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CONTENT

INTERACTIVE EFFECT OF EXCHANGE RATES WITH REMITTANCE ON INFORMAL REMITTANCE CHANNEL: A DYNAMIC ANALYSIS

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ABSTRACT

Purpose- It has been commonly observed that remittance flows to low- and middle-income countries surpassed overseas development assistance. It is also often noted that the sums remitted through formal channels represent only a fraction of total remittances: a large though unknown amount of funds finds its way to families in migrants' areas of origin through informal channels. In Nigeria for instance, there is high prevalence of informality and the country currently has multiple exchange rates and adopts the managed floating exchange rate system. The objective of this paper is to examine whether multiple exchange rate has been an incentive for the popularity of unsafe informal channels in the remittance ecosystem of Nigeria. In order to achieve the objective, this study examines the interactive effect of exchange rate with remittance on informal remittance channels in Nigeria.
Methodology- Annual time series data were employed for the study. The data spanned the period 2004 to 2020 and were sourced from Index Mundi.com and the Global Economy.com. Autoregressive distributed lag (ARDL) model was used to analyze the data.
Findings- The interactive term i.e., LOGOEXC*LOGREMR (official exchange rate * personal remittances received) has positive and significant influence on informal remittance channel only in the short run.
Conclusion- Exchange rate has been an incentive for the popularity of unsafe informal channels in the remittance system of Nigeria. The implication is that government must carry out exchange rate reforms, including a unified market-clearing rate that reduces the gap between official and parallel market exchange rates which would enhance sending remittances through formal channels.

Keywords: Exchange rates, remittance, commercial banks, autoregressive distributed lag (ARDL), Nigeria.
JEL Codes: B26, C51 F31

1. INTRODUCTION

The informal economy is described as the sum total of economic activity that happens outside state regulation, which is neither taxed nor represented in a country's GDP. The size of the informal sector in Nigeria is estimated at about 65% of Nigeria's 2017 GDP and consists of activities that range from agricultural production to mining and quarrying, small-scale building and construction and machine-shop manufacturing (Maketaxfair.net, 2020). In some cases, the informal economy is referred to as a shadow economy if associated with illegality and illicit activities such as internet scams, black markets, crime, production, and smuggling of illegal drugs, and money laundering or as the case may be. In this case study, the focus is on informal remittance and it is essential to state the exact definition to be used in the study of this informality. Remittances are financial transfers by migrants to their country of origin (Van Hear et al., 2005). Official remittance channels of transfer include bank services, money transfer operator (MTO) services, etc. Informal remittances are transfers that take place through informal channels. Unofficial remittance channels of transfer include carrying cash when travelling back home, relying on trader relationships or value transfer systems to offset import payments with remittances (Cooper and Esser, 2018).

According to Agusto and Co (2022), Nigeria has over $21 billion annually in inflows from diaspora remittances, making it the second-largest recipient of remittances on the continent, only after Egypt. The remittances from the Nigerian diaspora have

become a major mainstay of the country's economy. At the macro level, diaspora remittances represent the second-largest source of foreign exchange inflow into the country, second only to crude oil earnings. Interestingly, the country's yearly remittance is conservatively valued at $34 billion (Iyatse, 2021). But the country rarely comes close to realizing this figure, going by historical data. But that is less a concern than the consistent reduction in the amount received via the official window in the past few years.

Nevertheless, the stability of the exchange rate is a major macroeconomic indicator used to measure the performance of an economy. Nigeria's forex market has undergone significant changes over the years. The forex market has evolved from a fixed regime in the 1960s to a pegged arrangement between the 1970s and the mid-1980s, and to various types of managed floating systems since 1986 (the structural adjustment program period) (FDC, 2021). The crux of this paper therefore is to examine the interaction between official exchange rate and personal remittances received and its impact on informal remittance channels in Nigeria. As Iyatse (2021) observed, the official remittance market in Nigeria is in a battle for survival on all fronts. First, its old foe – the informal channels – is not relenting. And peer-to-peer (P2P) transfer is rearing its ugly head in readiness for what could be apocalyptic.

The remainder of this paper is structured as follows, section 2 is for literature review while section 3 gives an overview of remittance inflow and exchange rate management in Nigeria. Section 4 presents the data and methodology. Section 5 showcases the empirical findings, and finally section 6 concludes the paper.

2. LITERATURE REVIEW

Remittances have been growing rapidly in the past few years and now represent the largest source of foreign income for many developing countries. However, it is hard to estimate the exact size of remittance flows because many transfers take place through unofficial channels. Worldwide, officially recorded international migrant remittances were projected to exceed $483 billion in 2011, with $351 billion flowing to developing countries (Ratha, 2020). These flows are recorded in the balance of payments; exactly how to record them is being reviewed by an international technical group. Unrecorded flows through informal channels are believed to be at least 50 percent larger than recorded flows (Ratha, 2020). Not only are remittances large but they are also more evenly distributed among developing countries than capital flows, including foreign direct investment, most of which goes to a few big emerging markets. In fact, remittances are especially important for low-income countries. Remittance flows to low-income countries are nearly 6 percent of their gross domestic product (GDP), compared with about 2 percent of GDP for middle-income countries (Ratha, 2020).

Furthermore, data from the World Bank showed that global remittances grew by 10 percent to $689 billion in 2018 from $633 billion in 2017 with developing countries receiving 77 percent or $528 billion of the total inflows (Komolafe, 2020). The World Bank also showed that remittances to developing countries rose further by 4.9 percent to $554 billion in 2019. In Sub-Saharan Africa, which include Nigeria and 47 countries, remittances rose by 4.3 percent to $48 billion in 2019 from $46 billion in 2018 (Komolafe, 2020). World Bank data also shows a rising trend in diaspora remittances into Nigeria. From $20.8 billion in 2014, remittances into Nigeria rose to $25.1 billion in 2018, translating into 4.3 percent growth (Komolafe, 2020). Highlighting the impact of remittances on Nigeria's economy, Pricewaterhouse Coopers (PwC) noted that the $25.1 billion remittances inflow in 2018 translates to 83 percent of the Federal Government budget in 2018 and 11 times the Foreign Direct Investment (FDI) flows in the same period (Komolafe, 2020). Nigeria's remittance inflows were also seven times larger than the net official development assistance (foreign aid) of $3.4 billion received in 2017(Komolafe, 2020).

However, the World Bank noted that the remittances reported represent official records, and are lower than figures of total inflow through formal and informal channels. A study by the bank indicated that remittances through informal channels could add at least 50 percent to the globally recorded flows. For Nigeria this translates to about $7.5 billion additional remittances based on the figure for 2018 (Komolafe, 2020).

This represents a huge foreign exchange leakage and portends serious implications for the economy, especially at a time of declining foreign exchange earnings from crude oil, which accounts for over 80 percent of the nation's foreign exchange earnings (Komolafe, 2020).

The focus of this study is on Nigeria because its migrants are often well educated and highly skilled. For instance, in the USA, they are the immigrant group with the highest level of education in the country (Chron, 2018). This profile allows the diaspora to send larger amounts of money back home compared to other Sub-Saharan African countries due to higher average earnings.

Nevertheless, studies have been carried concerning remittances in Nigeria (Odozia et al., 2010; Nwosu, 2012; Iheke, 2012; Akinpelu et al., 2013; Akano et al., 2013;   Adeagbo and Ayansola, 2014; Fayomi et al.,   2015; Adeyi, 2015; Loto and Alao, 2016;

Ebenezer, 2015; Egbulonu and Chukuezi, 2019; Anetor, 2019; Adeseye, 2021). In addition, Oke and Adetan (2018); Williams et al. (2018), Odili (2015), Ajibola et al (2015), Dickson and Ukavwe (2013), Ngerebo and Ibe (2013), Oriavwote and Oyovwi (2012), Nwude (2012), Aliyu (2011), Joseph (2011), Osinubi and Amaghionyeodiwe (2009), Ogunleye (2008), and Udoh and Egwaikhide (2008) have researched on exchange rate in Nigeria, but no study has been conducted on the effect of official exchange rate on the preference for unofficial remittance channels. Nevertheless, Nigeria operates a dual exchange rate. Scott (2021) defines a dual exchange rate as a setup created by a government where their currency has a fixed official exchange rate and a separate floating rate applied to specified goods, sectors or trading conditions.

In 2016, the Nigerian economy entered a recession. The CBN introduced the dual exchange rate system in 2017 after the nosedive of the Naira, hitting as low as N600 to the dollar, after the depletion of the country's oil revenue following the slump of global oil prices from $57 to $37 per barrel, thus putting pressure on the nation's foreign exchange reserve (Eletu, 2021). Oil revenue represents 90% of Nigeria's foreign exchange earnings and accounts for more than half of the governments' total revenue (Eletu, 2021). The multiple exchange rate system set by the CBN consists of parallel rates and official rates. The official rate (available to investors and importers and exporters only) harbors a much lower rate compared to the parallel rate, which is easily accessible to the country's residents. Specifically, this study attempts to examine the effect of an independent variable on a dependent variable changes, depending on the values of one or more other independent variables. As such, it investigates the dynamic interaction between official exchange rate and personal remittances received (two-way interaction) and its impact on informal remittance channels using autoregressive distributed lag (ARDL) models in a single-equation framework.

3. REMITTANCE INFLOW AND EXCHANGE RATES MANAGEMENT IN NIGERIA: OVERVIEW

Diaspora remittances into Nigeria increased by 15.6% QoQ to $9.22 billion in H1 2021 compared to $7.98 billion recorded in the second half of 2020. It also represents a marginal 2.2% increase compared to $9.02 billion recorded in the corresponding period of 2020. This is according to the review of Nigeria's balance of payment account as released by the Central Bank of Nigeria (CBN) (Oyekanmi, 2021). The increase is as a result of measures introduced by CBN to encourage diaspora Nigerians to send their remittances through the banking system. Among other things, the measures allow beneficiaries to have unfettered access and utilization to foreign currency proceeds, either in foreign exchange cash and/or in their Domiciliary Accounts. Furthermore, the CBN directed payment switching and processing companies to stop local currency transfer of diaspora remittances received through International Money Transfer Operators (IMTOs). The apex bank also directed Mobile Money Operators (MMO) to disable wallets from receipt of funds from IMTOs. To complement these measures, the CBN in February 2021 introduced the "Naira4Dollar" scheme, which rewards beneficiaries of remittances with N5 for every $1 of remittance sent through the banks (Komolafe, 2022).

The World Bank report also indicated that Nigeria was the largest recipient of remittance inflows in the Sub-Saharan region of Africa in 2021. Meanwhile, remittance inflows to Sub-Saharan Africa grew by 6.2% to $45 billion in 2021, and is projected to grow by 5.5% in 2022. According to the World Bank, remittances to low-and middle-income countries were projected to have grown by 7.3% to reach $589 billion in 2021 (Oyekanmi, 2021).

Nevertheless, Nigeria's forex market has undergone significant changes over the years. The forex market has evolved from a fixed regime in the 1960s to a pegged arrangement between the 1970s and the mid-1980s, and to various types of managed floating systems since 1986 (the structural adjustment program period).

The country currently has multiple exchange rates (parallel, bureau de change, International Air Transport Association (IATA), investors and exporters window, but to name a few) and currently adopts the managed floating exchange rate system. On May 24 2021, the CBN officially replaced the official exchange rate with the more flexible Nigerian Autonomous Foreign Exchange Fixing Rate (NAFEX) rate in an attempt to unify the country's multiple exchange rates. This replacement means a technical devaluation of the naira by 7.56% to the NAFEX rate (N410/$) from the previous official rate of N379/$ (Proshareng.com, 2021). However, the exchange rate has remained volatile at the parallel market, driven by speculative activities and panic buying.

4. DATA AND METHODOLOGY

4.1. Data

The data for the variables were collected from Index Mundi.com and the Global Economy.com., and the time span selected from 2004 to 2020 due to the availability of data. The variables include:

ICHAN = informal remittance channel or informal transfers (proxy by informal sector as percent of total annual GDP).

COMB= Commercial bank branches (per 100,000 adults) are retail locations of resident commercial banks and other resident banks that function as commercial banks that provide financial services to customers and are physically separated from the main office but not organized as legally separated subsidiaries.

OEXC= Official exchange rate (LCU per US$, period average) refers to the exchange rate determined by national authorities or to the rate determined in the legally sanctioned exchange market.

REMR = Personal remittances, received (current US$) in Nigeria consist of all current transfers in cash or in kind made or received by resident households to or from nonresident households.

OEXC*REMR = Interactive term, i.e., the product of personal remittances received and official exchange rate.

FINF= Financial freedom index evaluates: the extent of government regulation of financial services, the degree of state intervention in banks and other financial firms through direct and indirect ownership, the extent of financial and capital market development, government influence on the allocation of credit and openness to foreign competition. Higher index values denote banking efficiency and independence from government control and interference in the financial sector.

MFRI= Monetary Freedom index for Nigeria from the Heritage Foundation reflects the stability of prices in Nigeria and the use of price controls by the government. Price stability with minimal price controls is the ideal state for the free market. The score for the monetary freedom index is based on two factors: the weighted average inflation rate for the most recent three years and price controls. Higher index values denote price stability without microeconomic intervention.

4.2. Empirical Model Specification

To investigate the interactive effect of official exchange rate with remittances on informal remittance channels, the following is specified:

Informal Remittance Channel = ƒ (Commercial Bank Branches, Official Exchange Rate, Personal Remittances Received,

$$\text{Financial Freedom Index, Monetary Freedom Index)} \qquad (1)$$

Or

$$\text{ICHAN = ƒ (COMB, OEXC, REMR, MFRI, FINF)} \qquad (2)$$

The above equation can be written in econometric and natural log form as:

$$\text{ln}ICHAN_t = \eta_0 + \eta_1 \text{ln}COMB_t + \eta_2 \text{ln}OEXC_t + \eta_3 \text{ln}REMR_t + \eta_4 \text{ln}(OEXC * REMR)_t + \eta_5 \text{ln}MFRI_t + \eta_6 \text{ln}FINF_t + \Phi_t \qquad (3)$$

where the subscript t denotes the studied time period, In is the logarithmic form of the variable and Φ denotes the error-term. The parameters η_0 and η_i (1,2,3,4,5, and 6) are the intercept and the coefficients to be calculated. Apriori, $\eta_2 > 0$, $\eta_4 > 0$; $\eta_1 < 0$, $\eta_3 < 0$, $\eta_5 < 0$, $\eta_6 < 0$

4.3. Technique of Analysis

The dependent variable is dynamic in nature and have persistence nature where present size of shadow economy has to some extend dependency on pass size. Therefore, instead of static models i.e. OLS, equation (1) is estimated using Autoregressive distributed lag (ARDL) model which is often used to analyze dynamic relationships with time series data in a single-equation framework. The current value of the dependent variable is allowed to depend on its own past realizations – the autoregressive part – as well as current and past values of additional explanatory variables – the distributed lag part. In its basic form, an ARDL regression model is as follows:

$$y_t = \beta_0 + \beta_1 y_{t-1} + ... + \beta_p y_{t-p} + \alpha_0 x_t + \alpha_1 x_{t-1} + \alpha_2 x_{t-2} + ... + \alpha_q x_{t-q} + \varepsilon_t \qquad (4)$$

where ε_t is a random "disturbance" term.

The model is "autoregressive", in the sense that y_t is "explained (in part) by lagged values of itself. It also has a "distributed lag" component, in the form of successive lags of the "x" explanatory variable. Sometimes, the current value of x_t itself is excluded from the distributed lag part of the model's structure.

Since the data used in this study are time series, there is need to check the stationarity of the data before applying ARDL model. This is because unit roots can cause unpredictable results in time series analysis. However, the application of ARDL is possible even when the variables under consideration are integrated on different order (I(0), I(1) or mixture of both (Pesaran et al., 2001).

As such, the stationarity properties of our data was checked using the Augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1979) and the Phillips Perron (PP) test (Phillips and Perron, 1988). The PP unit root test is similar to the ADF test; the primary difference is in how the tests each manage serial correlation. Where the PP test ignores any serial correlation, the ADF uses a parametric autoregression to approximate the structure of errors. Oddly enough, both tests typically end with the same conclusions, despite their differences (Moffatt, 2019). The general form of these tests is estimated in the following forms:

$$\Delta Y_t = b_0 + \beta Y_{t-1} + \mu_1 \Delta Y_{t-1} + \mu_2 \Delta Y_{t-2} + \ldots + \mu_p \Delta Y_{t-p} + e_t \tag{5}$$

Where, Y_t represents time series to be tested, b_0 is the intercept term, β is the coefficient of interest in the unit root test, μ is the parameter of the augmented lagged first difference of Y_t to represent the pth order autoregressive process and e_t is the white noise error term.

5. EMPIRICAL FINDINGS

5.1. Preliminary Test

The correlation coefficient in Table 1 revealed the existence of a linear relationship between the regressand and the regressors. From the result, the coefficient of correlation of the dependent variable (LOGICHAN) with respect to itself was (1.00) which revealed perfect correlation. There was a positive correlation between informal remittances (LOGICHAN) and LOGOEXC and LOGFINF with coefficients of 0.654 and 0.003 respectively. LOGICHAN and LOGOEXC were strongly positively correlated. Interestingly, the values for LOGICHAN vs LOGFINF indicated that they are basically not correlated. On the other hand, LOGCOMB, LOGREMR, and LOGMFRI all had negative correlation with informal remittance (LOGICHAN). Their respective coefficients were -0.530, -0.028, and -0.509. LOGICHAN and LOGREMR indicates very weakly negatively correlation while LOGICHAN vs LOGCOMB, LOGICHAN vs LOGMFRI showed moderately strong negative correlation. However, the entire values in the correlation matrix revealed a moderately weak relationship and indicates the absence of multicollinearity among the variables in the model.

