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# **Financial Studies**



## "VICTOR SLĂVESCU" CENTRE FOR FINANCIAL AND MONETARY RESEARCH

## FINANCIAL STUDIES



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



# FINANCIAL STUDIES

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## EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN PURCHASING MANAGERS INDEX AND BIST INDUSTRIAL INDEX UNDER STRUCTURAL BREAKS<sup>1</sup>

## Emrah ŞAHİN, PhD\* Selim GÜNGÖR, PhD\*\* Süleyman Serdar KARACA, PhD\*\*\*

#### Abstract

The purpose of the study is to put forward the long-term and causality relationship between the BIST Industrial Index and the Purchasing Managers Index (PMI) for the period January 2008 - December 2018 in Turkey. First of all, the existence of a long-run relationship between variables has been investigated with cointegration test. It has been determined that there is a long-run relationship between series. For this reason, the coefficient estimation for the long-run relationship between the series has been made a prediction with the Fully Modified Ordinary Least Squares cointegration coefficient estimator. Finally, the existence of causality relationship between the series has been investigated with the asymmetric causality test in the study and it has been determined that there is a unidirectional causality relationship from PMI to BIST Sinai index in terms of positive and negative shocks. Therefore, with this study it can be said that the PMI is a predictor of stock prices.

**Keywords:** BIST Industrial Index, PMI, Cointegration Test with Multiple Structural Breaks, Asymmetric Causality Test.

<sup>1</sup> This paper is a revised and developed version of the paper presented at the 2nd International Banking Congress held on 19-20 April 2019 in Corum, Turkey.

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#### JEL Classification: C22, C53, D53

#### 1. Introduction

Due to changes in global economic conditions, it is essential that economists use indicators that can predict the shifts in the economy and especially in the manufacturing sector. The PMI is one of indicator that provides predictive information about the economic situation of countries.

Chien and Morris (2016) have conducted the study about PMI obtained from the monthly survey data of firms measures the developments in economic activities directly from the manufacturing sector and indirectly the whole economy of the country. PMI data is used to forecast and evaluate the economy because it's published before GDP of the country. Kauffman (1999) has claimed in his study that the PMI provides some insights about the changes in economic activities in the United States and, therefore, PMI can be considered as strategic purchasing decisions. Koenig (2002) has stated in his study that the PMI has power to forecast GDP changes. Smirnov (2010) has investigated the leading indicators of the 2008 crisis in Russia, determined that one of the two main indicators as the undeniable marker of the upcoming crisis is PMI. De Bondt (2012), in his study, has stated that it will be beneficial to scrutinize the PMI data before making the GDP estimate.

Kilinc and Yucel (2016) have claimed that the PMI could be used to forecast the current and next quarter growth rate. In view of this, the PMI is one of the indices used to predict production trends and activities. The PMI is one of the most closely monitored indices in the world in production control, inventory management, and effective marketing analysis by economic organizations, including central banks and local businesses (Khundrakpam and George 2012, 2). The PMI hold the title of the most followed job survey in the world due to its capacity to produce current, accurate, and mostly unique monthly economic trend indicators (Istanbul Chamber of Industry 2019, 4).

In collaboration with the US Department of Commerce, the US National Association of Purchasing Managers (NAPM) has launched a production survey in the 1930s for purchasing managers in production enterprises. The main objective of the survey has been to obtain better business knowledge surrounding production activities in the economy. The PMI has been officially founded in 1982 by Theodore S. Torda, together with the ISM (Institute for Supply Management) formerly

known as NAPM (Mudgal 2014, 7). The PMI is a seasonally adjusted monthly composite diffusion index of five indicators from the economic activity in the manufacturing sector. These five indicators are weighted as follows: new orders—30%, output—25%, employment—20%, suppliers' delivery times—15%, and stock of items purchased—10%. This index is subjective since it is based on survey data obtained from purchasing executives of enterprises in the manufacturing sector. The PMI is considered a predictor for changes in industrial production, real GDP, real stocks, real sales, sales/stock ratio, federal fund rate, foreign exchange return, and monetary policy.

