frequency of e-commerce usage is associated with higher tax payment motivation.	Pearson Correlation
H2: Individuals using cash-on-delivery payment methods exhibit a higher tendency for tax evasion compared to those using digital payment methods.	Chi-Square Test, Odds Ratio
H3: Higher income levels are positively correlated with tax payment motivation.	Linear Regression Analysis
H4: Individuals with a strong perception of tax fairness are more likely to prefer digital payment methods over cash-on-delivery in e-commerce.	Spearman Correlation

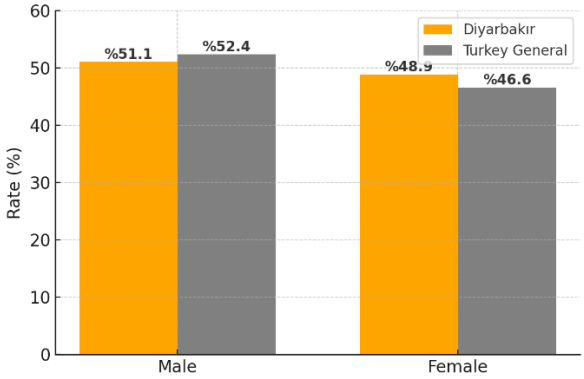
3.4. Validity and Reliability

The validity and reliability of the study were ensured through several measures. To ensure content validity, the survey instrument was developed using scales validated in previous literature on tax compliance and e-commerce. The study's internal reliability was confirmed by a Cronbach's Alpha coefficient of 0.91, indicating a high degree of consistency among the scale items. Key variables were operationalized as follows: tax motivation was measured on a 5-point Likert scale (1: Not at all motivated – 5: Very motivated), while tax evasion propensity was assessed through a scenario-based question where participants indicated their likelihood of engaging in a transaction without an invoice. To enhance external validity, the sample was selected to represent various socioeconomic and educational backgrounds within Diyarbakır. Furthermore, objectivity in data analysis was maintained by performing all statistical analyses using IBM SPSS Statistics 30.0, with a significance level set at $p < 0.05$.

4. FINDINGS AND DISCUSSION

The analysis of the data yielded significant insights into the interplay between e-commerce adoption and tax compliance in Diyarbakır. The demographic profile of the 675 participants reveals a balanced gender distribution (51.1% male, 48.9% female), which aligns closely with national e-commerce participation rates.

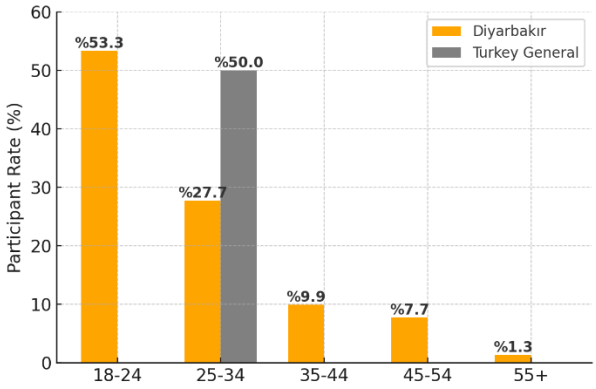
Figure 1: e-Commerce Adoption Rates by Gender in Diyarbakır and Turkey (National Overview)



References: Diyarbakır data are derived from a survey conducted on a sample of *n* = 675; Internet usage data in Turkey are sourced from Hizmetix (2024); e-commerce participation data in Turkey are obtained from MatOnline (2024).

A key demographic characteristic of the sample is its youthfulness; the 18-24 age bracket represents the largest group (53.3%), a finding that contrasts with the national trend where consumers aged 25-36 dominate e-commerce spending.

Figure 2: Age Distribution of Participants in Diyarbakır and Turkey (National Overview)



References: Diyarbakır data are derived from a survey conducted on a sample of *n* = 675; e-Commerce market data in Turkey are sourced from the Ministry of Trade, Republic of Turkey (2024).

Furthermore, the sample is highly educated, with over half (50.8%) holding a bachelor's degree or higher. This aligns with national reports suggesting a positive correlation between educational attainment and e-commerce use.