Table 1: Correlation Matrix

	LOGICHAN	LOGCOMB	LOGOEXC	LOGREMR	LOGMFRI	LOGFINF
LOGICHAN	1					
LOGCOMB	-0.530	1				
LOGOEXC	0.654	-0.438	1			
LOGREMR	-0.028	0.117	0.382	1		
LOGMFRI	-0.509	0.731	-0.564	-0.069	1	
LOGFINF	0.003	0.463	0.257	0.580	0.135	1

Source: Author's computation using Eviews 10 software

The descriptive statistics of the key variables in equation 1 are shown in Table 2. It depicts that the Jarque–Bera test for most of the variables used in the study are insignificant, which implies that most of them are normally distributed. The skewness measures the degree of lopsidedness in the frequency distribution. Conversely, kurtosis measures the degree of tailedness in the frequency distribution. In Table 2, the Kurtosis shows that some of the distributions of series are flat peak (platykurtic) relative to the normal (normal distribution is 3) while some are sharply peaked (leptokurtic). Half of the variables showed negative skewness while the other half showed positive skewness. The standard deviation shows that there is some dispersion in all the variables while the mean shows the average values of the variables from 2004 to 2020.

Table 2: Descriptive Statistics

	LOGCOMB	LOGOEXC	LOGREMR	LOGICHAN	LOGMFRI	LOGFINF
Mean	1.630335	5.185793	23.59474	4.003547	4.252995	3.651238
Median	1.605430	5.058218	23.74578	3.971423	4.254193	3.688879
Maximum	1.880991	5.723847	23.91420	4.176078	4.347694	3.912023
Minimum	1.329724	4.775335	21.54425	3.924742	4.122284	3.401197
Std. Dev.	0.177473	0.353453	0.543037	0.073126	0.054114	0.130860
Skewness	0.044445	0.643410	-3.425296	1.014120	-0.538468	-0.818456
Kurtosis	1.661833	1.805782	13.52336	2.960906	3.603468	3.708809
Jarque-Bera	1.274002	2.183127	111.6841	2.914991	1.079476	2.253842

Probability	0.528876	0.335691	0.000000	0.232819	0.582901	0.324029
Sum	27.71570	88.15847	401.1106	68.06030	72.30092	62.07105
Sum Sq. Dev.	0.503945	1.998865	4.718224	0.085558	0.046853	0.273989
Observations	17	17	17	17	17	17

Source: Author's computation using Eviews 10 software

The stationary test on the time series properties of the data were examined by conducting the unit root test using the Augmented Dickey-Fuller (ADF) test and Philips-Perron test. The ADF was conducted with a maximum lag of 3 and Schwarzt information criterion. Philips-Perron test was conducted with default (Bartlett kernel) spectral estimation method as well as with Newey-West Bandwith automatic selection. The both test statistics were done for two alternative specifications. First, it was tested with intercept, and then it was tested without intercept. The result of ADF (Table 3) and PP (Table 4) unit root tests reflect that there is no unit root in the series. Both tables suggest that the variables are either stationary at order I(0) at order I(1). Based on the outcome, the autoregressive distributed lag (ARDL) model was considered as the best econometric method to apply compared to others in a case when the variables are stationary at I(0) or integrated of order I(1).

Table 3: Augmented Dickey-Fuller (ADF) Unit Root Test Result

Variables	With intercept		Without intercept		Order of
	Levels	**1st diff**	**Levels**	**1st diff**	**Integration**
LOGCOMB	-2.091125	-2.704373***	-0.046764	-2.813005*	*I(1)*
LOGFINF	-3.132900**	-5.452590*	-1.544685		*I(0)*
LOGICHAN	-1.347422	-4.363234*	-2.013440**	-3.796649*	*I(0)*
LOGMFRI	-0.496957	-3.902587**	-0.817126	-3.924957*	I(1)
LOGOXEC	0.182274	-2.605025	2.010643	-2.232693**	I(1)
LOGREMR	-21.01812*	-4.423228*	1.175082	-29.73830*	I(0)

Note: Significance level at 1%, 5% and 10 % as *, ** and *** respectively

Table 4: Phillips-Peron Unit Root Test Result

Variables	With intercept		Without intercept		Order of
	Levels	**1st diff**	**Levels**	**1st diff**	**Integration**
LOGCOMB	-1.343420	-2.704373***	-0.289956	-2.813005*	*I(1)*
LOGFINF	-4.414099*	-5.856631*	0.874859	-5.811897*	*I(0)*
LOGICHAN	-1.267358	-4.363234*	-2.015783**	-3.790754*	*I(0)*
LOGMFRI	-0.496957	-3.902587**	-0.817126	-3.924957*	I(1)
LOGOXEC	0.182274	-2.622455	2.010643	-2.232693**	I(1)
LOGREMR	-15.65655*	-82.37909*	1.175082	-32.50025*	I(0)

Note: Significance level at 1%, 5% and 10 % as *, ** and *** respectively

5.2. Lag Selection Criteria

Before applying the ARDL bound test for checking if cointegration exists or not among the variables, it is wise to select an appropriate lag order of the variable. The optimal lag order of the vector autoregression (VAR) model for the selection of appropriate lag order was deployed. The observed results in Table 5 show the entire lag selection criteria for employing the ARDL bound test which implies that the model gives better results at lag 1.

Table 5: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	102.1305	NA	2.44e-13	-12.01631	-11.72659	-12.00148
1	213.0790	124.8170*	3.04e-17*	-21.38487*	-19.35682*	-21.28102*

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

5.3. Bounds Test

Since it was established that none of the selected series are I(2) or beyond and the optimal order of lag has been determined, presence of the long run cointegration was tested using bounds test. The results of the ARDL bound test of cointegration are displayed in Table 6. The F-statistics has a higher value (6.816019) than the upper bound critical value, provided by Pesaran et.al (2001), is 5.23 (at 1% significance level) hence there is a strong reason to reject the null hypothesis of no long-run relationship at 1% significance level. Invariably, there is the existence of cointegration among the variables studied.

Table 6: F-Bounds Test   Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
		Asymptotic: n=1000		
F-statistic	6.816019	10%	2.75	3.79
K	6	5%	3.12	4.25
		2.5%	3.49	4.67
		1%	3.93	5.23

5.4. ARDL Model

A 'general-to-specific' methodology was applied when estimating the ARDL model, with the original model estimated with one lag for each variable and a constant. The over-parameterized ARDL model is presented in column 1 (ARDL 1) of Table 7 and a more parsimonious model was obtained by deleting insignificant variables. The results of the parsimonious ARDL model are reported in column 2 (ARDL 2) of Table 7. It shows the coefficients of current and lagged values of each explanatory variable as well as the coefficients of lagged value of the dependent variable. Diagnostic tests were conducted to examine the health conditions of the parsimonious long-run ARDL model (ARDL 2). The probability value of the Jarque-Bera statistics (0.405308) is greater than 5% level of significance, hence the null hypothesis of normality is accepted, and therefore the residual of the model is normally distributed. The model passed the Ramsey RESET specification test with the probability value of F-statistic (0.2252) greater than 0.05 indicating that the null hypothesis is not to be rejected at 0.05 levels implying no functional misspecification in the model. However, the Breusch-Godfrey serial correlation LM test clearly shows that the probability Chi-Square (0.0621) is less than 0.05 at 5% significance level which leads to the conclusion that the residual in the long-run ADRL model is serially correlated. In terms of the Likelihood ratio test for redundant variables, Ho: variables are redundant; H1: null hypothesis is not true. Decision criteria: reject null hypothesis if the value of the adjusted R2 from the parsimonious model is lower than that from the over-parameterised model. The result in Table 7 shows that the value of the adjusted R2 from the parsimonious model (ARDL 2) is slightly lower than that from the over-parameterised model (ARDL 1). As such, null hypothesis is rejected. That means, the variables are in the model are not redundant. As a matter of fact, the result of parsimonious long-run ARDL model (ARDL 2) in Table 7 shows that informal remittance channel in the prior period LOGICHAN (-1), commercial bank branches in the current period [LOGCOMB], commercial bank branches in the prior period [LOGCOMB (-1)], official exchange rate in the current period [LOGOEXC], and personal remittances received in the current period [LOGREMR] significantly influence informal remittance channel in the long run. Specifically, ARDL 2 result suggests that informal remittance channel in the prior period LOGICHAN (-1) is negatively related to the informal remittance channel in the current period. Evidence indicates that a percentage increase informal remittance channel in the prior period shrinks informal remittance channel in the current period by about -1.173297. The coefficient is statistically significant at 1% significance level. Moreso, commercial bank branches in the current period [LOGCOMB] has a positive and significant effect on informal remittance channel in the long-run. A one per cent increase in commercial bank branches in the current period enhances informal remittance channel by 0.577561%. With around 8,000 commercial bank branches – most of them in big cities – in a country of 200 million people, formal banking services remain out of the reach of most Nigerians (Ajifowoke, 2021). A quarter of respondents in a 2018 survey by Enhancing Financial Innovation and Access (EFInA) cited distance

as one of the factors discouraging them from patronising formal banking institutions (Ajifowoke, 2021). This could compel formal remittance senders and recipient to search for informal remittance channels as portrayed by the result of this study. Surprisingly, commercial bank branches in the prior period [LOGCOMB (-1)] has a negative and significant effect on informal remittance channel in the long-run. Statistically, this result is significant at 10% significance level. Evidence provided indicates that an increase in commercial bank branches in the prior period decreases informal remittance channel in the long-run by 0.266358%. As Ajifowoke (2021) observed, more Nigerians are now financially included compared to some years ago, however, thanks to the emergence of agency banking and mobile money models in the country. Both have been key to deepening access to financial services.

Furthermore, official exchange rate in the current period [LOGOEXC] has a significant negative long-run association with informal remittance channel at a 1% significance level while official exchange rate in the prior period [LOGOEXC (-1)] has a substantial insignificant positive long-run association with informal remittance channel. Moreso, in Table 7 (ARDL 2), estimated coefficients provide evidence that personal remittances received in the current period [LOGREMR] is negatively related to informal remittance channel in the long-run. Going by the specific coefficient, an increase in personal remittances received in the current period [LOGREMR] reduces informal remittance channel by 16.83817% in the long run. This result is statistically significant at 1% significance level. This result reflects Central Bank of Nigeria's constant strive to improve remittance infrastructure, ease the process of international money transfer and simplify the experience for senders and recipients. Recently, Central Bank of Nigeria explained that its new "Naira 4 Dollar Scheme" seeks to make remittance through formal bank channels cheaper and more convenient for Nigerians in the diaspora (Adegboyega, 2021). To account for the short-run relationships, an error correction model was estimated and the results are shown in ARDL 3 of Table 7, the error correction model [ECM (-1)] indicates the degree of adjustments in which the dependent variable adjusts to changes in the independent variables. The results show a well-defined error correction term [ECM (-1)] with an expected negative coefficient value of -1.242728 which indicates that about -12.43% of the previous periods disequilibrium in informal remittance channel (LOGICHAN) is corrected in the long-run. Surprisingly, the error correction model ECM (-1) was statistically insignificant at any of the standard conventional 1% or 5% or 10% significance levels. As such, insignificant variables were deleted and the coefficient of error correction term became negative and statistically significant at 10% significance level (see ARDL 4). The implication of a significant error correction term is that there is in fact a long-term relationship between the dependent variable and the independent variables in the model. An examination of the coefficients and statistical significance of the variables analyzed reveal a varying degree of relationships between the dependent and explanatory variables. In the short run (ARDL 4), commercial bank branches in the current period [LOGCOMB] has a positive and significant effect on informal remittance channel. Also, the interactive term i.e., LOGOEXC*LOGREMR (official exchange rate * personal remittances received) had positive and significant influence on informal remittance channel (LOGICHAN) while one period lag informal remittance channel [LOGICHAN(-1)], one period lag commercial bank branches [LOGCOMB(-1)], official exchange rate in the current period [LOGOEXC], and personal remittances received in the current period [LOGREMR] all have significant negative relationships with informal remittance channel (LOGICHAN) in the short run.

Specifically, a 1%-point increase in interactive term, i.e., LOGOEXC*LOGREMR (official exchange rate * personal remittances received) increases informal remittance channel (LOGICHAN) by 3.001878%. In addition, an increase in one period lag informal remittance channel [LOGICHAN (-1)] by 1% causes informal remittance channel (LOGICHAN) to decline by 1.171541% over the short-run period at the 1% significance level. Similarly, one-unit increase in first period lag of commercial bank branches [LOGCOMB (-1)] will lead to 0.218094 fall in informal remittance channel (LOGICHAN).

Furthermore, the result shows that official exchange rate in the current period [LOGOEXC] has

coefficient of -71.05951which is significant at 1% indicating that a unit increase in official exchange rate in the current period [LOGOEXC] will lead to 71.05951unit decrease in informal remittance channel (LOGICHAN) in the short run.

A closer examination reveals that the coefficient of personal remittances received in the current period [LOGREMR] is -0.318859 and it is statistically significant at 1% significance level. This implies a negative and significant relationship exist between personal remittances received in the current period and informal remittance channel in Nigeria. This implies that a percentage increase in personal remittances received in the current period all things being equal will result in 0.318859 per cent decrease in informal remittance channel in Nigeria in the short run.

Nevertheless, a few diagnostic tests were deployed to examine the errors in the model. The adjusted coefficients of determination (adjusted R-square) value of 0.975200 reveals that about 97.5% of the systematic variations in the dependent variable (LOGICHAN) is jointly explained by the independent variables all taken together. Invariably, the model is a good fit. The Ramsey reset test illustrates that the functional form of the estimated model is correct. Similarly, Breusch-Pagan-Godfrey heteroscedasticity test shows that there is no heteroscedasticity problem in the model. But the Breusch-Godfrey Serial Correlation LM Test shows that

the residual in the short-run ADRL model is serially correlated. However, the estimated scores of the Jarque–Bera test result implies that the existing model is normal distributed. This study also performed the cumulative sum (CUSUM) of recursive residuals and cumulative sum of square (CUSUMSQ) of recursive residuals stability tests. Fig. 1 shows the CUSUM and Figure 2 shows the CUSUMSQ plots. Both figures depict that the CUSUM and CUSUMSQ statistics are well within the critical bounds, implying that the model is stable over the period analyzed.

Table 7: Autoregressive Distributed Lag (ARDL) Model Result

Long Run			Short Run		
Variable	**ARDL 1**	**ARDL 2**	**Variable**	**ARDL3**	**ARDL4**
LOGICHAN(-1)	-1.198796*	-1.173297*	D(LOGICHAN(-1))	-1.181186*	-1.171541*
LOGCOMB	0.399278***	0.577561**	D(LOGCOMB)	0.575584**	0.529669*
LOGCOMB(-1)	-0.111073	-0.266358***	D(LOGCOMB(-1))	-0.248402	-0.218094**
LOGOEXC	-83.31764*	-76.46758*	D(LOGOEXC)	-69.63931**	-71.05951*
LOGOEXC(-1)	7.650065	6.663576	D(LOGOEXC(-1))	4.980966	5.340202
LOGREMR	-18.58653*	-16.83817*	D(LOGREMR)	-15.21186**	-15.58316*
LOGREMR(-1)	1.607971	1.397275	D(LOGREMR(-1))	1.038436	1.109390
LOGOEXC*LOGREMR	3.514884*	-0.276008	D(LOGOEXC*LOGREMR)	2.943944**	3.001878*
LOGOEXC (-1)*LOGREMR(-1)	-0.313824	-0.276008	D(LOGOEXC(-1)*LOGREMR(-1))	-0.205349	-0.218869
LOGMFRI	-0.069237	-0.037915	D(LOGMFRI)	-0.109551	
LOGFINF	-0.169028	-0.344380	D(LOGFINF)	-0.353686**	-0.318859
LOGFINF(-1)	0.111106		LOGFINF(-1)		
			ECM(-1)	-1.242728	-1.294891***
Diagnostic Test					
Adjusted R-squared	0.974322	0.963926		0.968913	0.975200
Durbin-Watson stat	2.057377	2.727808		1.974531	1.993544
Serial correlation	0.8644	0.0621		0.7737	0.0802
Heteroscedasticity	0.3614	0.6568		0.8515	0.3150
Normality	0.906147	0.405308		0.681617	0.724724
Ramsey RESET	0.6581	0.2252		0.4118	0.7552
CUSUM Stability Test					Model is stable
CUSUMSQ Stability Test					Model is stable

Significance level at 1%, 5% and 10 % as *, ** and *** respectively

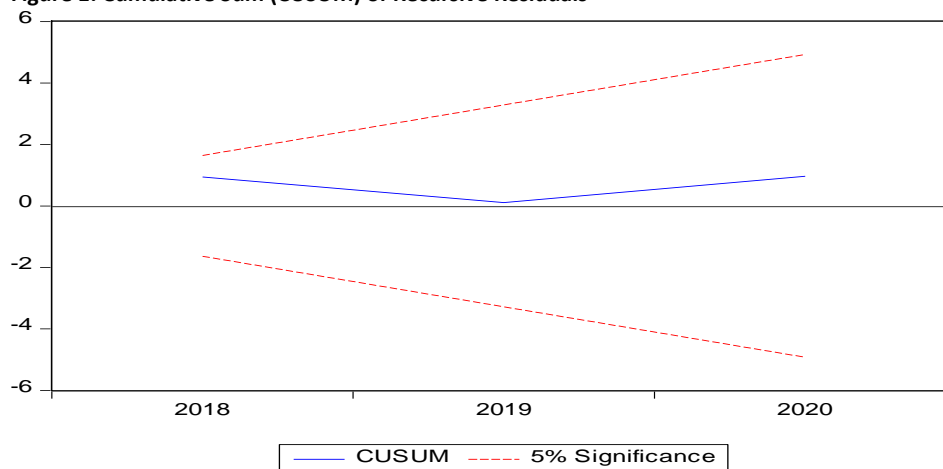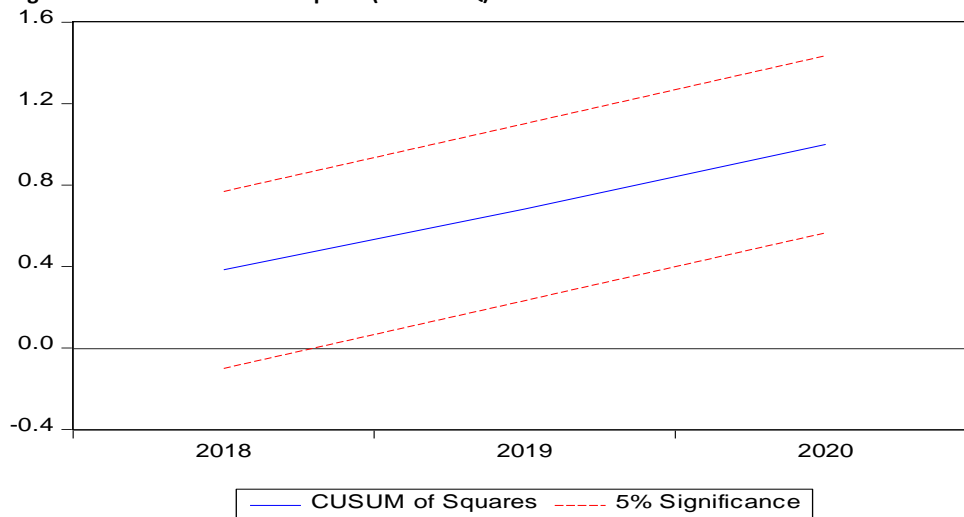**Figure 1: Cumulative Sum (CUSUM) of Recursive Residuals**

Figure 2: Cumulative Sum of Square (CUSUMSQ) of Recursive Residuals

5. CONCLUSION

International remittances have been recognized as an important driver of the economy of most developing countries. It plays vital roles in poverty reduction, income redistribution and economic growth, especially in rural areas. This study examines the interactive effect of exchange rate with remittance on informal remittance channels in Nigeria from 2004 to 2020. The study used secondary annual time series data obtained from Index Mundi.com and the Global Economy.com. The Autoregressive distributed lag (ARDL) model which is often used to analyze dynamic relationships with time series data in a single-equation framework was used for data analysis after achieving data stationarity through Augmented Dickey-Fuller (ADF) test and Philips-Perron test. The result of parsimonious long-run ARDL model reveals that informal remittance channel in the prior period LOGICHAN (-1), commercial bank branches in the current period [LOGCOMB], commercial bank branches in the prior period [LOGCOMB (-1)], official exchange rate in the current period [LOGOEXC], and personal remittances received in the current period [LOGREMR] significantly influence informal remittance channel in the long run. Only commercial bank branches in the current period [LOGCOMB] has a positive and significant effect on informal remittance channel in the long-run.