The PMI survey asks respondents (purchasing manager) that how the current level of the five key economic activity indicators (new orders, output, employment, suppliers' delivery times, and stock of items purchased) compares to the previous month. The responses are simply "higher," "lower," or "the same." Then the unweighted ratio of firms in each category is sorted, and a diffusion index is formed by calculating the sum of the ratio of positive responses and half of "the same" responses. A reading above 50 in a diffusion index indicates that more companies have an expansion in their activities. Finally, the current data is seasonally adjusted and converted into a single weighted composite index (Harris 1991, 61-62; Bose 2015, 42; Cho and Ogwang 2005, 25). The diffusion index is a leading indicator and practical summary of measurement shows the direction of change. The fact that the diffusion index is below 50 indicates that there is decrease in the variable and reading above 50 indicates that there is increase (Istanbul Chamber of Industry, 2019, 4). Ultimately, it has considered that the purchasing in the manufacturing sector is made based on consumer demand, it is also cleared that the PMI is the first visible indicator of an economic slowdown. Furthermore, since it is the first major survey data released each month, it is among the most followed economic indicator in the market (Adelekan et al. 2019, 4).

The PMI data has certain advantages over official economic statistics. Most of the official series, such as the GDP released quarterly. There are often delays in the publication of the official economic data. The official data are usually revised after publication. Lastly, the use of different methods in the measurement of the official data weakens the comparability (Bose 2015, 42-43). The most significant disadvantage of the PMI is its subjective nature and the incalculable economic impacts found in the responses of the firms participating in the survey (Joseph et al. 2011, 214). While, as a

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diffusion index, the PMI determines the diffusion of changes in economic activity, it does not identify the intensity of the change. Also, as the responses are not weighted for the magnitude of the firms, the PMI might miss the overall shift in economic conditions resulting from movements in a few large firms (Bose 2015, 43).

The aim of the study is to investigate the existence of a longrun and causality relationship between Turkey's PMI and BIST Industrial index, i.e., whether the PMI is a predictor of the BIST Industrial index. The other sections of the study are as followed: Sections 2, literature review, Section 3, the data set and method used in this study and Section 4, findings and evaluations.

#### 2. Literature review

Although there are many studies tested the relationship between PMI and various economic and financial indicators, the studies which examine the relationship between PMI and stock prices are fewer in literature. In this regard, Table 1 includes certain studies that test the relationship between PMI and various indicators.

#### Table 1

Study	Model	Data	Conclusion
Collins	Granger	Different years have	The PMI is not a predictor of stock
(2001)	Causality Test	been used for	market performance. But the stock
		different countries.	market performance is a predictor of the
			PMI.
Afshar et al.	Granger	1980:Q1 - 2005:Q4	The PMI is a significant indicator in
(2007)	Causality Test		explaining GDP fluctuations.
Johnson and	Regression	1973:1 - 2009:12	There is a positive relationship between
Watson	Analysis		changes in the PMI and stock returns.
(2011)			
Wang (2012)	VAR Model	2009:1-2001:7	The PMI is essential in the analysis and
-			prediction of the stock market trend.
			There is a long-run cointegration
			relationship between the PMI and the
			Shanghai Composite Index.
Tsuchiya	Fisher's Exact	1991:1 - 2010:12	The PMI is a predictor of the Industrial
(2012)	Chi-Square Test		Production Index (IP), but it is not a
	-		predictor of GDP.
Mudgal	Granger	2000:8 - 2013:8	PMI is not a predictor of stock prices in
(2014)	Causality Test		the manufacturing sector; however,
			stock prices in the manufacturing sector
			are a predictor of PMI.

# Studies testing the relationship between the PMI and various financial and economic indicators

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Study	Model	Data	Conclusion
Habanabakize and Meyer (2017)	Granger Causality Test	2000Q1 - 2016Q4	There is a bi-directional causality relationship between the PMI and the Manufacturing Sector Employment. The domestic revenue is a reason for PMI.
Akdag et al. (2018)	Granger Causality Test	2007:2 - 2017:12	The BIST Industry index is a predictor of PMI and is also a predictor of the Industrial Production index and Capacity Usage Rate of PMI.
Adelekan et al. (2019)	Granger Causality Test	2014:7 -2017:6	The PMI is a vital predictor of GDP improvement in Nigeria.

Source: Prepared by the authors.

Upon the literature review, it is observed that classical econometric models have been generally used in the studies. It is believed that this study will contribute to the scientific world because it differs from other studies in terms of testing the relationship between current econometric models and series.