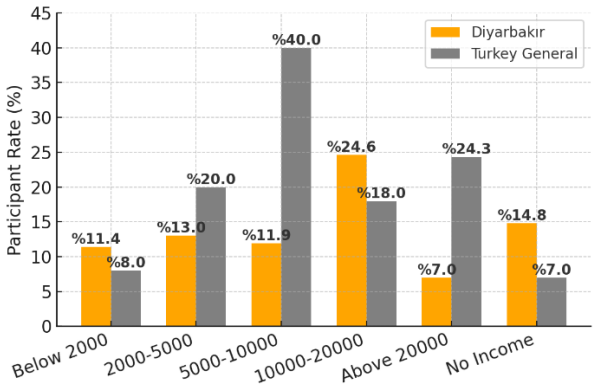
Table 2: Educational Attainment and e-Commerce Adoption Rates: A Comparative Analysis of Diyarbakır and Turkey (National Overview)

Educational Attainment	Diyarbakır (%)	Turkey (National Overview) (%)
Primary Education	%6,5	Data Not Available
Secondary Education	%37,2	Data Not Available
Higher Education (Bachelor's)	%50,8	Predominant Group Among e-Commerce Users
Master's Degree	%5	Data Not Available
Doctorate Degree	%0,4	Data Not Available

References: Diyarbakır data are derived from a survey conducted on a sample of *n* = 675; e-Commerce market data in Turkey are obtained from the Ministry of Trade, Republic of Turkey (2024)

Furthermore, the sample is highly educated, with over half (50.8%) holding a bachelor's degree or higher. This aligns with national reports suggesting a positive correlation between educational attainment and e-commerce use.

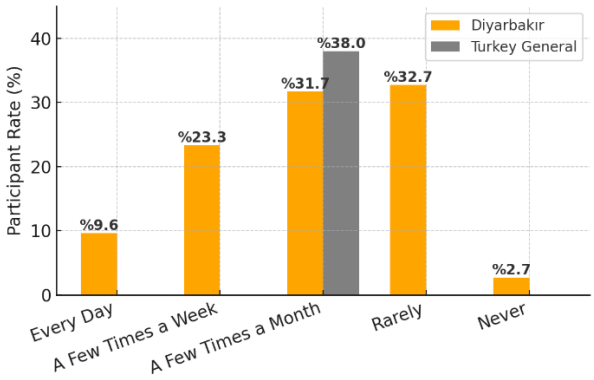
Figure 3: Income Distribution in Diyarbakır and Turkey (National Overview)



References: Diyarbakır data are derived from a survey conducted on a sample of *n* = 675; e-Commerce market data in Turkey are obtained from the Ministry of Trade, Republic of Turkey (2024)

E-commerce usage patterns in Diyarbakır are predominantly needs-based rather than habitual, with most users making purchases "several times a month" (31.7%) or "rarely" (32.7%).

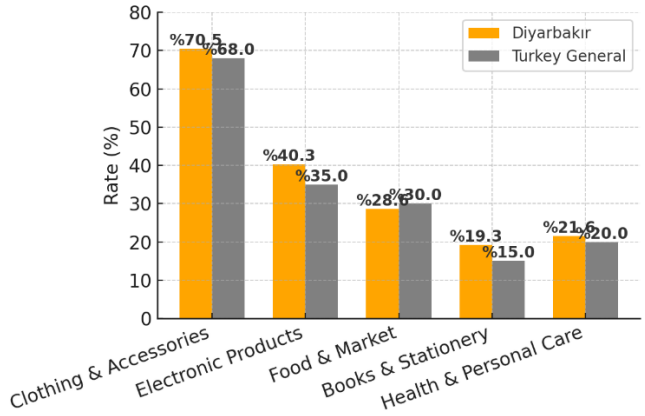
Figure 4: Frequency of e-Commerce Usage in Diyarbakır and Turkey (National Overview)



References: Diyarbakır data are derived from a survey conducted on a sample of *n* = 675; e-Commerce data in Turkey are obtained from MatOnline (2024).

The preferred product categories, led by apparel and electronics, mirror national consumption habits.