In the short run, commercial bank branches in the current period [LOGCOMB] has a positive and significant effect on informal remittance channel. Also, the interactive term i.e., LOGOEXC*LOGREMR (official exchange rate * personal remittances received) has positive and significant influence on informal remittance channel (LOGICHAN) while one period lag informal remittance channel [LOGICHAN(-1)], one period lag commercial bank branches [LOGCOMB(-1)], official exchange rate in the current period [LOGOEXC], and personal remittances received in the current period [LOGREMR] all have significant negative relationships with informal remittance channel (LOGICHAN).

The bottom line is that the interactive term, i.e., LOGOEXC*LOGREMR (official exchange rate * personal remittances received) has positive and significant influence on informal remittance channel (LOGICHAN) only in the short run. The implication is that government must take a strong step towards full exchange rate unification, i.e., closing the gap between the sole official rate and the parallel market rate by unifying both of them around the Nigerian Autonomous Foreign Exchange Rate Fixing mechanism (NAFEX) commonly referred to as the "Investors' and Exporters' FX Window". In addition, government, money transfer agents and commercial banks should continue to investments and support innovation in international digital money transfer. At the same time, commercial banks should expand their geographical footprint especially in areas with a low presence of financial institutions. This can be achieved by establishing agent locations in insufficiently served localities.

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INFLUENCE OF INVESTOR AWARENESS ON PERFORMANCE OF REAL ESTATE INVESTMENT TRUSTS IN KENYA

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ABSTRACT

Purpose- The performance of the listed REITs has not been as expected and efforts by REIT managers to issue more real estate securities have been slow. This posed the concern of whether the unexpected performance of REITs in Kenya was due to external factors, such as investor awareness, which is not under the control of the investment market. Thus the study sought to examine how investor awareness influences performance of REITs in Kenya.
Methodology- Predictive correlational research design was employed while target population comprised of Fund Managers, Stock Brokers and Investment Banks and Property Developers. Structural Equation Modelling was used to test the hypothesized relationships at 5% significance level.
Findings-The results indicate that investor awareness have no significant influence on performance of REITs in Kenya. Majority of the respondents agreed that they were knowledgeable about Kenya's real estate market, and their membership in the REITs Association of Kenya has provided insightful market research and databases. Such investors can access with ease reports of the REITs issuing firm. Further, although investors usually follow and update themselves on the REITs markets through the online platform, such awareness does not influence the level of performance of REITs in Kenya.
Conclusions- It can be concluded that although efforts have been put in place to ensure investors' awareness of real estate securities, such efforts have not boosted the uptake of REITs among investors. Investor awareness efforts employed by Capital Markets Authority in conjunction with the REITs Association of Kenya are not likely to enhance the performance of REITs in Kenya. The results indicate that REITs uptake has not attained a critical mass necessary to create liquidity in the capital market. Based on the findings, there is minimal publicity campaigns carried on by the Capital Markets Authority to sensitize potential investors on REITs.

Keywords: Investor awareness, performance of REITs, property market.
JEL Codes G40, R30, C12, C51, L21

1. INTRODUCTION

Since the 2000s, the property market has grown to be the second-largest investment alternative after fixed-income instruments, but larger than the money market and stocks, according to Pham (2013). Real estate investment funds, property firms, and property securities funds make up the three most popular subcategories of listed property securities (Jakpar, 2018). One of the listed real estate assets, real estate investment trusts (REITs), have emerged as the top investment option for both retail and institutional investors. As a result, the focus of this study is on REITs because they have emerged as a substantial asset class of investment options for investors who may be looking for alternative investments. A REIT is a company whose shares are traded publicly like any other stock and that owns and manages real estate assets that generate income (Oreagbe, 2010). A REIT is eligible for a special tax position that taxes income at the investor level rather than the corporate level, according to the European Public Real Estate Association (2012). REITs sell and invest directly in real estate via mortgage or property, similar to stocks on securities exchange. The current study's focus is on REITs since they give investors a chance to own a proportion in either existing properties

or ones that are currently being constructed (Ndung'u & Onyuma, 2020). In order to give investors exposure to real estate without having to acquire and sell actual properties, REITs trade like stocks. Through the capital market, real estate developers can offer investors units or shares in a building that is either commercial or residential. Individual investors can also own the real estate assets through REITs (Africa Business Communities, 2015). Additionally, REIT income in the form of dividends is predictable because the majority of occupant rent is set before a lease agreement. Income REITS offer investors the chance to invest in a variety of properties, including hostels, office buildings, warehouses, and shopping centers. For the risks they take on, REITs also provide investors with competitive returns. The process by which investors improve their understanding of financial products and the risks associated with investing in such products is referred to as investors' awareness (Prabakaran, 2018). Investors can be divided into two groups: aware investors and uninformed investors. Investors who are aware about risky stocks and who are familiar with the probability distribution of stock returns are said to be aware investors. According to Guiso and Jappelli (2005), investors' extent of exposure and knowledge of the investment industry influences uptake of financial securities. Investor awareness can be attributed to low subscription rates and consequent poor performance of REITs especially in Kenya. This posed the concern of whether the unexpected performance of REITs in Kenya was due to external factors, such as investor awareness, that are not under the control of the investment market. Thus, the main objective of this study was to evaluate the influence of investor awareness on the performance of Real Estate Investment Trusts in Kenya. Section 2 of this paper presents key literature relating to the study. Data and methodology used is discussed in section 3, section 4 contains the findings and discussions while section 5 highlights the conclusions.

2. LITERATURE REVIEW

2.1 Global Perspective of the REITs Market

The creation of Real Estate Investment Trusts by the American Congress in the 1960s, with the goal of facilitating access to inexpensive investments in commercial real estate facilities, marked the beginning of the growth of REITs markets (Oranlee, 2014). REITs were created to assist potential investors who lacked the substantial funds needed to buy real estate property but were nonetheless ready and able to purchase REIT shares (Naidoo, 2014). Prior to the US REIT regime's implementation, institutional investors and high-net-worth individuals dominated the commercial real estate sector. The top 10 REITs in the world by 2019 were all headquartered in the United States, according to Statista (2019). The largest REIT in the world as of the end of 2019 had a market value of US\$19.11 billion and was located in Boston (Macro trends, 2020). Japan, Hong Kong, Australia, Singapore, as well as smaller economies like Taiwan, Malaysia, and Thailand, are the major players in the Asia-Pacific REITs market. Asia Pacific's REIT market grew as a result of the 2001 introduction of REITs in Japan. Asian REITs become the most popular among investors despite the shaky global economy. Japan is the largest REIT market in Asia Pacific with 63 reported REITs and a market worth of 147.2 billion dollars (Savills Research, 2019). Dubai was the first country in the Gulf to permit the entry of REITs. The law allowing REITs to manage and control real estate property portfolios took effect in the year 2006. From the year 2015, Bahrain, Saudi Arabia, Oman, Abu Dhabi, and Saudi Arabia all introduced REITs markets. Only 3% of the value of the listed real estate companies is found in the United Arab Emirates, which has a REIT market capitalization of more than \$800 million overall (Global Ethical Banking, 2019). By 2019, there were over 250 Asia-Pacific (APAC) REITs, and their combined market value had risen to more than 330 billion US dollars (Vreeker, 2020). Following the approval of legislation in Thailand, the Philippines, and India, new REIT markets were also anticipated to spur more growth; however, China is still in the planning stages. In addition to the customary office building and shopping mall-themed REIT products, PWC (2019) noted that the eventualization of REITs in China would be quite unique in having a strong presence of residential REIT products. China started a REIT trial to fund capital-intensive infrastructure projects in late April 2020. Bloomberg (2020) asserts that due to the program's success, individual investors were introduced to a market that may one day be worth \$3 trillion. Such achievements offer beneficial lessons for other economies, like Kenya's.

2.2. Development of REITs Market in Africa

The African REIT market has grown in recent years. South Africa, Ghana, Nigeria, Kenya, and Tanzania are among the nations that have adapted to global REIT systems. In May 2013, South Africa's REIT law came into effect. The SA-REITs are governed by the requirements and regulations for the Johannesburg Stock Exchange listings in accordance with international standards. Rental income must make up at least 75% of their REITs' yearly earnings, while shareholders must receive at least 75% of their non-taxable taxable income. In comparison to other African nations, the real estate market in South Africa is seen as being mature (EPRA, 2013). In South Africa, there are roughly 23 active REITs with a combined market value of about 26.1 billion US dollars (Cytonn Investments, 2019). The REITs laws were enacted by the Nigerian Securities Exchange Commission in 2007. Asset-backed securities called Nigerian REITs can be organized as closed-end or open-end trusts. N-REITs must have at least 100 unit holders in

order to be eligible for tax-exempt status (Nigerian Stock Exchange, 2014). Real estate asset groupings must make up 70% of open-end REITs. Contrarily, the real estate assets of closed-end REITs must represent at least 75% of the total asset value. Both are limited to owning asset categories related to domestic real estate. Mortgage rent and property sales must account for at least 75% of the total yearly revenue. Only three REITs, with a combined market value of around 151 million US dollars, are listed in Nigeria (Press Reader, 2019). In 1994, the Ghanaian Stock Exchange Commission passed the REIT law. Housing Finance Company Bank was the first business to use the REIT system in 1995. Ghana's REIT industry has remained largely undeveloped ever since (Bunten, 2015). The oldest REIT market in the area, Ghana, has one listed REIT with a market value of approximately 11 million US dollars, according to the Oxford Business Group (2019).

Tanzania passed laws governing REITs and collective investment plans in 2011. The Collective Investment Schemes provide that the CMA may only approve close-ended structured funds. Real estate investments made by REITs must exceed the value of the entire assets in accordance with Rule 51 of the Tanzania Collective Investment Schemes (CMSA, 2011). The only residential REIT in Tanzania is Watumishi Housing Company (WHC-REIT), which was founded in 2014. (Watumishi Housing Company, 2019). The industrial worth of WHC-REIT, according to Oxford Business Group (2019), was about 40 million US dollars. Moreover, despite the Republic of Rwanda introducing regulations for REITs, no REIT has yet been registered there. In a similar vein, REIT regulations were established in Uganda in 2017, but no REIT has been registered as of yet (NAREIT, 2019).Due to the lack of housing for the poorest sectors of the economy, financing costs for Kenya's real estate industry expansion have remained high. The fulfilment of this goal has proven to be incredibly challenging due to the high expenses associated with the construction or financing of dwelling units for the lower end of the market. In addition to raising funds to finance affordable housing projects, REITs can improve market liquidity (Ndung'u & Onyuma, 2020). The Nairobi Securities Exchange developed cutting-edge solutions to increase the number of listed securities and its market capitalisation. One of the unique products is a listing segment for SMEs called the Growth Enterprise Market Segment (GEMS). Ibuka, a program for incubating and accelerating businesses with growth potential, has also been developed. Additionally, REITs and derivatives- financial instruments that derive value from underlying assets have been developed. One of the attempts to expand NSE listings was the introduction of REITs. The REITs regulations were developed in 2013 by the Capital Markets Authority. Through a public offering in 2015, Stanlib Fahari Income-REIT (FAHR) became the first real estate security to be listed on the Nairobi Securities Exchange. The launch of REIT structures was intended to increase capital market financial inclusion. The platform was created to give potential investors the possibility to participate in real estate without needing a lot of money. Investors would get distributable income or dividends in exchange from the issuing company. Stanlib's market capitalization in 2019 was roughly 0.015 billion US dollars (Cytonn Investments, 2019).

2.3. Performance of REITs in Kenya

Since Stanlib Fahari Income REIT was issued, its performance following registration was significantly below expectations, with only 3.6 billion Kenyan shillings (29 percent) taken in as compared to the expected range of 2.6 to 12.5 billion. Since being listed, the I-REIT has lost over 50% of its value, but the share price has maintained between Ksh 9 and Sh14 (Rich, 2019). A property developer named Fusion Capital attempted to market a Ksh 2.3 billion Development REIT in 2016, however the offering was unsuccessful. In contrast to the criteria of seven investors, Fusion Capital only received a 38 percent subscription from its four investors (Crested Capital, 2016). Fusion Capital decided to raise the funds privately and quit the D-REIT. A blatant sign of the poor performance and low uptake of REITs is the failure of the Fusion Capital D-REIT and the Stanlib I-REIT to achieve the minimum subscription and investor requirements. This was one of the main areas that the current study focused on. Further, Acorn Holdings, a developer of dorms for students, also planned to raise Ksh 7.5 billion through REITs in February 2021. The real estate investor was only able to raise Ksh 2.1 billion (Khusoko, 2020; Accorn Holdings, 2021). Acorn Holdings REIT is the most recent undersubscribed REIT in Kenya, which is significant for the current study because it demonstrates investors' lack of interest in new investment vehicles.

2.4. Investor Awareness and Performance of REITs

Prabakaran (2018) examined the stock market awareness and performance of stocks invested in India. The study used Partial Least Squares Structural Equation Modelling (PLS-SEM) to test the hypothesized relationships. The findings showed there exists a relationship between investor awareness and the performance of stocks invested. The study concluded that without prior knowledge or information, investors can lose heavily. This study focused on equities as opposed to REITs, which this study intended to address. Likewise, the current study employed SEM in examining the hypothesized relationship between investor awareness and REIT performance to make inferences. According to Ricciardi (2008), the information that investors choose to analyse has an impact on how they see the market. He further stressed that investors are not able to absorb all information, thus they become selective as to which information can consciously receive their attention, and thus determine their awareness level. Similarly, Shefrin and Statman (2000) reported that investors' attitudes towards the stock market associated risks depend on the behaviour of the stock market. Their arguments looked at the processing of information among investors in the context of the

behaviour of the stock market while negating the property market. This is a knowledge gap that the current study wanted to address. In the context of investing in mutual funds in India, Saini, Anjum, and Saini (2011) investigated the relationship between investor awareness and risk perceptions. Primary and secondary data were used while Chi-square was used to examine the nature of the association. According to the study's findings, the majority of investors have a positive attitude about investing in mutual funds, and it was noted that it is important to maintain this attitude by giving them current information on various trends in the mutual fund sector. The findings of this study showed that investors perceive less risk as they become more aware about market patterns. Further, Bobade, Nakhate, Malkar and Bhayani (2020) carried out an empirical study on the awareness and acceptability of mutual funds in Pune City using a descriptive research design. The study found that there was a positive association between awareness and the acceptability of mutual funds. These studies looked at mutual funds while the current study focused on REITs. Thus, the current study assessed the investors' awareness level and uptake of REITs which are structured as mutual trusts.

Using a descriptive research design, Malathy and Saranya (2017) conducted a study that looked at the connection between investor awareness and investment choices in Chennai, India. The study found that investor awareness is a significant factor that influences investors' decisions leading to better performance for the stocks they have invested in. The study found that investors' knowledge of policies and economic conditions aids their investment decisions which automatically enhance the performance of stocks. The current study sought to examine the investors' awareness of various aspects and whether there exists any correlation between investors' awareness and performance of REIT stocks, a missing gap in the above study. Further, the current study used a correlational research design in examining the relationship between investor awareness and the performance of REITs. Rana (2019) examined the factors influencing how investors perceive risk and its relationship to investment behavior. According to the study, two factors—"financial knowledge" and "social learning"—are particularly important for investor awareness. The perception of risk among investors in the Nepali stock market is further influenced by two aspects, affection and cognition. This is based on data from 204 individual investors that participated in the Nepali stock market. The study found that investor knowledge and perceived risk attitude variables had a significant predictive power in assessing investor behaviour in Nepal. The key focus of the study was investor awareness and uptake of listed stocks with an inclination towards the risk attitude variable only. Apart from the risk perception of investors, other investor awareness factors such as the ability to access firms' reports, and knowledge of the market are also critical in enhancing uptake of any financial security. This study further assessed whether such factors enhance the performance of REITs. Further, the study focused on individual investors rather than all investors and associated stakeholders, which would have enabled access to an in-depth opinion. The current study sought to address this gap. The reviewed empirical studies did not focus on REITs in terms of investors' level of awareness. The market performance of REITs showed poor results in the past few years. As far as the REITs market in Kenya, because REITs are a relatively new market sector, there is a lack of investor understanding or education about them, which results in low market investment. It was, however, unclear if any relevant stakeholders saw this as an investment in this developing economy. This study, therefore, determined the level of awareness of REITs among relevant stakeholders.