#### 3. Data set and method

In this study, it has been investigated the relationship between Turkey's PMI and BIST Industrial index. Accordingly, the monthly data of the PMI and the BIST Industrial indices from January 2008 -December 2018 are analyzed. In this study BIST Industrial Index data has obtained from the investing.com website, whereas the PMI data has obtained from the IHS Markit company. Subsequently, the relationship between the series have been tested using Eviews and Gauss 10 software programs, by taking the natural logarithm of the data.

Although some studies are made assuming that the series are directly linear, it is widely accepted that testing the linearity of the series is a more accurate approach before unit root and cointegration tests (Sarac and Zeren 2014, 7). First in the study has been investigated whether the series are linear or not using the Harvey et al. (2008) linearity test. Most of the linearity tests in the literature act on the assumption that the series are stationary at level. However, the employment of these tests for non-stationary series causes the results to be incorrect. Taking this into account Harvey et al. (2008) have developed a method that tests the linearity of the series, regardless of the stationarity of the series. The alternative hypothesis of Harvey's (2008) linearity test states that the series are not linear, whereas the simple hypothesis states that the series are linear. The alternative hypothesis is accepted if the test statistics determined as a result of the test are higher than the critical values set by Harvey et al. (2008), whereas the simple hypothesis is accepted if they are lower (Harvey et al. 2008, 1-24).

In this study the presence of the unit root in the series have been investigated using the multi-structural break unit root test by Carrion-i-Silvestre et al. (2009). Whether a variable is stationary in the time series is determined by unit root tests. If there is a unit root in a series, it is not stationary. If the series is not stationary, in the event of any shock or political changes that might occur, the effect of this situation on the variable will permanent (Govdeli 2016, 226). Stationary time series subjected to structural breaks in the level and/or trend are not stationary if structural breaks are not included in unit root tests. Therefore, the series that seem to be stationary will actually be seen as not stationary. Thus, the unit root tests that take into account the structural breaks in the trend function will be more convenient and useful for such series (Sevuktekin and Cınar 2017, 414-415).

The first structural break unit root test has been developed by Perron (1989) and continued by Zivot-Andrews (1992), Lumsdaine-Papell (1997), Perron (1997), Ng-Perron (2001) and Lee-Strazicich (2003). While these methods allow up to two breaks in the series, Carrion-i-Silvestre et al. (2009) have developed a unit root test which allows up to 5 breaks. Using the Bai and Perron (2003) logarithm and with the help of the quasi-GLS method, this test found points for a structural break by minimizing the sum of error frames (Carrion-i-Silvestre et al. 2009, 1754-1792; Gocer et al. 2013, 7). The process of producing stochastic data used in the Carrion-i-Silvestre et al. (2009) test is as follows:

$$y_t = d_t + u_t \tag{1}$$

$$u_t = \alpha u_{t-1} + v_t, \qquad t = 0, 1, \dots, T$$
 (2)

Carrion-i-Silvestre et al. (2009) developed the following five different test statistics (Carrion-i-Silvestre et al. 2009: 1762):

$$(\lambda^0) = \frac{[S(\bar{\alpha}, \lambda^0) - \bar{\alpha}S(1, \lambda^0)]}{S^2(\lambda^0)}$$
(3)

$$MP_T(\lambda^0) = \frac{[c^{-2}T^{-2}\sum_{t=1}^T \tilde{y}_{t-1}^2 + (1-\bar{c})T^{-1}\tilde{y}_T^2]}{s(\lambda^0)^2}$$
(4)

$$MZ_{\alpha}(\lambda^{0}) = (T^{-1}\tilde{y}_{T}^{2} - s(\lambda^{0})^{2}) \left(2T^{-2}\sum_{t=1}^{T}\tilde{y}_{t-1}^{2}\right)^{-1}$$
(5)

$$MSB(\lambda^{0}) = \left(s(\lambda^{0})^{-2}T^{-2}\sum_{t=1}^{T}\tilde{y}_{t-1}^{2}\right)^{1/2}$$
(6)

$$MZ_t(\lambda^0) = (T^{-1}\tilde{y}_T^2 - s(\lambda^0)^2) \left(4s(\lambda^0)^2 T^{-2} \sum_{t=1}^T \tilde{y}_{t-1}^2\right)^{1/2}$$
(7)