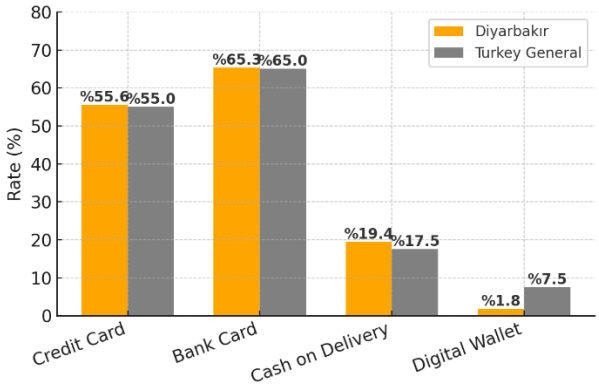
Figure 5: Most Frequently Purchased Product Categories in Diyarbakır and Turkey (National Overview)



References: Diyarbakır data are derived from a survey conducted on a sample of *n* = 675; The most sold e-commerce products in Turkey in 2023 are sourced from T-Soft (2023); Global fashion e-commerce market data are obtained from Research and Markets (2024); Consumer electronics e-commerce market insights are based on Research and Markets (2024).

However, a critical divergence appears in payment methods. While debit and credit cards are prevalent, the use of cash-on-delivery (COD) remains significant at 19.4%, and the adoption of digital wallets is conspicuously low. This points to regional disparities in digital financial infrastructure and user trust.

Figure 6: Payment Method Preferences in Diyarbakır and Turkey (National Overview)



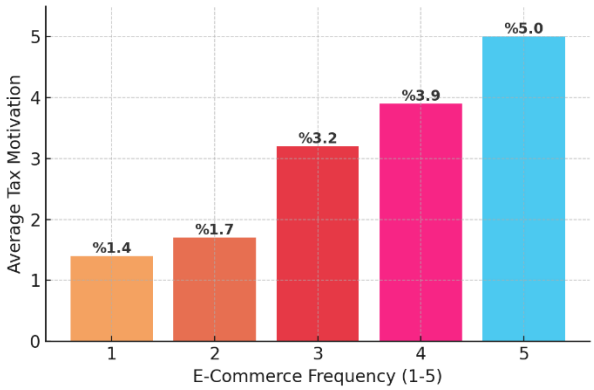
References: Diyarbakır data are derived from a survey conducted on a sample of *n* = 675; Card usage habits in Turkey are based on Interbank Card Center (2017); payment regulations and data-sharing services are sourced from Central Bank of the Republic of Turkey (2021); e-commerce success, consumer behavior, and emerging trends in Turkey are derived from Deloitte Turkey (2022).

Hypothesis testing confirmed several key relationships. First, to test the association between e-commerce frequency and tax motivation (H1), a Pearson correlation was conducted. The analysis revealed a statistically significant, moderately positive relationship ($r = 0.42$, $p < 0.01$), supporting the hypothesis that greater engagement with digital commerce fosters higher tax awareness.

Table 3: Pearson Correlation Results

Variable Pair	*r*	*p*	Significance
e-Commerce Frequency ↔ Tax Motivation	0.42	0.003	**

Figure 7: Relationship Between e-Commerce Frequency and Mean Tax Motivation

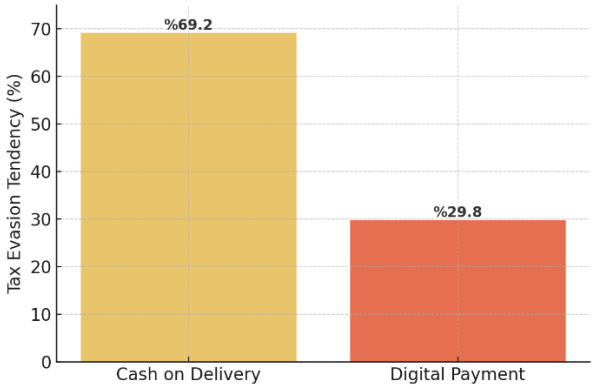


Second, the analysis for H2 provided strong evidence that payment choice is linked to tax evasion propensity. A Chi-Square test and Odds Ratio calculation showed that COD users are 2.15 times more likely to exhibit tax evasion tendencies than those using digital payments ($\chi^2=8.76$, $p<0.01$), validating concerns about COD facilitating the informal economy.