3. DATA AND METHODOLOGY

To ascertain whether there were any predictive correlations between the factors, the study used a correlational research design. Predictive correlational designs, according to Gall, Gall, and Borg (2007), are suited for investigations that aim to use two quantitative variables in the prediction of associations. Seventy-nine property developers, twenty-seven fund managers, twenty-five stock brokers and investment banks, four corporate members of the REITs Association of Kenya, and one listed REIT at the Nairobi Securities Exchange made up the target population. Applying stratified random sampling, a sample size that was representative was determined. Since the target population, consisted of key players in the REITs sector, they were segmented into sub-groups based on their homogeneity, stratified random sampling was the most suitable method for this study. Structured questionnaire was utilized to obtain the primary data. Through pretesting, Cronbach alpha, and factor analysis, the data instrument reliability and validity was confirmed. Further, Exploratory Factor Analysis (EFA) was used to check if the constructs were converging and how independent they were in their contribution to the study. Additionally, Confirmatory Factor Analysis (CFA) was employed to see if the hypothesized association between the observable and underlying latent variables was true. Using path analysis diagrams, CFA was employed to confirm the hypothesis while also denoting variables and components (Pallant, 2011). It was also employed as a method for evaluating or testing whether the measurement items accurately measured the specified constructs, with indicators that contributed successfully to the study being retained for further Structural Equation Modelling.

3.1. Exploratory Factor Analysis

Factor analysis is a technique for identifying factors among observable variables to extract a small number of factors from a large number of variables that can explain the variance observed in the larger number of variables (Hair, Black, Babin, Anderson & Tatham, 2006). Principal component analysis was employed to see if items extracted through EFA were related.

The matrix in Table 1 contains the coefficients or loadings that were used to express the item in terms of the components. The range of the pattern matrix loading indices is 0 to 1.0, where 0 denotes the absence of any relationship between the variables and 1.0 denotes the perfect relationship between the variables and a factor pattern. The average factor loading should be greater than 0.7, according to Byrne (2006). The factor loadings, according to the results, range from 0.867 to 0.908. Only 4 items, per the results, satisfied the loading criteria of 0.7 and were retained for further analysis.

Table 1: Component Matrix for Investor Awareness

	Component 1
IA1- I am knowledgeable about Kenya's real estate market	.906
IA2- My membership to REITs Association of Kenya (RAK) has Provided insightful market research and databases that that can be practically used by members	.908
IA3- I am able to access with ease reports of the REITs issuing firm	.867
IA4- I usually follow and update myself on the REITs markets through the online platform which provides information regarding REITs	.875
Extraction Method: Principal Component Analysis	
a. 1 components extracted.	

The component matrix factor loadings for Performance of REITs are shown in Table 2 and ranged from 0.728 to 0.817. According to the findings, five items met the 0.7 loading criterion and were kept for further analysis.

Table 2: Component Matrix for Performance of REITs

	Component 1
RP1-There is growth in residential projects (students hostels) being funded through REITs	.728
RP2-Appetite for REITs has grown since the value of real estate properties keeps on appreciating thus minimizing the risks of capital loss	.798
RP3-There has been increased competitive price discovery for residential properties (apartments) occasioned by REITs backed real estate projects	.746
RP4-There has been increased competitive price discovery for commercial properties (warehouses, offices, malls, shops) occasioned by REITs backed real estate projects	.817
RP5-REITs returns have decreased due rental defaults and low occupancy rates which have yielded low income	.737
Extraction Method: Principal Component Analysis.	

3.2. Confirmatory Factor Analysis

The covariance and causal modelling of variables were tested by Confirmatory Factor Analysis utilizing Analysis of Moment Structures (AMOS). The degree to which the indicators represent latent variables is determined through CFA. Indicators that make a significant contribution to the study should be retained for Structural Equation Modelling (Hair, Black, Babin & Anderson, 2010). Factor loadings should be more than 0.5, according to Bayram (2013), which was the case in this study. Furthermore, the Critical value of 1.96 was used to determine whether the models were significant at a significance level of 0.05

4. FINDINGS AND DISCUSSION

The contribution of each of the investor awareness indicators to the latent construct (Investor Awareness) was tested using regression weights from Confirmatory Factor Analysis. According to the regression weights, all of the factor loadings by standardized beta estimates were statistically significant ($p<0.05$). This demonstrates that the indicators grouped effectively to measure the various constructs, confirming the study's findings. Table 3 and Figure 1 present the results.

Table 3: Regression Weights and C.R Values for Investor Awareness

			Estimate	S.E.	C.R.	P
REITs Performance	<---	Investor_Awareness	.030	.058	.520	.603
IA1	<---	Investor_Awareness	1.136	.089	12.722	***
IA2	<---	Investor_Awareness	1.150	.090	12.758	***
IA3	<---	Investor_Awareness	.931	.094	9.897	***
IA4	<---	Investor_Awareness	1.000			

P<0.05**

According to Table 3, there is no significant association between investor awareness and performance of REITs in Kenya. This is because the standard path coefficients on the influence of investor awareness on the performance of REITs were found to be statistically insignificant (β = 0.030, calculated t-value = 0.520, P>0.05). The calculated t-value of the coefficient of investor awareness was discovered to be less than 1.9, the usual normal distribution critical ratio. This indicates that one additional unit increase in performance of REITs was linked to 0.40 units increase in investor awareness. *Hence, the study concluded that there is no statistically influence of investor sentiments on performance of REITs in Kenya.* The findings are inconsistent with those of Prabakaran (2018) who examined the stock market awareness and performance of stocks invested in India and showed that there exists a relationship between investor awareness and performance of stocks invested. The study concluded that without prior knowledge or information, investors can lose heavily. The results are, however, in agreement with those of Ricciardi (2008) who asserted that investors are not able to absorb all information, thus they become selective as to which information can consciously receive their attention, and thus determine their awareness level of regulatory policies held constant. The results are consistent with those of Kaur and Bharucha (2021) who looked into the connection between Indian mutual fund investor behavior and investor awareness The study found that there was no significant influence of investor awareness on investment behaviour in the mutual funds' industry. Further, the result of CFA hypothesis testing was confirmed using regression analysis to enrich the findings.

Table 4: Coefficients with Investor Awareness as a Predictor

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.670	.226		16.202	.000
	Investor Awareness	.040	.055	.056	.715	.476
a. Dependent Variable: performance of REITs						

Results from Table 4 further show that as investor awareness rises by one unit, REIT performance in Kenya rises by 0.040 units. *As a result, the analysis concluded that, investor awareness has no statistically significant influence on REIT performance in Kenya.* The findings are in line with those of Kaur and Bharucha (2021), who looked at the connection between investor awareness and investment behaviour in Indian mutual funds. The study found that there was no significant influence of investor awareness on investment behaviour in the mutual funds' industry. Further, the findings are in agreement with those of Ricciardi (2008) who asserted that investors are not able to absorb all information, thus they become selective as to which information can consciously receive their attention, and thus determine their awareness level of regulatory policies held constant. The following regression model was fitted.

Performance of REITs = 3.670+0.040 Investor awareness

5. CONCLUSION

From the findings, investors are knowledgeable about Kenya's real estate market, and their membership in the REITs Association of Kenya has provided insightful market research and databases. Such investors can access with ease reports of the REITs issuing firm. Although investors usually follow and update themselves on the REITs markets through the online platform, such awareness does not influence the level of performance of REITs in Kenya. Further, there are minimal publicity campaigns carried on by the Capital Markets Authority and the Nairobi Securities Exchange to sensitize potential investors on REITs. It can be concluded that although efforts have been put in place to ensure investors' awareness of real estate securities, such efforts have not boosted the uptake of REITs among investors. Investor awareness efforts employed by Capital Markets Authority in conjunction with the REITs Association of Kenya are not likely to enhance the performance of REITs in Kenya. The results indicate that REITs uptake has not attained a critical mass necessary to create liquidity in the capital market. Based on the findings, there is minimal publicity campaigns carried on by the Capital Markets Authority to sensitize potential investors on REITs. It is recommended that the Capital

Markets Authority review the existing market legislation that governs the listing of REITs especially policies on tax for issuance of REITs. In conjunction with the ministry of finance, CMA should consider exempting stamp duty which is charged during the transfer of property into a REIT firm. The Capital Markets Authority should ensure that investors are provided with minimum return guarantees to create confidence in REITs market.

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THE EFFECTS OF INTERNET OF THINGS ON THE TRANSPORTATION COST MANAGEMENT: A STUDY OF LOGISTICS COMPANY

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ABSTRACT

Purpose- The purpose of this study is to examine the Internet of Things (IoT) conceptually and structurally. In this regard, the study will examine the potential effects of the investments of the Internet of Things in the transportation operations of logistics, discuss the potential effects of the transportation costs of the Internet of Things and investments on control and Management. This study also analyze and evaluate such investments in a logistics company.

Methodology- In order to examine the potential effects of IoT investments on the management of transportation costs, an interview was conducted with an Istanbul-centered company of logistics service provider in this study. The data were collected and evaluated by asking open-ended questions within the scope of qualitative research with an interview technique.

Findings- It was determined that the company gained the advantage of real-time monitoring and controlling of the transportation operations, real-time monitoring of vehicles and drivers, monitoring of the thermal conditions of loads, monitoring and controlling of the incidents of losses and accidents through hardware and various technology like the Internet of Things (IoT) and integrated sensors to it. On the other hand, the study received comprehensive support of data from the company about the transportation process and the control of vehicles, loads, and drivers with IoT investments and the costs of transportation. Thus, the study obtained significant advantages for determining, calculating, and controlling costs. However, since IoT investments are new, and R & D operations for some integrated technologies continue in the company, the quantitative data that include cost advantages have not been formed yet. Therefore, a limited evaluation was conducted.

Conclusion- Technically, IoT is a technology that connects the vehicles in transportation operations in logistics with smart networks. IoT enables complete control and real-time monitoring for transportation operations, and it can decrease setbacks and waiting during the transportation process. In this regard, it can increase the management power for the transportation costs by offering advantageous qualities, such as comprehensive data support and real-time monitoring for determining and calculating the transportation costs and controlling expenses or spending. Hence, IoT can increase value-added for transportation operations and provide competitive pricing advantages with its cost. Consequently, IoT investments can provide advantages like "offering a transportation service with high value-added to supply chains, decreasing the costs of vehicles and drivers, and optimal pricing" to logistics companies against their opponents.

Keywords: Internet of things, transport operations, logistics cost, transportation cost, cost management.
JEL Codes: L90, L91, M10

1. INTRODUCTION

Nowadays, Logistics Service Providers (LSP) utilize information technologies for transportation operations similar to warehousing operations to increase efficiency, optimize the usage of capacity and resource (the usage of containers and trucks to optimal fullness), decrease waiting period, achieve economic fuel consumption, decrease the expenses of drivers, and accelerate the deliveries (Prasse et al., 2014:20). Although technologies like automatization traditionally provide easiness to warehousing operations thanks to its central structure, new generation technologies that support mobilization should be used in transportation operations besides automatization (Forcolin et al., 2011:7). At this point, smart logistics express the use of new generation technologies in accordance with traditional logistic solutions for a mobilized transformation in which transportation operations can be optimally planned, managed, and controlled (Song et al., 2021:4253).

In other words, smart logistics is a Logistics 4.0-based transformation that aims gains, such as rapid adaptation to changes in demands, and changes in other environmental factors, development of operational skills, increasing value-added, improvements to costs, creation of rapid and flexible movement order, and professional management of operations, by utilizing new generation technologies (Chen, Sun et al., 2021:1-2). Logistics 4.0 describes an process in which logistic operations are installed with new technologies and smart systems, and labor force participation is decreased extensively in order to deliver an order to its consignee rapidly, impeccably, and profitably (Correa et al., 2020:1). At this point, the Internet of Things (IoT) is a network structure that things in different places in the production of logistics services (vehicles, facilities, other equipment, and items) are connected to each other with smart and secure networks. These things can also communicate with each other rapidly and transfer real-time data (Hopkins and Hawking, 2018:578). Therefore, IoT can provide some potential advantages in terms of "smart logistics" by connecting vehicles in different places that have been used in transportation operations to each other through a smart network.

The purpose of this study is to research the effects of a new generation field of investment, the Internet of Things, on monitoring, controlling, and managing costs. In this regard, research was conducted on IoT and a logistics company with supportive investments in IoT through the interview technique. The study also includes findings from the answers to open-ended questions and evaluations of these findings.

2. CONCEPTUAL FRAMEWORK

2.1. The Internet of Things

The Internet of Things (IoT) is a technology that senses various equipment operations in real-time by connecting them, supports logistic operations for produced data from this equipment, and transfers these data immediately (Liu et al., 2018:663). In other words, IoT is a new generation of technology that provides data transfers and communications between things in different places and supports the transformation of these data into information by processing them and the application of decisions through these data (Guo and Qu, 2015:935). IoT aims for a job environment that can expand when the number of included things in the network increases, can ease mobility, real-time monitoring and control can be conducted, high-volume data can be produced, these data can be utilized by analyzing them, and all things can connect to a network with a digital id (Tu et al., 2018:65-66).

Basically, the architectural structure of IoT comprises four layers: "Sensing Layer, Network Layer, Processing Layer, and Application Layer." "Sensing Layer" captures data about various physical activities with hardware integrated into IoT, such as the RFID (Radio Frequency Identification) System, cameras, sensors, and microphones. "Network Layer" transmits the collected data in Sensing Layer to upper layers in real-time. "Processing Layer" provides data collection from Network Layer in Cloud, and the presentation of the usage of decision-maker, or smart things by filtering these data with advanced software, computers, algorithms, and calculation techniques. The most upper layer, "Application Layer," ensures the transmission of the final decision after analyses and interpretation of the data (Chen, Chen and Yang, 2021:4; Song et al., 2021:4255).

In terms of logistics system IoT unites a system of components such as trucks, containers, tankers, and ships which aim to deliver "the right product with the right quantity to the right place in the right time" with sensors, GPS (Global Positioning System), the RFID (Radio Frequency Identification) System, sound detectors, and cameras (Hopkins and Hawking, 2018:579). In addition to the applicational usage of new generation technologies during transportation operations, IoT also aims to install a smart network structure that increases the autonomous working skills of things (Chopra, 2020:261).

2.2. The Potential Effects of the Internet of Things to Transportation Operations

Nowadays, sensors with temperature, humidity, speed, and other perceptual qualities have been used along with technologies like GPS within transportation operations. Wireless Sensor Network (WSN) that connects these sensors to a smart network eases obtaining and transmitting data from vehicles and containers during the transportation process. In this regard, WSN can be a significant component for monitoring the transportation process, determining existing and possible issues, and providing solutions for those issues. (Song et al., 2021:4255). On the other hand, although the RFID system has been used extensively in warehousing, it can also contribute to transactions of obtaining, transmitting, and confirming data by installing the system into vehicle doors and containers during the transportation. Basically, the RFID System comprises RFID Tag (it can be used in the long-term by changing its components), RFID Tag Readers, Antennas, and computers. It is a technology that allows wireless uploads and transmissions of data. Thus, since the RFID system can be read wirelessly, and its tag component can be changed continuously and securely, it has become widespread along with WSN in transportation. Although RFID and WSN wireless technologies, IoT smart network system is essential for the real-time transmissions of produced data and movement sensors during transportation. Therefore, IoT connects trucks, containers, and other

components in a broadband network by integrating hardware, such as WSN, RFID, GPS, cameras, and microphones, to itself. (Anandhi et al., 2019:544). The usage of IoT during transportation operations can be expressed with the aid of a figure:

Figure 1: Wireless Logistics based on Smart Sensor Nodes
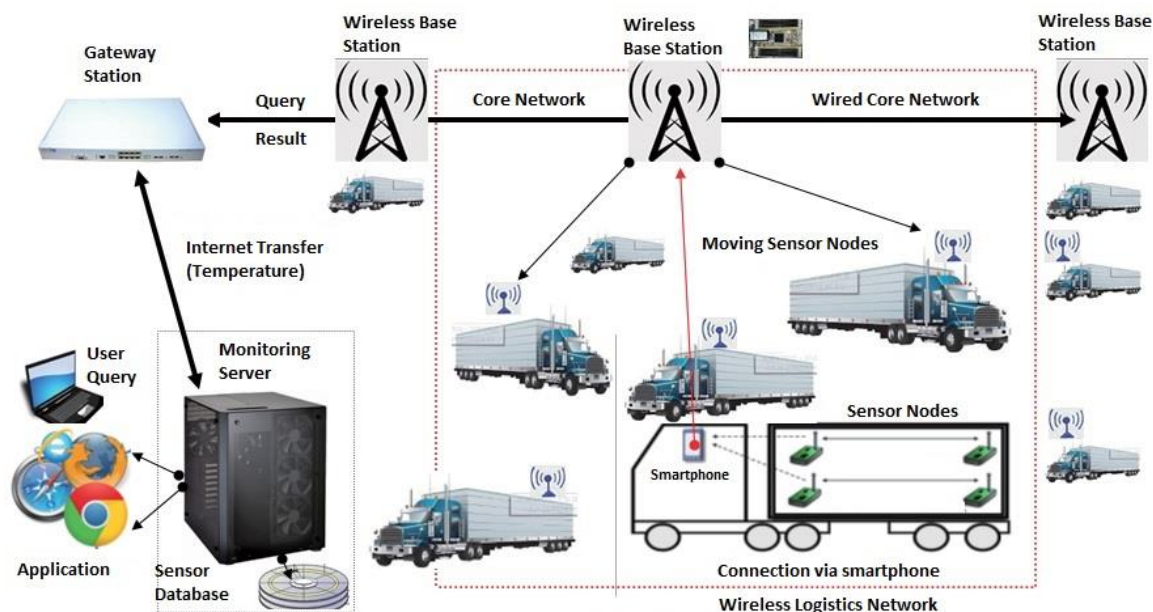
Source: Byun, 2019, p. 522

When Figure 1 is examined, installed sensors in vehicles during the transportation process play a significant role in collecting captured real-time data by sending them to the gateway. While integrated sensors to IoT can provide instant monitoring of vehicles like GPS, they can also provide data about the conditions of loads in the vehicle. Similarly, IoT can accelerate vehicle drivers to send data to the gateway with their smartphones as well. When WSN is integrated into IoT, just like in Figure 1, it not only allows wireless monitoring and control of the transportation process operationally but also eases the transmissions of piled data in Sensor Nodes to mainframes (hence, to databases) without waiting. However, advanced software will be necessary for the transmission of obtained data from IoT and IoT-integrated technologies. On the other hand, adequate internet infrastructure and eliminating geographical connection issues for the materialization of functioning in Figure 1 have significant roles. In this way, produced real-time data with IoT will contribute greatly to the performance of the transportation process alongside determining, analyzing, and controlling transportation costs.