In this study, the existence of a long-run relationship between the series has been investigated by Maki (2012) multiple structural break cointegration tests. In the case of a structural break between the series in cointegration analysis, there may be deviations in cointegration tests just as in the unit root tests. Therefore, it is necessary to consider the effects of structural breaks when conducting cointegration tests. In view of this, Maki (2012) has developed a new test method that can allow up to five breaks compared to other structural break tests. Each period in the test is considered possible breakpoint and by calculating t statistics the points where t is the lowest are considered as break dates. According to the method, the entire series must be I (1). Maki developed four models to test whether there is a long-run relationship between the series in the event of structural breaks (Maki 2012, 2011-2015; Gocer et al. 2013, 10):

Model 0: There is break in the constant term, trendless model.

$$y_t = \mu + \sum_{i=1}^{n} \mu_i D_{i,t} + \beta x_t + u_t$$
(8)

**Model 1:** There is break in the constant term and slope, trendless model.

$$y_t = \mu + \sum_{i=1}^{\kappa} \mu_i D_{i,t} + \beta x_t + \sum_{i=1}^{\kappa} \beta_i x_t D_{i,t} + u_t$$
(9)

Model 2: There is break in the constant term and slope, trend model.

$$y_t = \mu + \sum_{i=1}^{\kappa} \mu_i D_{i,t} + \gamma t + \beta x_t + \sum_{i=1}^{\kappa} \beta_i x_t D_{i,t} + u_t$$
(10)

Model 3: There is break in the slope and trend in the constant term.

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$$y_t = \mu + \sum_{i=1}^k \mu_i D_{i,t} + \gamma t + \sum_{i=1}^k \gamma_i t D_{i,t} + \beta x_t + \sum_{i=1}^k \beta_i x_t D_{i,t} + u_t$$
(11)

This study estimates coefficients for the long-run model with the Fully Modified Ordinary Least Squares (FMOLS) cointegration estimator. The FMOLS model has been developed on a deviation of results when predicting the long-run relationship between the series using the least squares method. This method corrects the problem of endogeneity and autocorrelation with a non-parametric approach (Ay et al. 2016, 81-82). Descriptive variables must be in the state I(1) or I(0) to use this method. This method, which also generates good results in small samples, is not sensitive to lead values and lag numbers (Phillips and Hansen 1990, 99-125; Lebe and Akbas 2015, 201).

The presence of a causality relationship between the series has been investigated using the asymmetric causality test by Hatemi-J (2012) in the study. This test considers the effects of negative and positive shocks separately. The idea of transforming data into cumulative negative and positive changes comes from the work of Granger and Yoon (2002). The authors have used this approach in the test of cointegration, which they call hidden cointegration. Hatemi-J (2012) has developed an asymmetric causality test using this idea for causality analysis. The situation is asymmetrical since negative and positive shocks have different causal effects.

The causality relationship between  $y_{1t}$  and  $y_{2t}$  variables defined as a random walk below is formulated as follows (Hatemi-J 2012, 448-449):

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{10} + \sum_{i=1}^{t} \varepsilon_{1i}$$
 (12)

and

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{20} + \sum_{i=1}^{t} \varepsilon_{2i}$$
 (13)

Here t = 1, 2, ..., T,  $y_{1,0}$  and  $y_{2,0}$  constants are the initial value, and negative and positive shocks are defined as follows:

$$\varepsilon_{1i}^{+} = \max(\varepsilon_{1i}, 0), \ \varepsilon_{2i}^{+} = \max(\varepsilon_{2i}, 0), \ \varepsilon_{1i}^{-} = \min(\varepsilon_{1i}, 0), \ \varepsilon_{2i}^{-} = \min(\varepsilon_{2i}, 0),$$
 (14)  
in this case,

$$\varepsilon_{1i} = \varepsilon_{1i}^+ + \varepsilon_{1i}^-$$
 and  $\varepsilon_{2i} = \varepsilon_{2i}^+ + \varepsilon_{2i}^-$  (15)

The above equations can be written after editing, as follows:

$$y_{1t} = y_{1t-1} + \varepsilon_{1t} = y_{1,0} + \sum_{i=1}^{t} \varepsilon_{1i}^{+} + \sum_{i=1}^{t} \varepsilon_{1i}^{-}$$
(16)

and similarly.

$$y_{2t} = y_{2t-1} + \varepsilon_{2t} = y_{2,0} + \sum_{i=1}^{t} \varepsilon_{2i}^{+} + \sum_{i=1}^{t} \varepsilon_{2i}^{-}$$
(17)

#### 4. Findings

In the study, first, graphs of the series are created, and the corresponding results are presented in Figure 1.