Table 4: Chi-Square and Odds Ratio Results

Payment Method	Propensity for Tax Evasion (%)	Chi-Square (χ^2)	*p*	OR	95% Confidence Interval
Cash-on-Delivery	63.2	8.76	0.002	2.15	[1.50 - 3.08]
Digital Payment	29.8				

Figure 8: Tax Evasion Propensities of Cash-on-Delivery and Digital Payment Users

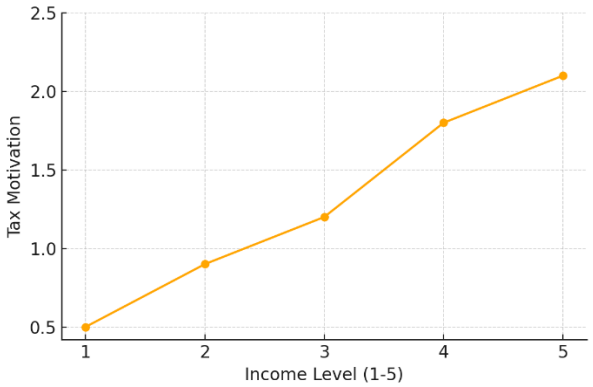


Third, supporting H3, linear regression analysis demonstrated a significant positive correlation between higher income levels and greater tax motivation (β=0.37, p<0.01). However, the model's limited explanatory power (R^2=0.14) suggests that income is just one of several factors influencing tax compliance.

Table 5: Regression Analysis Results

Variable	β	Standard Error	*t*	*p*	R^2
Income Level	0.37	0.12	3.08	0.004	0.14

Figure 9: Relationship Between Income Level and Tax Motivation

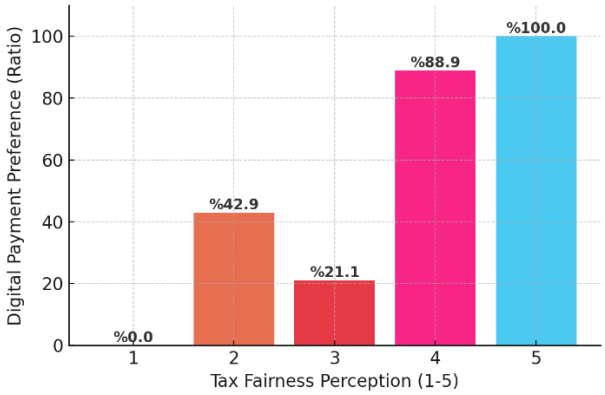


Finally, H4 was only partially supported; a weak but significant Spearman correlation was found between perceived tax fairness and the preference for digital payments (ρ=0.28, p<0.05). This indicates that practical considerations like security and usability likely outweigh abstract perceptions of fairness in driving payment method selection. This finding challenges the direct applicability of some Western-centric tax compliance theories (e.g., Feld & Frey, 2007; Kirchler, 2007) in this regional context. It suggests that in environments with lower institutional trust or digital literacy, pragmatic factors such as perceived security, transaction costs, and usability may be more potent drivers of payment choice than abstract concepts like the fairness of the tax system.

Table 6: Spearman Correlation Results

Variable Pair	ρ	*p*	Significance
Perceptions of Tax Fairness ↔ Digital Payment	0.28	0.021	*

Figure 10: Relationship Between Perceptions of Tax Fairness and Digital Payment Preference



The discussion of these findings highlights a critical paradox in Diyarbakır: a young, technologically adept population shows high e-commerce adoption, yet structural factors and behavioral patterns, such as the persistence of COD, create significant risks for tax non-compliance. The persistence of this paradox may be rooted in the region's unique socio-economic fabric, where informal, trust-based commerce is prevalent and institutional trust in government or financial systems can be lower than national averages. These underlying factors can suppress the formalizing effect of technology. The lower tax motivation among the youngest demographic, coupled with the high propensity for tax evasion among COD users, points to a clear need for targeted policy interventions. The weak influence of perceived tax fairness on payment choice further suggests that policy should focus on tangible incentives and structural improvements, implying that building a secure and accessible digital payment ecosystem is a more urgent policy priority than campaigns focused solely on tax fairness.