Installed gears to loads and containers with IoT like GPS and sensors enable real-time monitoring and control in several aspects, such as general conditions of loads, thermal and humid balance condition, conditions of weather and route, the possibility of an accident, conditions of vehicles' engines, and location of vehicles (Shah et al., 2020:253; Humayun et al., 2020:58). Thus, when the number of components like vehicles, containers, warehouses, transshipment centers, and delivery points increased, or the number of deliveries to geographically different points increased, flexibility and automatization will be easier. In other words, IoT will provide a service production responsive to the increases in the numbers of vehicles, containers, and facilities in the transportation process and pickups and deliveries to geographically different places (Liu et al., 2018:663-664; Bashir et al., 2019:1). In addition to these developments, the usage of IoT will decrease setbacks in the process thoroughly by contributing to determining and intervening with these problems following predictive maintenance procedures and malfunction indicator systems (through sensors) for the vehicles (Hopkins and Hawking, 2018:583). IoT will contribute to analyses and optimizations with its broadband network structure in accordance with the sudden changes of the route and order by presenting previous and current data about the transportation process to the decision-makers. In this regard, IoT will become a powerful supportive technology compatible with whichever update for the transportation process for the transactions of speed, time and cost estimation, and optimization (Lopes and Moori, 2021:4; Sergi et al., 2021:19).

2.3. The Potential Effects of the Internet of Things on the Management of Transportation Costs

Logistic costs consist of all the costs of operations (services like warehousing, packaging, preparations to dispatching, transportation, and insurance) that have been conducted from the supply of a product to the delivery of this product to the

customer. Logistic cost items are: transportation costs, inventory and material handling costs, warehouse and distribution costs (planning and management of the centers of warehouse and distribution), and informatics costs (demand forecasting, order processes, and production scheduling costs) (Ozdemir, 2018:16). Transportation costs basically consist of fuel expenses, vehicle expenses, and driver expenses (accommodation, food, and document expenses), expenses about the route (tolls), and expenses for the protection of the order (Globerman and Storer, 2015:68). Transportation costs encapsulate various factors, such as expenses and investments related to weight and volumes of loads, risks, vacant capacity, equipment, labor expenses, and visible or nonvisible alternative costs (Kaya, 2018:130).

Consequently, transportation costs include routine expenses natural to transportation operations (expenses like loading-unloading and protection), unplanned expenses (abiding expenses for vacant capacity), extraordinary expenses (expenses due to delays from losses and accidents), and alternative costs (returns of the alternative investments) (Stępień et al., 2016:491). Supportive activities for transportation like warehousing, customs clearance, and other services should be included in transportation costs. Moreover, when transportation costs are calculated, situations stemming from waiting like "transactions of loading-unloading in different places, and break" during the management of transportation operations from pickup to deliveries should be considered carefully. Costs originating from these waitings should be included in analyses for the calculation of transportation costs as well (Shine-Der and Yen-Chen, 2014:23-24; Sebestyén, 2017:159-160). Hence, "order's content, hazard class, orders that belong to more than one customer, differences of delivery points, distance, route, transshipping, fuel, and other parameters" should be taken into account for the determination and calculation for the costs of transportation operations (Turkensteen and Klose, 2012:500). When it is considered from this aspect, the association between transportation costs and produced transportation services can be made as follows:

Figure 2: Cost Calculation Model for Logistics Service Providers
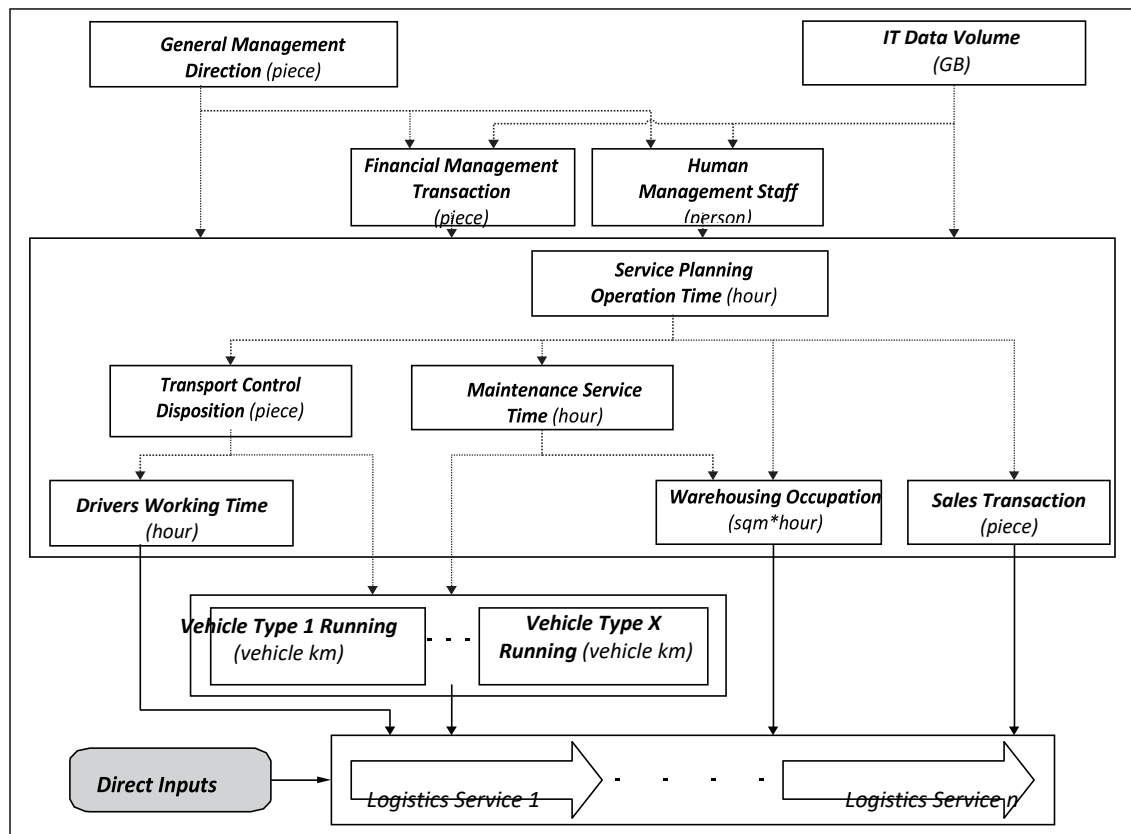
Note: sqm: Square meters; GB: Gigabyte; km: Kilometer
Source: Bokor, 2012: 519

According to Figure 2, when costs are calculated in transportation, routine expenses such as "fuel consumption, energy consumption for warehousing, the usage of facilities, and tolls" should be included in the calculation of transportation costs directly. Then, driver expenses following the calculation model for transportation costs, labor expenses, finance expenses,

expenses for information technologies, maintenance and repair expenses, process control expenses, warehousing expenses, and marketing expenses should also be included. Pricing in terms of route length became easier in the created model for the calculation of transportation costs within this framework. As seen in Figure 2, procuring the support of information technologies affects control costs and other expenses. Moreover, it can be seen that information technology should be monitored as a separate expense. In this regard, installing IoT network system for monitoring and controlling costs may provide significant data support for the calculation and determination of costs. Therefore, LSP can be used to determine, monitor, and control the transportation costs of IoT investments.

IoT will be a significant item for delivering various types and amounts of orders from the customers of different regions with minimum costs, especially like in Figure 2. In this regard, IoT will ease the performance analyses of the cost accounts model for cost elements by providing real-time data, efficiently and rapidly operating automatization and software, and running trial and error simulations in order to achieve minimum costs for transportation transactions (Wang et al., 2020:2-3). As determined before, since IoT will provide real-time data during the transportation process, it will support cost updates following possible or extraordinary developments during the course by easing the updates on the costs (Chen, Sun et al., 2021:3).

Furthermore, costs can be controlled with IoT in during the transportation with precautions like directing the vehicles to different routes without waiting, leading the vehicles to contracted gas stations or resting places aiming not to pass the limited spending budget, and providing rapid maintenance and repair services to malfunctioned vehicles. Therefore, the advantages of recalculations of transportation costs and live updates for the prices of transportation services will become a possibility with IoT (Guo and Qu, 2015:935). On the other hand, IoT will decrease transportation costs with contributions, such as decreasing fuel consumption, shortening delivery time, utilizing predictive maintenance procedures, and planning dynamic routes, thanks to its immense data support (Hopkins and Hawking, 2018:582-583). In addition, IoT has the potential to contribute to achieving calculation and optimizations of costs for the transportation process by ensuring automatic data flow from multiple databases, such as the banking system (Chen, Sun et al., 2021:4). However, IoT will cause increases in informatics expenses because it connects multiple things, users, and databases to a smart network. Thus, although IoT provides significant advantages to the costs in transportation operations, it will also increase informatics expenses in standard cost systems. In these circumstances, informatics expenses can be decreased if new generation vehicles like Autonomous Vehicles could be more widespread in transportation operations (Byun, 2019:522).

3. PREVIOUS STUDIES

A literature survey was conducted for the studies that examined the effects of IoT on transportation costs. In this regard, Chen, Sun et al. (2021) suggested an estimation method for vehicle routing and optimization of delivery time through components like IoT and GPS, cameras, sensors, and detectors integrated into IoT. The authors tested the Gradient Boosting Partitioned Regression Tree Model for this purpose. They observed positive results from this model. Moreover, they emphasized how high profits can be achieved with IoT by adding more data to the analysis.

Wang et al. (2020) suggested an IoT-supported smart dispatch platform that coordinates customers, order-picking robots, and Cloud Technologies. This platform has a three-level system. The first level is a framework structure for an IoT-based smart dispatch platform. The second is an optimization model for efficient coordination between customers, order-picking robots, and Cloud Technology, and the third is the core two-level algorithm with Dijkstra's Algorithm and the Ant Colony Algorithm that supports smart dispatch transactions. They determined that IoT-supported dispatching operations are more advantageous than traditional methods.

Hopkins and Hawking (2018) analyzed the role of IoT with Big Data Analytics for improving driver security, decreasing costs, and reducing negative effects on the environment in a logistics company. They analyzed telematics system data, sensor data (break, speed, and motor), and driver resting data by combining them with visual data (Truckcam Application). They observed results like the provision of eco-driving and the reduction of negative effects on the environment (emission effects) during the transportation process. Zhang et al. (2018) conducted a case analysis for the IoT system that aims at the integration of logistics activities in a production business. They concluded that IoT can decrease energy consumption and waiting times. Liu et al. (2018) designed and suggested an IoT-supported real-time data concentrated sensing model for the optimization of logistics processes in terms of costs, fuel consumption, environmental impact, and distances. They concluded that the optimization of logistics resources is possible with the total reduction of logistics costs, fuel, and distances through the simulation of the RFID-based twenty vehicles. Chen, Chen, and Yang (2021) applied the Analytical Hierarchy Process method (five primary factors and twenty-one evaluations) for generating basic achievement factors that will utilize IoT in smart logistics service production. At this point, they concluded that adopting IoT as an application will have significant effects on indicators like information gathering, wireless communication, low costs, getting real-time data, provision of data integrity,

privacy, and cargo tracking. Correa et al. (2020) researched to measure Brazilian logistics companies' reasons for investing in IoT and Big Data Analytics and their expectations from these investments. In this regard, they detected that expectations like profitability, cost minimization, customer satisfaction, and estimation ability are salient for the companies.

Tu (2018) analyzed to discover the factors that affect the decisions of Taiwanese companies from different industries to adopt IoT with Structural Equation Modeling (SEM). The author detected that IoT is prominent in improving costs and technological benefits. Lopes and Moori (2021) researched IoT's role in the relationship between strategic logistics management and operational performance. They analyzed the survey data of seventy-six Brazilian logistics and retail companies that utilize IoT in their study. They concluded that IoT partially affected the relationship between strategic logistics management and operational performance. Moreover, they also detected that IoT contributed to the connection of things, automatization, remote control, and decreasing mistakes.

4. DATA, METHODOLOGY AND FINDINGS

This study analyzed the effects of one company's IoT investments on transportation cost management. In this regard, it will include an interview with one of the company's executives that provides domestic and foreign transportation services. Although the center of this company is in Istanbul, it has various facilities and a large vehicle fleet domestically. The company can produce logistical solutions for many sectors, especially cold chain services. It also has technological investments in transportation activities, especially for warehousing. The interview included questions to the executive of this company about the company's general structure, the structure of transportation activities (the structure of warehousing activities as well), IoT investments, the effects of IoT investments on transportation activities, and the potential effects of IoT investments on transportation cost management. Finally, the study conducted qualitative analysis and evaluation within the framework of the answers of this company's executive.

4.1. General Findings about the Company

The center of this company, which an interview was conducted for the research, is Istanbul, but it provides various logistics services both nationally and internationally, especially in "transportation, warehousing, and inventory management." This logistics company offers suitable solutions to products or load types like food, textile, electronics, domestic appliances, medicines, cold chain, and automotive. The company conducts its transportation operations with road transportation integrated with railway, maritime, and airline transportation types. In this sense, a figure was prepared for general information about this company:

Table 1: General Information about the Company

Income of the Company (2021 Year)	9.7 billion TL
Operating Period	18 Year
Number of Employees	12.000
Number of Warehousing Centers	122
Number of HUB (Dispatching Consolidation Center)	21
Warehousing Space	1.200.000 m^2
Warehousing Capacity	3.500.000 m^3
Total Number of Vehicles (Self-owned vehicles)	4.000 pieces
Number of Pallet Allocation Centers	11 pieces (67.000 m^2)

Note: m^2: Square meters; m^3: Cubic meters

When Table 1 is evaluated, it is safe to say that the company conducts its logistics services extensively with self-owned vehicles. The company has 122 warehousing centers and 11 Pallet Allocation Centers (the warehouses with only pallets that the company either uses for its logistics services or rents them to other companies). Moreover, the company also has 21 HUB (Dispatching Consolidation Center) facilities special to dispatch transshipments and combinations. The space the company uses for warehousing activities is approximately 1.200.000 m2, and the warehousing capacity is 3.500.000 m3. The company has 4.000 self-owned vehicles for transportation operations. Finally, the 2021 incomes of the company are approximately 9,7 billion Turkish Liras, its operating period is 18 years, and the number of employees in the company is 12.000. Son In addition to the data in Table 1, the company's logistics activities are "Transportation, Warehousing, Inventory Management, Handling, Pallet Recycling, Barcoding, Labeling, Renting (Usually Equipment), and Cold Chain Logistics." The shares of these activities in the annual "Operating Incomes" are as below:

Figure 3: The Contribution Levels of Logistics Activities to Annual Operating Income of the Company
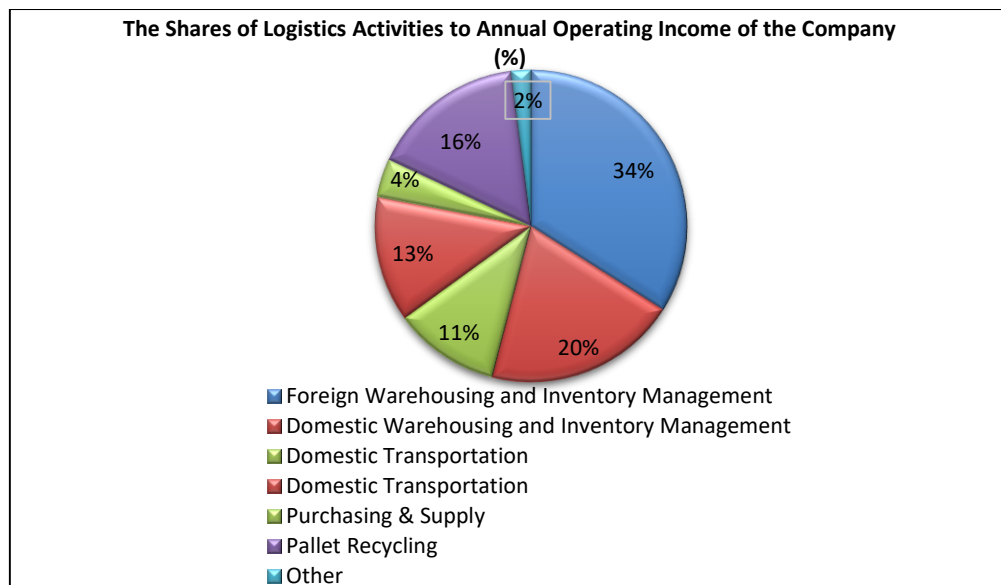
According to Figure 3, the shares of logistics activities in operating income are sorted proportionally. Foreign Warehousing and Inventory Management's share including labeling and barcoding are 34%. Domestic Warehousing and Inventory Management's share are 20%, and Pallet Recycling's share is 16%, Foreign Transportation Operation's share is 13%, Domestic Transportation Operation's share is 11%, Purchasing and Supplying Operation's share is 4%, and other operations' share (like renting equipment) is 2%. In this sense, when Figure 3 was analyzed, while the company's warehousing operations have a 54% share in "Operating Incomes," transportation operations have a 24% share. Finally, the company's executive emphasized that the company has a 60% market share, especially in warehousing and transportation for cold chains.