#### Figure 1





Source: Prepared by the authors.

Examining the figures above, it is noticed that the related series contain trends, and there are structural breaks in specific points. In this study the linearity of the series has been examined using the linearity test of Harvey et al. (2008), and the findings are presented in Table 2.

#### Table 2

	Lir	nearity	v te	est r	้ esเ	ults
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Variables	W-Lam	Critical Values			
	Statistics	10 %	5 %	1 %	
LNPMI	3.71	7.63	7.65	7.70	
LNINDUSTRIAL	0.64	10.43	10.55	10.77	

Source: Prepared by the authors, according to Harvey et al. (2008)

According to the results from the Harvey et al. (2008) linearity test as W-lam statistical values at a 1% significance level for both series are lower than the critical values, which show that series are linear. Because the series are linear and they incorporate trend and structural breaks, the analysis has continued with linear structural break tests, and the constant and the trend findings obtained from the models have been reported in the tables.

The presence of the unit root in the series has been investigated by the multi-structural break unit root test by Carrion-i-Silvestre et al. (2009) in the study, and the findings are reported in Table 3.

#### Table 3

Variable	e Test Statistics					
	РТ	MPT	MZA	MSB	MZT	
LNPMI	18.379714 (9.1115838)	17.190048 (9.1115838)	-24.384381 (-45.182400)	0.14253373 (0.10556962)	-3.4755967 (-4.7209407)	2009/2, 2010/3, 2011/4, 2012/7, 2017/1
LNINDUSTRIAL	14.234548 (9.5097894)	13.573403 (9.5097894)	-32073591 (-45.178986)	0.12453462 (0.10561760)	-3.9942724 (-4.7116506)	2009/3, 2010/4, 2011/5, 2016/4, 2017/11
ΔLNPMI (I.Differences)	8.2856556 (8.5811375)	7.8741036 (8.5811375)	-50.369285 (-45.455983)	0.099632708 (0.10435557)	-5.0184283 (-4.7688038)	2009/1, 2010/2, 2011/7, 2013/8, 2017/2
ΔLNSINAI (I.Differences)	7.6855479 (8.8726299)	7.2690016 (8.8726299)	-57.800061 (-46.314129)	0.092943536 (0.10363878)	-5.3721421 (-4.8114495)	2009/1, 2011/8, 2013/5, 2014/9, 2017/10
Values in parenthe first differences of	eses indicate cri the series.	itical values, wh	ile the phrases	with " $\Delta$ " indice	ate unit root res	ults in the

Multiple structural break unit root test

Source: Prepared by the authors, according to Carrion-i-Silvestre et al. (2009)

Examining the above results of the Carrion-i-Silvestre et al. (2009) unit root test, as the level values are higher than the critical values of test statistics in absolute values in general at the 5% significance level, the series contain a unit root. Therefore, the unit root test has been repeated by taking the first differences of the series, and as the first differences of both series at the 5% significance level are less than the critical values of the test statistics in general, it has been determined that the series are stationary. As this finding meets the

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prerequisite for the cointegration test, the presence of a long-run relationship between the series has been investigated by Maki (2012) multiple-structural breaks cointegration test, and the obtained findings have been presented in Table 4.

#### Table 4

	Cı	ritical Valu	ies	Test Statistics	Break Dates			
	1 %	5 %	10 %					
MODEL 0         -5.959         -5.426         -5.131         -4.0052927         2008/12, 2011/3, 2012/8, 2013/9, 2016/3								
MODEL 1	-5.708	-5.196	-4.938	-5.2154641**	2008/11, 2010/1			
MODEL 2         -6.915         -6.357         -6.057         -5.6071963         2010/1, 2011/1, 2013/2, 2013/9, 2016/11								
MODEL 3 -7.553 -7.009 -6.712 -7.0705788** 2009/7, 2011/5, 2013/8, 2017/1								
***, ** and * respectively represent statistical meaningfulness at the level of 1%, 5%, and 10%. Critical values are obtained from Maki's (2012) study								

Multiple structural breaks cointegration test results

Source: Prepared by the authors, according to Maki (2012)

Upon examining the results of the Maki (2012) multiple structural breaks cointegration test, as the test statistics for the trend (model 1 and model 3) models with the 5% significance level are higher than the critical values which shows that there is a cointegration relationship between the PMI and BIST Industrial Indices. In other words, the series act together in the long-run. This finding meets the requirement for the cointegration coefficient estimation. Therefore, structural breaks from all models have been included in the model, and the coefficient estimator. Accordingly, through the deductive elimination method and elimination of meaningless breaks from the model, the findings obtained have been presented in Table 5.