From these findings, several policy recommendations emerge. To counter the risks associated with COD, it is essential to strengthen digital payment infrastructure and build consumer trust. This can be achieved by mandating digital invoicing for all e-commerce transactions and expanding secure payment options with features like two-factor authentication. Financial incentives, such as tax benefits or discounts for using digital payments, could effectively shift consumer behavior away from cash. Furthermore, targeted educational campaigns are needed to enhance tax awareness and digital literacy, especially among the youth and in rural areas. Supporting the digital transformation of local SMEs with technical and financial assistance is also crucial for integrating them into the formal economy and broadening the tax base.

The study is not without its limitations. The sample's overrepresentation of young, educated, urban participants may limit the generalizability of the findings to the entire regional population. Moreover, the reliance on self-reported data for a sensitive topic like tax evasion introduces a potential for social desirability bias. Future research should therefore seek to diversify its sample to include more rural and varied demographic groups. Integrating qualitative methods, such as in-depth interviews, would provide deeper context to the quantitative findings, particularly regarding motivations for tax evasion and distrust in digital payments. Advanced statistical models like Structural Equation Modeling (SEM) could also be employed to analyze the complex, multidimensional relationships between institutional trust, technology adoption, and tax compliance.

5. CONCLUSION AND IMPLICATIONS

This study provides a pioneering regional analysis in Turkey by examining the relationship between the digital economy and tax compliance in Diyarbakır. Using a quantitative research design with survey data from 675 participants, the study investigated how e-commerce usage frequency, payment methods, income level, and perceived tax fairness influence tax motivation. The findings confirm that increased e-commerce frequency is positively associated with higher tax motivation ($\beta=0.42$, $p<0.01$), supporting the literature that suggests digital transactions enhance financial transparency and compliance. Conversely, the study reveals a significant challenge for fiscal policy: individuals using cash-on-delivery (COD) methods exhibit a 2.15 times greater propensity for tax evasion compared to digital payment users. This finding highlights the role of cash-based transactions in fostering the informal economy, a conclusion that aligns with previous research by Schneider (2004).

Furthermore, the research substantiates the positive correlation between income level and tax motivation ($\beta=0.37$, $p<0.01$), consistent with the work of Alm and Torgler (2011). However, the model's limited explanatory power ($R^2=0.14$) indicates that tax compliance is a multifaceted issue influenced by other sociopsychological factors beyond income, such as social norms and institutional trust. Interestingly, the study found only a weak relationship between the perception of tax fairness and the preference for digital payments ($\rho=0.28$, $p<0.05$). This suggests that practical concerns, such as technological trust deficits and financial literacy, are more decisive in payment choices than abstract notions of fairness, a point that complements multidimensional tax compliance models (Feld & Frey, 2007; Kirchler, 2007).

Based on these findings, several strategic policy implications emerge for enhancing tax compliance in developing regions. It is imperative to strengthen the digital financial infrastructure by mandating electronic invoicing for all transactions, including COD, and by expanding secure mobile payment systems through measures like two-factor authentication. Concurrently, tax incentives for digital payments could steer consumers away from cash. Educational initiatives are also crucial; tax literacy programs targeting young consumers and digital literacy campaigns in rural areas can foster a culture of compliance. Supporting the digital transformation of SMEs through technical training and financial aid will further help integrate local businesses into the formal economy.

While this study offers valuable insights, its limitations—such as a sample skewed towards young, educated urban participants and reliance on self-reported data—necessitate caution in generalization and open avenues for future research. Subsequent studies should aim for broader sample diversity, particularly including rural populations, and integrate qualitative methods like in-depth interviews to explore the sociocultural nuances of tax evasion. Employing advanced statistical models, such as Structural Equation Modeling (SEM), would also allow for a more comprehensive analysis of the complex interplay between institutional trust, technological adoption, and tax motivation. Ultimately, as Turkey's digital economy grows, a holistic approach that combines regulatory oversight, technological innovation, and public education will be critical for enhancing fiscal sustainability and combating informality.

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