4.2. Findings about Transportation and Warehousing Operations

As expressed in Figure 3, the company's logistics activities are primarily transportation and warehousing. The company has vendor services for transportation activities like project type transportation (special to large loads with one vehicle and heavy tonnage), partial transportation, cold chains transportation, and hazardous materials and liquid food transportation. Since the company generally uses road transportation, relative information about this subject is summarized as below:

Table 2: General Information about Transportation Activities

Information about Road Transportation	
Number of Vehicles for Domestic General Load Types	1.720 Self-owned Vehicles
Number of Dedicated (Special to One Customer) Vehicles (for Pallet Allocation)	380 Self-owned Vehicles
Number of Vehicles for Cold Chain Logistics	1.200 Self-owned Vehicles
Load Quantity Domestic	8.000.000 tons
Number of Vehicles for Foreign General Load Types	700 Self-owned Vehicles
Foreign Load Quantity	500.000 tons

As seen in Table 2, the company has 4.000 self-owned road transportation vehicles. 1.720 of these vehicles are for domestic general load types like food, textile, medicine, and electronics. 1.200 of these vehicles are for cold chains. 700 of these vehicles are for internationally general load transportation. 380 of these vehicles are for Dedicated (Special to One Customer) Transportation that is designed for pallet allocation. When the quantities of loads are determined, the company has 8.000.000-ton domestic and 500.000-ton foreign transportation jobs. As seen in Table 2, the company extensively conducts its transportation activities with its vehicle fleet. The company spreads its technological investments to transportation activities as well. The researched company has various facilities for warehousing activities: "Central (Leading) Warehouse, HUB (Dispatching Consolidation Center) Warehouse, Dedicated (Special to One Customer) Warehouse, Multi-User (Designed for more than one customer) Warehouse, Bonded (Entrepot) Warehouse, and Cold Chain Warehouse." The company has

multiple vendor services, such as handling, barcoding, labeling, inventory management, dispatch consolidation (HUB), and transshipment. When these vendor services are totally evaluated with warehousing activities, the information about this issue is summarized as below:

Table 3: General Information about Warehousing Activities

Number of Warehouses for General Load Types	96
Number of Warehouses for Cold Chain	26
Number of Pallets	2.500.000
General Warehousing Space	1.070.000 m^2
Warehousing Space for Cold Chain	130.000 m^2
Total Warehousing Capacity	3.500.000 m^3
Number of Packages Warehoused (Annually)	640.000
Number of Packages for Cold Chain Warehousing (Annually)	360.000

Note: m^2: Square meters; m^3: Cubic meters

As seen in Table 3, the company annually conducts warehousing services for 1.000.000 packages. 360.000 (36% of the sum of packages) of these services are for cold chain logistics, and 640.000 (64% of the sum of packages) of these services are for other loads. On the other hand, the company totally has 1.200.000 m2 of warehousing space. 130.000 m2 (10,8 % of the sum of warehousing space) of this warehousing space is allocated to cold chains, and 1.070.000 m2 (89,2% of the sum of warehousing space) is for other types of loads. Additionally, the company has a 3.500.000 m3 warehousing capacity and 122 warehouses. 96 (78,9% approximate sum of warehouse numbers) of these warehouses are for general load, and 26 (21,1% of the approximate sum of warehouse numbers) of these warehouses are for cold chain. Finally, the company has 2.500.000 pallets. The relative pallet data have consisted of pallets that the company either uses for its own warehousing and transportation services or rents to other companies.

4.3. Findings about IoT and Other New Generation Investments in Transportation Activities

The company interviewed for the research uses advanced software, sensors, RFID system, and Cloud-Computing supported automation in transportation activities for the transactions of "inventory input, racking, monitoring, controlling, preparations to dispatch, and inventory output." In addition to these transactions, the company also made various investments for its second basic logistics activity, transportation operations. At this point, investments that are directly related to the transportation process, except GPS, and investments for warehousing services that are conducted with transportation in an integrated manner are summarized in below table:

Table 4: IoT and New Generation Investments for Logistics Activities

Logistics Activity Type	Content of the Investment
Transportation Activity	*Internet of Things (IoT) *Wireless Sensor Networks (WSN) *Global Positioning System (GPS) *Cloud Computing *Electrical Truck (R&D studies continue.) *Autonomous Truck (R&D studies continue.) *Smart Container System (R&D studies continue.) *Big Data Analytics (R&D studies continue.) *Other software or programs (such as SAP, Manhattan Associates, RedPraire, JDA, Axata)
Warehousing Activity (including Handling, Inventory Management)	*Wireless Sensor Networks (WSN) *Radio Frequency Identification (RFID) System *Cloud Computing *Cyber-Physical Systems (R&D studies continues) *Big Data Analytics (R&D studies continues) *Machine Learning (R&D studies continues) *Other software or programs (such as SAP, Manhattan Associates, RedPraire, JDA, Axata)

According to Table 4, IoT and IoT-integrated WSN and GPS have been used in transportation operations lately. Nevertheless, the company also has software support with Cloud Computing that has been used in warehousing operations integrated with the IoT smart network. On the other hand, the company executive also expressed that they conducted R & D operations for new generation investments, such as "Smart Container, Autonomous Truck, Electrical Truck, and Big Data Analytics."

Moreover, the company executive was determined that IoT has been used in transactions such as "real-time monitoring during the transportation process, instant and locational monitoring of vehicles, monitoring and controlling thermal balances for the loads, route planning for vehicles, instant detection of incident or loss conditions, instant control of driver spendings, and performance analysis," in transportation. In addition, RFID, WSN, Cloud Computing, and various software have been used during warehousing activities as well. In this regard, the company executive indicated that R & D operations have been conducted in investments fields, such as "Big Data Analytics, Cyber-Physical Systems, and Machine Learning," for transportation activities and warehousing process that is digitally integrated into transportation activities with transportation activities. Although the company executive indicated that these investments are especially for cold chains logistics, he also mentioned that these investments have an important place in other services for other types of loads.

4.4. Findings about the Effects of IoT on Transportation Cost Management

The company executive indicated that they observed that IoT and IoT-integrated investments have significant advantages for general monitoring of transportation process and its control and management in addition to route planning and monitoring vehicles and loads in transportation operations. In this regard, the company executive expressed that the tolerated costs for transportation operations are driver expenses and vehicle expenses. Therefore, the transportation costs of the company have consisted of tolerated costs or expenses from picking up the loads to delivering them to their respective recipient. Within this aspect, the items of transportation costs can be expressed with a table:

Table 5: Transportation Cost Items of the Company

Transportation Cost Items	Amount
Fuel Expenses	XX
Document Expenses	XX
Insurance Expenses	XX
Tolls on Bridges and Highways	XX
Driver Expenses	XX
Communication (or Information Technology) Expenses	XX
Depreciation	XX
Maintenance-repair Expenses	XX
Taxes	XX
Management Expenses	XX
Total	**XX**

According to Table 5, transportation costs in process are tolerated expenses from picking up the loads to delivering the loads, such as fuel expenses, document expenses, tolls on bridges and highways, insurance expenses, driver expenses, communication (or Information Technology) expenses, depreciation, maintenance expenses, management expenses, and taxes. The company executive indicated that IoT investments provided advantages in terms of costs in addition to plannings for transportation process and monitoring and controlling the process in transportation operations. Within the scope of the research, the company executive indicated that they have not perceived IoT investments as a "cost item." Moreover, the company executive also expressed that they accepted IoT as "an investment field that provides high data support for decreasing the costs in comparison with the previous costs." This condition of IoT demonstrates that IoT investments are significant items of investment for monitoring and controlling transportation costs for the company.

On the other hand, the company executive expressed that IoT can provide more advantages for hindering losses and protecting loads, and delivering on time to the customers during the transportation process. This condition will create a decreasing effect on multiple costs tolerated in the transportation process. The company executive indicated that IoT and IoT-integrated investments provided, especially better pricing and customer satisfaction thanks to it about the effects of transportation costs. In this regard, he answered the question about the quantitative effects of IoT on transportation costs: "since IoT investments are relatively new, it is earlier to present quantitative data, and they can be observed in detail after more developments of the investments." Within the framework of the company executive's answers, IoT investments can affect transportation costs positively, like how they provide advantages to transportation operations' organization, monitoring, and control. IoT especially will provide optimal pricing with real-time data support for detection, calculation, and control of transportation costs. However, expenses for utilizing IoT investments can cause an increasing result for costs as items of transportation costs. In this regard, the improving effects of IoT on transportation costs can be observed clearer with

materializing investments which their R & D operations continue. The company executive signified these investments in Table 4.

5. DISCUSSION

When the results of this study are compared with studies in the literature survey: Chen, Sun et al. (2021) tested the gradient boosting partitioned regression tree model as an estimation model for route planning through IoT and IoT-integrated components in their study. At this point, the model has been analyzed separately as "holidays, working days, peak and non-peak hours, and congestion and non-congestion hours." According to this analysis, the model's estimation accuracy is increased with Mean Absolute Error (MAE) from 26,51% to 46,82%. The model's estimation accuracy is increased with Mean Absolute Percentage Error (MAPE) from 57,05% to 97,50%. The model's estimation accuracy is increased with Symmetric Mean Absolute Percentage Error (SMAPE) from 38,88% to 76,03%.In this regard, when the model has more data support with IoT, they submitted that more advantageous results can be achieved. Wang et al. (2020) suggested an IoT-supported smart dispatching platform that coordinates customers, order-picking robots, and cloud technology. In this regard, they achieved results with their suggested model in IoT-supported smart dispatching platform about the robots: the robot pickup at an average speed is 40 cm, the average pickup robot path is 500 cm, and the robot's average pickup time is 12,5 seconds. At this point, they observed that smart items supported with IoT are more efficient with their performances.

Zhang et al. (2018) detected that the model within the framework of IoT-supported system simulation successfully identifies problems about production logistics, self-organization, and adaptation. They detected 22% savings achieved from production logistics, 51% savings from production logistics time, and 37% from energy consumption from production logistics within the framework of IoT-supported system simulation. Liu et al. (2018) analyzed simulation analyses about the effects of costs, fuel, and environmental impact that encapsulate 20 vehicles with IoT-integrated RFID hardware. In this regard, they detected that sum of the costs can be decreased by 54,32%, total distance can be decreased by 61,46%, and the sum of fuel consumption can be decreased by 54,82% as a result of their simulation analyses. They argued that the environmental greenhouse effect would be decreased with optimal usage of logistics resources and optimal decrease of fuel consumption and distances within the framework of the model. On the other hand, the company executive in this study expressed that they observed multiple improvements, such as monitoring and controlling vehicles and drivers, monitoring and controlling conditions of losses, and monitoring and controlling thermal balances of loads, with IoT investments at the first stage. Hence, these conditions demonstrate that cost advantages can be provided, just like how IoT investments provided significant advantages for transportation operations' performances.

On the other hand, Hopkins and Hawking (2018) detected that a logistics company gained significant advantages for decreasing attention deficit and fatigue problems of drivers and controlling speed and vehicle performances with sensor support through IoT-based Truckcam and Drivercam applications. Lopes and Moori (2021) supported the hypothesis that "IoT application has a positive impact on Operational Performance (OP)" in the research they conducted with 76 Brazilian logistics and retail companies. Tu (2018) researched to discover decisive factors for Taiwanese companies from different industries to adopt IoT. In this framework, these hypotheses are supported: "H2: Perceived trustworthiness of technology has a positive effect on the perceived benefits of IoT technology. H3: Perceived benefits have positive effects on a firm's intention to adopt IoT technology. H5: External pressure has a positive effect on a firm's intention to adopt IoT technology. H4: Perceived cost has a negative effect on a firm's intention to adopt IoT technology. However, the upcoming hypothesis is not supported: "H1: Perceived trustworthiness of technology has a positive effect on a firm's intention to adopt IoT technology. In a similar way, it can be said that IoT has benefits for time and costs rather than technically developing monitoring and controlling capabilities during transportation operations when the answers of the company executive are examined in the study. It can be said that this advantage can be observed with realistic detections and increasing controlling power, especially for the costs of pricing transportation services. In this regard, it can be said that IoT technology provides positive effects on activity performance and costs, and it is a perceived technology as a beneficial investment field. In fact, the expression of the company executive about how the company initiated R & D investments for mentioned technological investments in Table 4 in order to provide benefits of IoT in detail supports this perception.

Chen, Chen, and Yang (2021) applied the AHP method for determining factors of using IoT in logistics. In this framework, they found that some factors became apparent according to participants' evaluations. These are Information Gathering Ability (factor score value: 0,3570), Wireless Communication Capability (factor score value: 0,3538), Expectation of Decreasing Operating Costs (factor score value: 0,4515), Expectation of Forming an Effective Market Information (factor score value: 0,2994), Expectation of the Integrity of the Data (factor score value: 0,4183), Expectation of Providing Information Privacy (factor score value: 0,3643), Expectation of Providing e-Logistics Services (factor score value: 0,3408), and Expectation of Creating a Cargo Tracking System (factor score value: 0,4017). Finally, Correa et al. (2020) analyzed profit expectations of businesses (grades of survey participants; 1: Zero Sum, 2: Low Profits, 3: Intermediate Profits, 4: High Profits, 5: Maximum

Profits) from IoT and Big Data Analytics in their study. They concluded that the expectation of mean profits for IoT is 2,54, and the expectation of mean profits for Big Data Analytics is 2,67. Moreover, they reached a conclusion that profit expectations for IoT are short-term (maximum one year). On the other hand, this study's observations of positive results about IoT investments in the company researched, such as developing monitoring and controlling capabilities, providing real-time data, developing controlling ability of drivers and vehicles, and developing controlling skills to decrease losses or incidents, cause more positive expectations. Also, the positive developments of pricings directed to transportation costs and realistic cost detections with IoT increase the company's expectations for higher profits. In fact, the company executive indicated that the investment should be developed properly in order to be observed in detail how IoT investments affected transportation cost management.

When IoT is examined with the conceptual framework, previous studies, and this study, it can be argued that IoT as an investment field provides technical real-time monitoring and control advantages and high-volume field data in transportation operations. On the other hand, it can be argued that IoT as an investment field provides cost advantages in terms of increasing value-added in transportation operations. In fact, the company executive who was interviewed indicated that the advantages have been observed with IoT investments, such as real-time detections, calculations, and pricing related with these transactions about transportation costs with monitoring and controlling the transportation process.

6. CONCLUSION

This study evaluated the collected data with an interview technique from a logistics company with IoT and IoT-integrated investments and the limited answers that one of this company's executive provided within the frameworks of these resources. In this regard, the company has investments directed to IoT, and IoT-integrated various software, such as GPS, WSN, the RFID System, and Cloud Computing. This company utilizes these investments in transportation and warehousing activities. In addition to IoT, the company continues its R & D operations with investments, such as Big Data Analytics, Smart Container Systems, Autonomous Trucks, and Electrical Trucks.

The benefits were observed in the company with IoT and IoT-integrated investments at the first stage like "the instant monitoring of transportation process, instant control of drivers and vehicles, monitoring and controlling thermal balances of loads, controlling losses or incidents, route planning, and performance analyses." On the other hand, positive effects in the company were observed in transportation costs in parallel with obtained benefits like monitoring drivers and vehicles, protecting loads, and decreasing losses. At this point, it was indicated that the advantages have been provided in pricing. However, the company executive indicated that since the quantitative data on IoT's direct impact on transportation costs and its provided advantages to controlling transportation costs have not been ready yet, the development of these investments in this subject should be waited.

Therefore, it can be argued that IoT and IoT-integrated investments contain potential such as providing significant data support in terms of detection, control, and management of costs besides the performance about transportation operations and providing data support about analyses about the behavior models of cost items. If the company uses IoT investments within the framework of below suggestions, they can provide significant advantages in terms of minimization and management of transportation costs:

➢ Every transportation cost item should be classified per the characteristics of being fixed or variable in its relations with the produced services. If some costs are associated with vehicles' kilometer usage status whenever stability is a possibility, the broad data support of IoT investments can become meaningful. Thus, the dynamic cost functions, which include the association of produced transportation services with transportation cost items, will be formed. In this regard, IoT investments will provide significant data support.

➢ The company can use suitable allocation keys and Activity Based Costing method to decrease transportation costs. Within this aspect, "the detection and monitoring expense components" about transportation cost items will be easier. Moreover, the company can manage these costs by utilizing variance analyses on transportation cost items. At this point, the company can gain significant advantages from IoT investments.

➢ The company can form standards for transportation cost items by receiving support from broad data (previous and current data). Hence, positive or negative variances for transportation costs will provide significant advantages in analyses for the company. In this regard, the company can obtain significant benefits from IoT investments.

➢ The company can make additional IoT-integrated investments, such as "Smart Tachograph, Telematics Applications, Augmented Reality, and Driver Sphygmomanometers," in order to get significant advantages for managing transportation costs.

Since the company executive indicated that IoT investments are relatively new, and the company executive provided limited answers due to the strategic protection of certain data, the study contains qualitative evaluations. Since this study, different from the previous studies that are close to this research field, includes direct evaluations in a logistics company and results depending on this evaluation, it is aimed to contribute to the literature as an infrastructure for the upcoming studies. However, qualitative analyses were conducted because the company's IoT investments have not been developed enough yet. In this regard, quantity-concentrated studies about transportation operations' performance and costs depending on how IoT and IoT-integrated new generation investments develop in the same or different companies can contribute more than this study to the literature in the future. Furthermore, studies can include a different perspective with surveys in a research dimension that more logistics companies can join for this research topic. Thus, these possible studies can contribute to the literature even more.