#### Table 5

#### Test Results for FMOLS cointegration coefficient estimator

	Coefficient Test S						
LNPMI	1.240512***	6.438559					
C 5.433511*** 7.232398							
@Trend	0.011035***	23.06524					
D2008-11	0.481524**	2.231677					
<b>D2009-7</b> -0.542785*** -2.647986							
D2011-3	-0.369463*	-1.804576					
*** ** and * respectively represent statistical meaninofulness at the level of $1\%$ 5% and $10\%$							

Source: Prepared by the authors.

The FMOLS test results in Table 5 show that the coefficient of the PMI is positive and statistically significant at the 1% level. In other words, one can say that a 1% increase in the PMI causes an increase in the BIST Industrial index by about 1.24%. In addition, it has been determined that the FMOLS estimator that structural breaks, in general, have a statistically significant and negative effect on the longrun relationship between the series, except for November 2008. In the last guarter of 2008, with the bankruptcy of Lehman Brothers and some giant companies, the global financial crisis has started to show its effect, and accordingly, some measures taken by both IMF and Central Banks of the country have made positive contributions to the economies, albeit for a short time. In other word, 1% increase in the PMI in November 2008 has caused a 0.48% increase in the BIST Industrial index. However, in conjunction with the global financial crisis deepened its impact on the real economy in the third quarter of 2009, 1% increase in the PMI has led to a 0.54% decrease in the BIST Industrial index. Finally, it can say that the impact of the European debt crisis in 2011 on the long-run relationship is statistically significant and negative at 10%, in other words, 1% increase in the PMI causes 0.36% decrease in the BIST Industrial Index.

Lastly, in the study, the existence of a causality relationship between the PMI and the BIST Industrial Index has been investigated with the help of the Hatemi-J (2012) asymmetric causality test, and the results have been presented in Table 6.

#### Table 6

Direction of Causality	Test	Boostrap Critical Values							
	Statistics	1 %	5 %	10 %					
$PMI^+ \longrightarrow SinEndks^+$	19.985***	9.289	6.235	5.070					
PMI <sup>+</sup> → SinEndks <sup>-</sup>	0.001	6.813	3.540	2.457					
$PMI^- \longrightarrow SinEndks^+$	1.604	7.743	4.381	2.958					
PMI <sup>−</sup> → SınEndks <sup>−</sup>	19.041***	11.478	5.070	3.114					
$SinEndks^+ \longrightarrow PMI^+$	2.672	11.554	6.448	4.730					
$SinEndks^+ \longrightarrow PMI^-$	1.714	7.075	3.576	2.552					
$SinEndks^{-} \longrightarrow PMI^{+}$	2.459	7.695	4.298	2.892					
SınEndks <sup>−</sup> <b>—</b> PMI <sup>−</sup>	1.304	8.672	3.874	2.880					
***, ** and * respectively represe	nt statistical meani	***, ** and * respectively represent statistical meaningfulness at the level of 1%, 5%, and 10%.							

Asymmetric causality test results

Source: Prepared by the authors, according to Hatemi-J (2012).

When the results of the Hatemi-J (2012) test investigating the causality relationship between the asymmetric positive and negative changes of the series are examined, one can observe a unidirectional causality relationship from the PMI to the BIST Industrial index since the test statistics on the 1% statistical significance level in terms of positive and negative shocks are higher than the critical values. A positive shock at the PMI also positively affects the BIST Industrial index, while a negative shock at the PMI causes negative shock on BIST Industrial index which mean that the PMI is a predictor of the BIST Industrial index. However, in terms of shocks, there is no causality relationship between the BIST Industrial index and PMI.

#### 5. Conclusion

This study has been conducted with an aim to reveal the longrun relationship as well as the causality relationship between the PMI and the BIST Industrial index for the period 2008:1 - 2018:12. Accordingly, the BIST Industrial index has been used as the dependent variable, whereas the PMI indicator has been used as the independent variable.