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FORECASTING & IMPACT OF COVID-19 ON AIRLINE SECTOR: A CASE STUDY OF TURKEY

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ABSTRACT

Purpose- An infectious virus called COVID-19 originated in China spread over the globe in a short time and became a pandemic. The aim of this study is to determine the relationship between the COVID-19 and the airline companies in Turkey. Thus, we went over daily stock prices of the companies as well as daily COVID-19 cases reported across the nation. As a result, two companies were chosen among all of them. From 11 March 2020 to 30 May 2022, we retrieved data of daily stock prices, COVID-19 cases and COVID-19 deaths recorded.
Methodology- Regression analysis was used to determine the association between COVID-19 and prices. The results were as expected; both companies demonstrated significance, and we concluded that they responded to the COVID-19. The second aim of the study is to utilize regression analysis to predict, between June 2022 and June 2023, both the number of verified COVID-19 cases and the prices of Airline companies.
Findings- The results were as expected; both companies were found significant, and we concluded that they responded to the COVID-19. By June 30, 2023, it is likely to see more verified cases if the corona virus spread rate in Turkey does not change. Data for COVID-19 instances will differ depending on the transmission rate. Briefly stated, COVID-19 cases and BIST 100 Travel Sector cases have a direct relationship. Because of a rise in COVID-19 vaccinations, both businesses exhibit an increasing tendency.
Conclusion- The Travel Sector in BIST 100 also exhibits a favorable correlation with COVID-19 cases. But both businesses exhibit a bullish or rising tendency as a result of vaccination which started in 2021. To stop the corona virus from spreading, precautions should be taken, such as keeping a safe social distance, washing hands regularly, and avoiding unwanted facial contact.

Keywords: COVID-19, BIST-100 Index, travel & leisure sector, forecasting, relationship between price and COVID, regression analysis.
JEL Codes: G15, G17, H84

1. INTRODUCTION

An infectious virus known as COVID-19 that started in China quickly spread throughout the world and became a pandemic. As a result, all business activities ceased around the globe. Travel & Leisure was one of the industry influenced mostly by the COVID-19 outbreak worldwide. It was either an established market, such as the New York Stock Exchange (NYSE), the London Stock Exchange (LSE), or an up-and-coming market, such as the Pakistan Stock Exchange and the National Stock Exchange of India (NSE). Although there have been other pandemics, COVID-19's effects on the travel and leisure sector are more detrimental and severe than those of severe acute respiratory syndrome (SARS) (Lee, C. C., & Chen, M. P., 2020). The following industries are included in this sector: travel and tourism, restaurants and bars, gaming, hotels, leisure services, and airlines. Researchers study various issues and find solutions to problems that are currently affecting stock markets, what the factors that affect the functioning of the market are, which industries are generally affected, and which are anticipated to be safe in a global crisis in order to understand the COVID-19's influence on the travel and leisure sector as well as the impact on different industries. The Stock Market, where businesses register to raise their capitals, is frequently regarded as a reliable indicator of economic health of a nation. It typically works in harmony with other aspects of economy of a nation, such as unemployment, interest rates, GDP, exchange rates, etc.

Even though it is a crucial component of an economy, it is notorious for being unstable, unpredictable, and easily influenced by a few rumors since it depends so heavily on unpredictable human behavior. Political issues, bond prices, inflation, company earnings, dividend policy, and many other factors influence the stock market. Similarly, COVID-19 has had a significant impact on stock markets all over the world, without an exception of developed, developing or underdeveloped countries. Almost all stock markets across the globe have displayed an unusual high volatility in recent years. COVID-19 has had a significant impact on the world economy. Furthermore, COVID-19 consistently disrupts Turkey's banking system. The stock market is a reliable economic indicator. Therefore, it would be helpful for the traders to discuss the effects on the airline industry as reported by the Istanbul Stock Exchange and analyze any trends in the growth or decline of the stock market because of COVID-19. In this study an attempt was made to research impact of COVID-19 on airline industry which encompasses the companies, Turkish Airline and Pegasus Airline. Economists and financial professionals are continually retaining COVID 19 accountable for any downtick witness in the stock market since its outbreak. The main cause behind the decreasing trend turned into complete lockdown and as a result, corporations started to shut down and investors started to take out their investment from the stock market.

Istanbul Stock Exchange (ISE) is regarded as one of the top stock markets, so it is crucial for us to observe stock market behavior in this situation and how to handle this case in the best possible way. For this reason, we have concentrated on the impact of COVID-19 on Istanbul Stock Exchange registered firms. In this case, or in any similar situation regarding magnitude and effectiveness that is of COVID-19, it is safer to analyze the travel businesses in a similar way. This study is conducted to assist traders in dealing with COVID-19 situation with which the number of positive cases rise, the stock market starts to fluctuate, and authorities enforce a total or partial lock down. In order to assist the investors in developing the appropriate mindset on how to approach this circumstance and how to be problem-free in this crucial situation, we decided to compare the impact of COVID-19 cases and stock prices in order to examine the trajectory of the stock market. For potential investors searching for capital on the Istanbul Stock Exchange, this study could be crucial. After reviewing a few articles, we formulated our null hypothesis, which was that the airline sector will not be affected and that there may be an influence on the travel industry if the value of p is less than 10%; otherwise, our null hypothesis could be rejected.

2. LITERATURE REVIEW

For developing hypothesis, we conclude a few research associated with Covid-19 and travel & leisure sector, financial markets, and other sectors. Chen et al. (2020) aimed to examine the impact on US travel and entertainment companies' stock returns because of authorities' regulations and restriction stirring from the COVID-19 pandemic. He used Linear regression models and took a sample of 137 airlines, casinos and gambling, lodges, recreational services, restaurants and bars, and travel and Tourism companies indexed at the U.S. from DataStream for the duration of January 2020 to April 2020. The Fama and French three-component model was used to compare the importance of the stringency measures. The findings conclude that the rigorousness of government policies and regulations impact negatively on stock returns. Also, after controlling the pandemic factors Lee and Chen (2020) analyzed the relationship among the COVID-19 variables and returns of travel and leisure sector changing distributions. The statistics used include a pattern of 65 countries from December 2019 to May 2020 and the Quantile Regression was employed for estimations. The results display that the impact from the number of confirmed cases rate have low effects on sector returns at majority quantile, however COVID-19 death rates have greater significant negative impacts on industry return. Further study concludes that there may be no correlation between travel and leisure sector returns and the variety of cases recovered. Also, there might be an effective correlation between industry returns and government response stringency index (GRSI).

Wang et al. (2021) studied the impact on travel and leisure stock market returns due to authorities' interventions in times of COVID-19 pandemic. He used the panel quantile regression model and took a sample panel of pinnacle 9 most important tourism countries which incorporates (Sweden, America, France, UK, Italy, Denmark, Turkey, Greece, and Spain) from database DataStream throughout January 2020 to November 2020. There are three government interventions indices which are economic support index, containment and health index and stringency index and two stock market variables which are volatile and returns used effectively to examine the significance of the version. The findings show that the intervention of presidency had a significant positive impact on sector stock returns, whilst marketplace was underneath adverse occasions. According to Ali et al. (2020), the corona outbreak had a significant negative impact on capital markets because as the pandemic spread, millions of people died, which had an impact on both market performance and stock price. According to studies, the market was significantly impacted by the COVID pandemic deaths from March 1, 2020, to March 30, and after April not many effects were found.

According to He et al. (2020), the pandemic had an impact on the major stock market sectors, including those related to transportation, electricity, and the environment. However, the impact of the coronavirus was ignored and the responses from the

IT, healthcare, education, and non-environmental businesses were positive. The government's quick responses and well-thought-out strategies helped to stabilize the situation for the Chinese markets. Topcu & Gula (2020) noted that the performance of emerging stock markets is at an all-time low, and that the performance of those same markets is beginning to improve by MARCH 30, 2020, eventually showing positive results.

Al Awadi et al. (2020) concluded that COVID-19 had effect on the Chinese stock market. They used regression methods to determine the relationship between stock price returns and mortality rates. After investigating the situation, they discovered that the epidemic had a negative impact on the stock market and that as the death toll rose, so did stock prices and daily returns. According to Waheed et al. (2020), the situation worsened at the beginning of the pandemic and had a negative impact on stock prices, but after some time, when the government began to take action, things started to improve. Since Pakistan is a developing nation, things might have been even better if precautions had been taken earlier.

According to Liu et al. (2020), COVID-19 had an impact on investors as well as the operations of a company. COVID-19 is rapidly spreading, and we need to take action to address both the public health issue and the financial issues facing the industries. During the pandemic, many labor-intensive industries reduced their operations and working hours in order to protect their employees, but this resulted in a decline in productivity, which ultimately led to losses for the businesses. If the businesses had been unable to absorb losses, they would have completely shut down their premises. In 2020 Onali investigated COVID-19 on a few stock markets. Using the VAR model, we found that the number of fatalities had a negative impact on the stock market and a positive impact when using the VIX model in the first three months (China, Italy, Spain). Ozturk et al. (2020) concluded that COVID-19 had a significant impact on the global market. Nearly all sectors of the Turkish economy experienced negative effects on the financial markets. Among them sports, tourism, transportation, banking, and insurance were those most affected.

Chaouachi (2020) focused on applying an ARDL estimate approach to model the impact of the Corona virus spillover on the stock market in KSA from 2 March 2020 to 20 May 2020. He examined the long-term causality as well as the short-term link between COVID-19 and the Saudi Arabian Stock Market. Since there is always a gulf between an actual impact on the nature of a pandemic and a conceptual knowledge of that influence, Ruiz Estrada et al. (2020) provided a main clarification and prediction of infectious disease behavior and added new hypothetical proof about the nature of epidemics. The examination of ten of the largest stock exchanges worldwide revealed that COVID-19 impacts could be destructive to society. According to Elahi et al. (2021), COVID-19 had a significant impact on the entire world. Financial markets, in particular, have faced a significant reaction. Additionally, the outcome demonstrated a decline in market liquidity and had a statistically negative influence on daily return on the markets. To determine the impact of COVID-19, the authors used various econometric models and sets of equations. Additionally, information was gathered from the WHO website and economic statistics handbooks.

The financial markets around the world are incredibly turbulent and unpredictable, according to Zhang et al. (2020). Moreover, he asserted that if all nations cooperated, it would be easier to develop remedies and end the pandemic. We can identify numerous strategies to restore the financial markets to their pre-pandemic condition by cooperating, as COVID-19 is closely tied to the financial markets. According to A Sans (2020), the coronavirus outbreak spread practically all over the world. Their article demonstrates how COVID-19 relates to developed financial markets. To calculate the effect of COVID-19 on financial markets, they used a variety of formulae and analytical methods. The findings of the study state that COVID-19 and all Capital Markets have a substantial positive link based on the body of existing knowledge. According to Shah Syed, Fatima (2020), there is no question that COVID-19 has had a minimal impact on the stock market. It is evident from the aforementioned article that the authors used a VAR MODEL in calculation of effect of COVID-19 on the stock market. volatility of the stock market is demonstrated in the outcome. Volatility is gradually rising as returns are falling. In contrast to other stock markets that are well developed, Pakistan's stock exchange was not severely affected by COVID-19. Numerous studies have been conducted on COVID-19 and its effects on various industries and financial markets around the world. According to Lee and Chen (2020), Wang et al. (2021), and Chen et al. (2020), government policies and activities are crucial in the fight against COVID-19. The primary goal of this study is to identify and address this problem and to show research gap. However, A Sans (2020), Ruiz Estrada et.al (2020), He et.al (2020), Topcu & gula (2020), Al Awadi et.al (2020), and Onali (2020) confirmed that there is evidence that travel companies and other sectors did not perform well during this time.

3. DATA AND METHODOLOGY

The goal of this project is to determine whether there is a correlation between the daily stock prices of companies in the travel sector and the number of COVID-19 cases and deaths that are reported on a daily basis in the nation. To do this, a regression analysis using the ordinary least square method must be performed separately between the prices of each company from each

sector and the number of COVID-19 cases and deaths, after which the regression results must be analyzed to determine which regression shows sig. Additionally, as both are international airlines and have an impact on industry, we employed exchange rates as a control.

3.1. Data Collection

The data used in this research is Secondary Data. The main source of data collection is from Thomson Reuters and some information was collected from FT Data Portal. The sample used for this research are the companies listed under the Istanbul Stock Exchange 100 (BIST-100) Index. Furthermore, we chose only airlines industry firms, Turkish Airline and Pegasus Airline. The frequency of the data is daily. The time-period of the data used is between 2020 March to 2022 May i.e., data for a period of 3 years. The main source of data collection regarding COVID-19 is from World Health Organization Website (https://Covid19.who.int/data). The time-period of the data used is from the beginning of pandemic to May 2022. In Covid-19 cases and death figures (1 & 2) you can see there are Covid waves, in which cases are on the highest and every new wave was higher than the previous one.

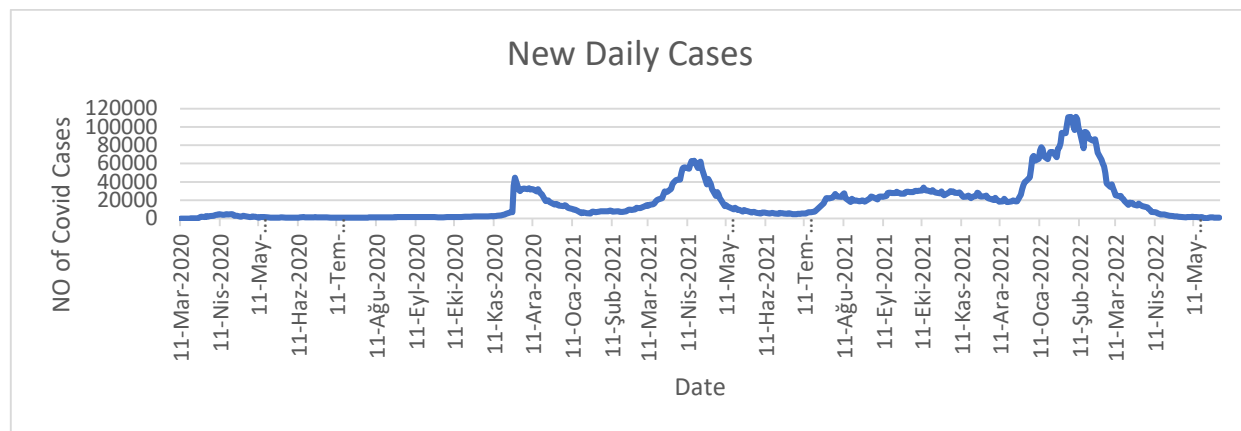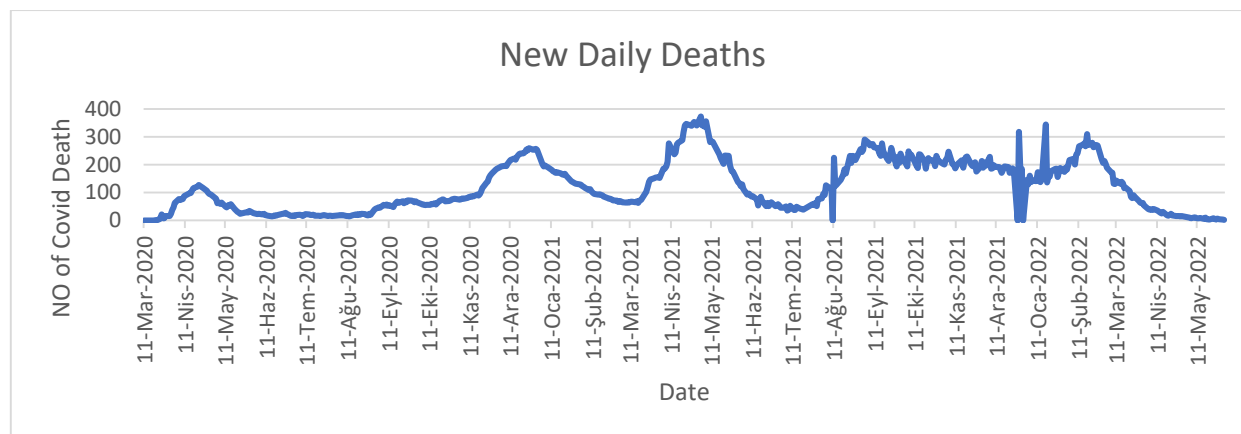**Figure 1: Covid Cases from March 2020 to May 2022**

Figure 2: Covid Deaths from March 2020 to May 2022

If we analyze the figures (3 & 4), we can see that stock prices of both companies were affected since there was lockdown and air traffic was closed in the initial wave. Then in 2021 Covid vaccination started and everything went normal. As a result, Covid waves did not have so much influence on the prices starting from 2021, whereas 2020 was in a shadow of Covid-19.

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Figure 3: Prices of Turkish Airline from March 2020 to May 2022

Figure 4: Prices of Pegasus Airline from March 2020 to May 2022
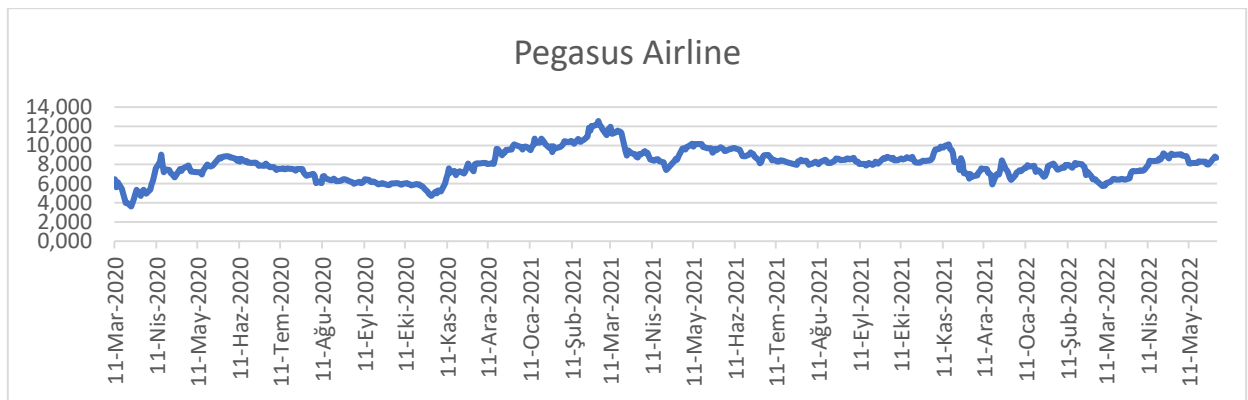
3.2. Equation for Performing Regression

We created different models to show that first one price is directly regressed with COVID-19 cases. Then we added one more variable which is COVID-19 deaths and obtained Model-1. Finally, we added a control variable which was exchange rate and obtained Model-2, where COVID-19 cases, COVID-19 deaths and Exchange rate were the same for each regression, but stock price variable was different for both companies.

$$(Price)_{it} = \beta0 + \beta1(Covid-19\_Cases)_{it} + \beta2(Covid-19\_Death)_{it} + (\varepsilon)_{it} \tag{1}$$

$$(Price)_{it} = \beta0 + \beta1(Covid-19\_Cases)_{it} + \beta2(Covid-19\_Death)_{it} + \beta3(Exchange\_rate)_{it} + (\varepsilon)_{it} \tag{2}$$

Some regression findings might not match our expectations for the reason of several potential issues. First, we checked the autocorrelation. There were several methods or tests to do that. The most often used tests to examine the autocorrelation are

1) Durbin- Watson test

2) Run test

3) Graphical method

4) The Breusch- Godfrey serial correlation test

To determine whether the autocorrelation is adequate or not in our study, we utilized the Breusch-Godfrey serial correlation LM test. In the case of autocorrelation, it was eliminated. There are other approaches to eliminate autocorrelation, however we chose the HAC (Newy-West) test.

After eliminating autocorrelation, we ran a heteroscedasticity test to determine whether or not there is heteroscedasticity. There are various techniques for determining heteroscedasticity, including

1) Residual plots

2) Breusch-pagan test

3) White test

We use white test to check heteroscedasticity whether exists or not. If so, we removed it by using Huber white method. These are some of the problems which might have arisen while performing regression.

4. FINDINGS AND DISCUSSIONS

The regressions were performed on our data by using software named excel, the following results and their interpretations were observed including significance of each model which showed whether daily stock prices of a company representing their corresponding sector responded to the change in daily COVID-19 cases or not. If not, then what might be the problems with the results that make it non-significant.

Table 1: Regression Analysis of Turkish Airline

	MODEL 1	MODEL 2
$(Covid-19\_Cases)_{it}$	0.000006***	0.000001***
	(0.0000)	(0.0000)
$(Covid-19\_Death)_{it}$	-0.001754***	-0.001107***
	(0.0000)	(0.0000)
$(Exchange\_Rate)_{it}$		0.080931***
		(0.0000)
Constant	1.787483***	1.065661***
	(0.0000)	(0.0000)
R-squared	0.15144	0.51337
F-statistic	49.2576	193.76178
S.E. of Regression	0.31160	0.23618

Note: *: significance at 10%, **: significance at 5% and ***: significance at 1%

As you can see in Table 1, there are two models. Model-1 variables are significant, but the entire model does not demonstrate any relevance, thus we chose Model-2. The regression results for Turkish Airlines can be analyzed using the likelihood of the t-statistic and the p-value. The model also displays overall significance. When an independent variable demonstrates individual significance at 1 percent (shown by ***), 5 percent (represented by **), and 10 percent (represented by *), it is considered significant in the model, The independent variable coefficient demonstrated a positive relationship between the independent and dependent variables and explained how a rise in the independent variable of 1-unit resulted in an increase in the dependent variable of 1.065661 value units. The coefficient of COVID-19 Cases was significant, demonstrated a positive relationship between the independent and dependent variables, and explained how a change in the independent variable of one unit corresponded to a change in the dependent variable of 0.000001 units, which was very small. A reduction of one unit in the independent variable caused an increase of 0.001107 units in the dependent variable, according to COVID19 Death, which was significant and exhibited a negative relationship between the independent and dependent variables. The solely employed control variables exchange rate had an impact on the dependent variables and was also significant. Finally, we observed the R-Square and F-statistic values, which helped demonstrate relevance of the model.

Table 2: Regression Analysis of Pegasus Airline

	MODEL 1	MODEL 2
$(Covid-19\_Cases)_{it}$	-0.000011***	-0.00001**
	(0.0007)	(0.0413)
$(Covid-19\_Death)_{it}$	0.006246***	0.005822***
	(0.0000)	(0.0000)
$(Exchange\_Rate)_{it}$		-0.053091**
		(0.0296)
Constant	7.472753***	7.94627***
	(0.0000)	(0.0000)
R-squared	0.08683	0.09464
F-statistic	49.25760	19.2014
S.E. of Regression	1.44310	1.43822

Note: *: significance at 10%, **: significance at 5% and ***: significance at 1%

As you can see in Table.2, there are two models. Model-1 variables were significant, but the entire model did not demonstrate any relevance, thus we chose Model-2. The regression results for Pegasus Airlines can be analyzed using the likelihood of the t-statistic and the p-value. The model also displayed overall significance. The independent variable was significant in the model if it exhibited individual significance at 1 percent (shown by ***), 5 percent (represented by **), and 10 percent (represented by *), The independent variable coefficient demonstrated a positive relationship between the independent and dependent variables and explained how an increase in the independent variable of 1-unit resulted in an increase in the dependent variable of 7.94627 value units. A decrease of one unit in the independent variable causes an increase of 0.00001 units in the dependent variable, which was very low, compared to the coefficient of COVID-19 Cases, which was significant and showed a negative relationship between the independent and dependent variables. The independent and dependent variables were positively correlated, and COVID19 Death demonstrate this. It describes how an increase of one unit in the independent variable corresponds to a rise of 0.00582 units in the dependent variable. Exchange rate was the only control variable we utilized, and it had a great impact on the dependent variables. Finally, we analyzed the R-Square and F-stat values, which likewise demonstrated that the Model-2 was still generally not significant.

Turkish Airline thus exhibited significance based on these values, and Pegasus failed to explain the model, leading us to the conclusion that the travel sector responded to the change in COVID-19 cases as well as with another control variable known as the exchange variable.

4.1. Forecast of COVID-19 Cases correlated with Stock Prices

A forecast is a numerical, probabilistic prediction about an unknown occurrence, outcome, or trend. It is based on previously known data. There are many forecasting techniques for infectious disease outbreaks, and which one to use depends on the key questions of the assessment, which are: (a) scope of the system, specifically how many parallel data series are to be monitored-this number can range from 1 to N-; (b) the quality of the data available; (c) the frequency of the data; and (d) the duration of various pandemic situations. The most popular statistical forecasting techniques include regression, time series, statistical process control, and methods that use geographic data. All these factors can be used as forecasting goals, including expected epidemic lifespan, intensity, peak timing, recurrence, geographic risk distribution, and short-term patterns in incidence. Forecasts for infectious diseases assist individuals in making plans for, avoiding, and dealing with illness, hospitalization, and death, as well as the financial burden associated with epidemics.

The three main categories of forecasting are causal models, time series analysis and projection, and qualitative research approaches. Regression analysis was employed in this study to anticipate company stock prices, and it was also used by Ghosal et al. (2020) to forecast COVID-19. Regression analysis is a technique used in statistics to identify patterns and trends in data. Ideal justification of Regression analysis for trend is the link between the explained variable and explanatory variable. Many different applications and programs can be used for forecasting, but for this case study, we chose Microsoft Office Excel.

In this study, one of the variables we forecasted was the stock values of the two companies. The information was gathered everyday between the beginning of the epidemic on March 11, 2020, and May 30, 2022. We chose to forecast the upcoming 12 months, from June 2022 to June 2023.

We forecasted the performance of both BIST 100-listed companies. As a result, we found out how COVID's past use of the Delta Variant and other factors affected the prices of these companies. Here, we provide a prognosis for the same period of time—June 2022 to June 2023—with a 95% confidence level. Additionally, we used data from one year ago, when immunization began.

In both figures 5 & 6 R-square is perfectly significant. If we talk about forecasting of prices in next year from June 2022 to June 2023 both firms' Turkish and Pegasus Airline shows a substantial increasing trend that price is going to increase within next year.

Figure 5: Forecast of the Turkish Airline Prices from June 2022 to June 2023 with Lower and Upper Confidence Bound
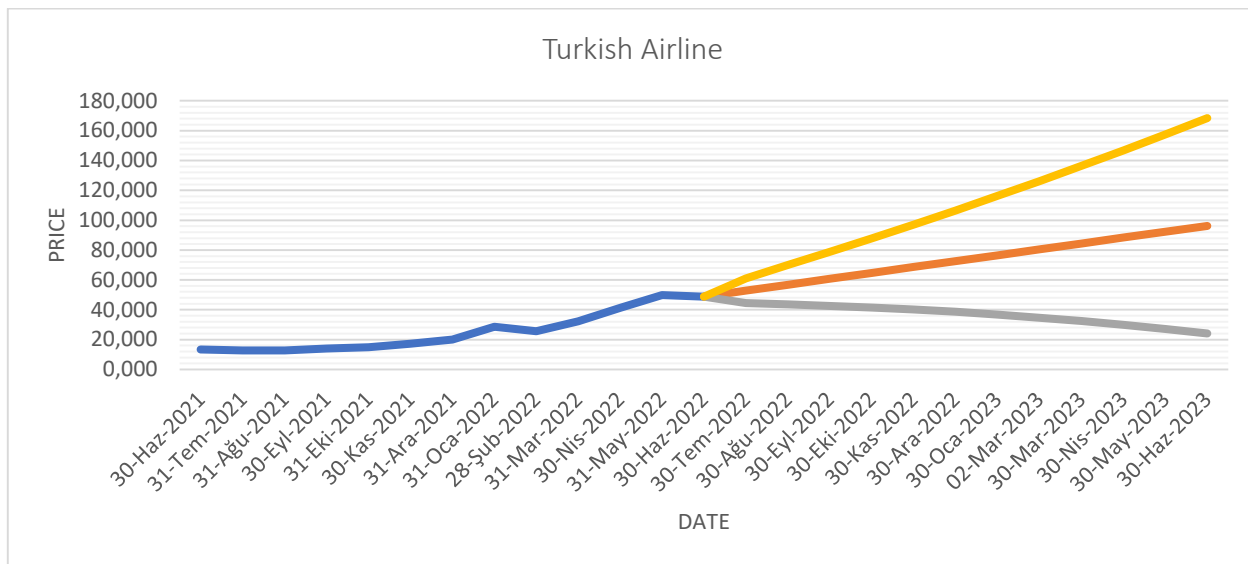

Considering overall Bist 100 Travel sector, we can say that COVID-19 cases had negative effect in times of Covid. But after that when vaccination started, it supported again Airline industry leading especially Turkish Airline to break many old records. It seems that in the future, the prices are going to increase.

Figure 6: Forecast of the Pegasus Airline Prices from June 2022 to June 2023 with Lower and Upper Confidence Bound
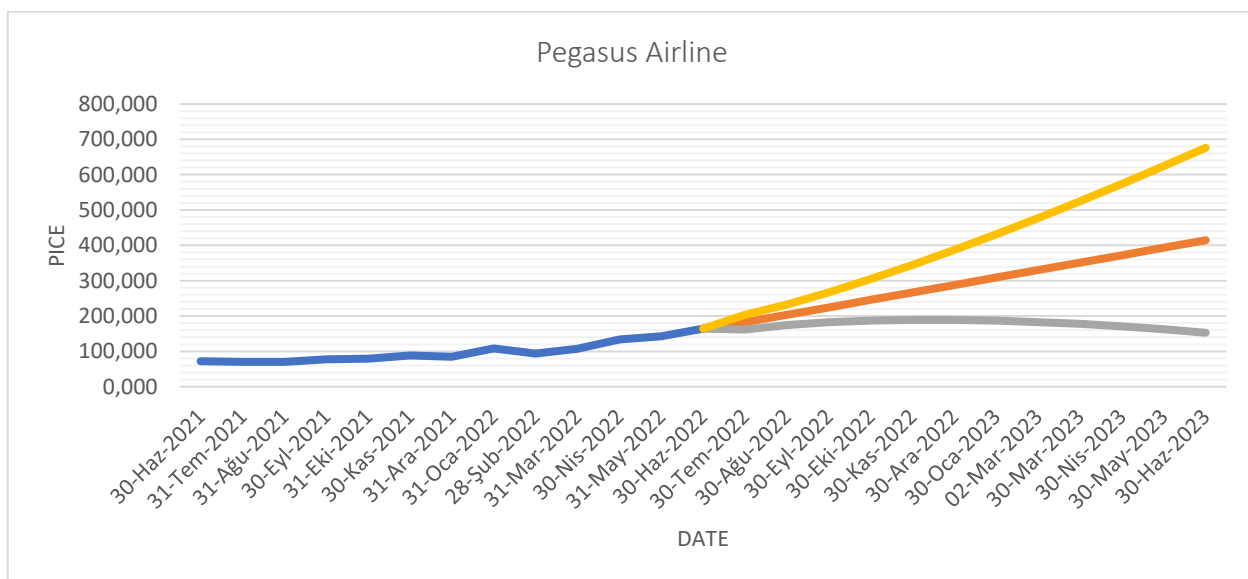
In figure 7 there was a downward trend in April and May 2022, but after June there was a rise in COVID-19 cases again.

Figure 7: Forecast of the Covid-19 Cases from June 2022 to June 2023 with Lower and Upper Confidence Bound
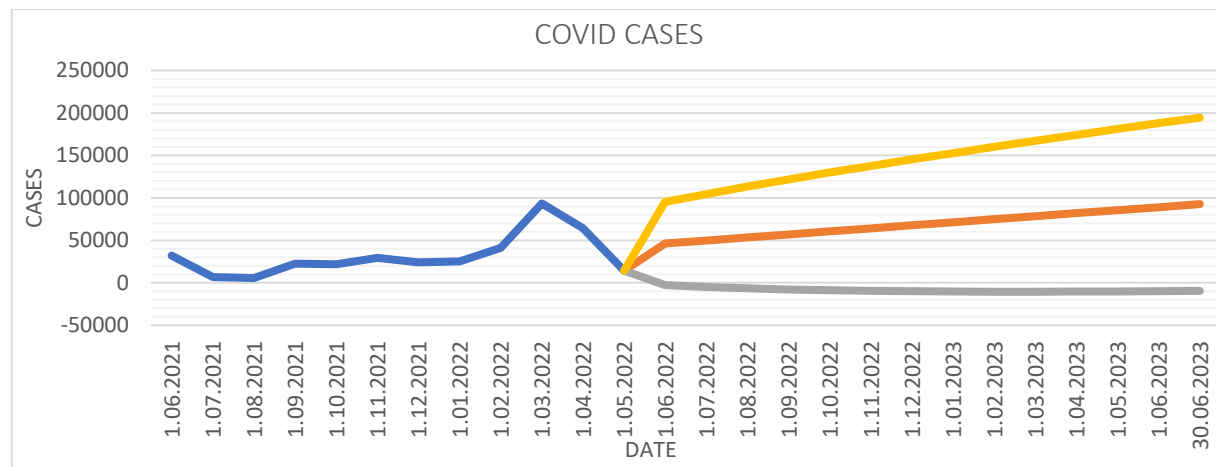
5. CONCLUSION

This study aimed to establish a link between the airline industry and COVID-19. For this purpose, we went over companies daily stock values as well as daily COVID-19 cases reported across the nation. The Istanbul Stock Exchange's Bist 100 Index and its listed companies in the travel industry were the main subjects of our investigation. Among all, there were only two companies. We also downloaded data for daily COVID-19 cases and COVID-19 deaths recorded in the country during the same time period from the WHO website for COVID-19. We extracted the daily stock prices of the two firms from 11-March-2020 to 30-May-2022.

Regression analysis was conducted after gathering all the relevant data. We utilized the ordinary least square method, and performed the analysis separately for each model and company. Model 1 failed to provide satisfactory results, so we switched to Model 2. Assumed daily COVID-19 cases, daily COVID-19 fatalities, exchange rates, and stock prices for each company were the dependent and independent variables, respectively. In order to get and evaluate the findings of the regression, a number of procedures were followed, including determining the likelihood of the F-statistic and R-square for the model's overall significance, T-statistics for individual significance of the variable, which should be less than 10%, 5%, or 1%, and the coefficient of the independent variable to check for its sign, which should be negative to show an inverse relationship between the dependent and independent variables in accordance with our requirement and theoretical premise.

Abbas et al. (2021) also supported our interpretation of the results, which demonstrated that responses of the two firms to the COVID-19 were significant. However, overall model for Pegasus Airlines did not exhibit any relevance.

This study could be useful to investors and institutions, particularly mutual fund companies, investment firms, and fund management firms that can manage their portfolios by taking the implications of COVID-19 on the travel industry into consideration. As you can see, COVID-19 cases are on the rise in China once more, and it is likely that the world would soon see another significant Covid-19 wave that are supposed to have an impact on the financial markets. This study enables users to create a desirable risk-adjusted portfolio by letting them know which subsectors were stable in earlier waves of COVID-19.

The research indicates that our second aim is to predict the pricing of businesses in the BIST 100 Travel industry. Therefore, if the corona virus transmission rate in Turkey does not change, more cases might be reported by June 30, 2022, according to the authors a research, Lodangi et al (2020). Data for COVID-19 instances could differ depending on the transmission rate. The Travel Sector in BIST100 also exhibits a favorable correlation with COVID-19 instances. However, both businesses exhibit a bullish or rising tendency as a result of vaccination starting in 2021.

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