Firstly, the existence of a long-run relationship between the series has been investigated using Maki's (2012) multiple structural breaks cointegration test, and a long-run relationship between the series has been identified. Therefore, structural breaks obtained from the cointegration test have been added to the model and the long-run coefficient estimation has been made through the FMOLS coefficient estimator. Consequently, it has been established that the coefficient for the PMI is statistically significant and positive which shows that increase of 1% in the PMI causes an increase approximately 1.24% in the BIST Industrial index. Further findings obtained from the FMOLS test show that structural breaks generally have negative effect on the long-run relationship between the series.

Finally, the existence of causality relationship between the PMI and the BIST Industrial index has been investigated by the Hatemi-J (2012) asymmetric causality test. As a result of the analysis there is unilateral causality relationship between the PMI and BIST Industrial index which is determined in terms of positive and negative shocks. In other words, it is also observed that positive shock in the PMI causes positive shock in the BIST Industrial Index and negative shock in the PMI causes negative shock in the BIST Industrial index. After the findings, it can be said that the PMI is a predictor of stock prices. This finding coincides with the findings of studies by Johnson and Watson (2011) and Wang (2012). However, this finding is different from the research findings of Collins (2001), Mudgal (2014), and Akdag et al. (2018). Collins (2001) found that stock market performance is a predictor of the PMI, Mugdal (2014) have been found that stock prices in the manufacturing sector are a predictor of the PMI, and Akdag et al. (2018) have been found that is the BIST Industry index is a predictor of the PMI.

Providing public information to the investors, the PMI is precursor indicator for investors to evaluate the historical performance of various sectors and make a profitable investment decision. In subsequent studies, the relationship between the PMI and different indices can be underlined using different methods and techniques, as well as comparison of the relationship between the PMI and selected stock portfolios traded in different indices or countries.

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## JORDANIAN BANKING SYSTEM: ANALYSIS OF TECHNICAL EFFICIENCY AND PERFORMANCE

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#### Abstract

The purpose of this study is to examine the connection between technical efficiency and banks' performance for 13 commercial banks in Jordan over the period 2010-2017. For this purpose, this study will employ the nonparametric model using the linear programming by Data Envelopment Analysis (DEA) to calculate technical efficiency and the panel regression analysis to estimate the relationship between technical efficiency and Banks' performance measured by return on asset (ROA), return on equity (ROE) and Tobin's Q. The empirical findings reveal that pure technical efficiency (PTE) is statistically significant with positive effect on ROA, ROE and Tobin's Q. Further, the relative technical efficiency (RTE) or scale efficiency (SE) has positive significant impact on ROA, ROE, and Tobin's Q. The market share and the ATMs coverage share also has a positive effect on bank's performance. On the other hand, bank's size has no significant effect on ROA and ROE but weak positive effect on Tobin's Q.

**Keywords**: Technical Efficiency, Banks' Performance, Commercial Banks, Data Envelopment Analysis

JEL Classification: G14, G21, L25

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#### 1. Introduction

Banking efficiency refers to the banks' ability to reform its plans and strategies to obtain maximum returns using the minimum possible expenditures and resources as managerial objectives that are being pursued by the top management. Efficiency makes banks more elastic to domestic and foreign shocks. In the world of increasing competition, banks are therefore fighting for a boost of efficiency, while organizers and decision makers have to achieve the efficiency prior globalization of the market especially that the number of foreign banks significantly increased. In general, efficiency in economics is interpreted as the maximum potential ratio between the output and the input of the product development process, which shows the optimal distribution of available resources that would allow achieving the maximum potential (Cvilikas and Jurkonyte-Dumbliauskiene, 2016). ROA, ROE and Tobin's Q ratios are globally utilized in financial analysis, permit to assess the banks' performance during a period time. So, their significance for management is of comparative nature. Whereas profitability is fundamental for a bank to preserve ongoing activity and for its clients to gain fair earnings.

Although high efficiency may enhance performance, researchers have mixed views on the connection between banks' efficiency and profitability. For this purpose, the study aims at providing an empirical contribution to the concept of the efficiency research of the bank's performance to examine the connection between efficiency and banks' performance for thirteen Jordanian commercial banks over the period (2010-2017).

#### 2. A brief review of literature

The literature on Banks efficiency in the developed countries contains a large number of articles (see Berger et al., 1993; Berger and Humphrey, 1997; Berger and Mester, 1997 for an extensive review of literature on the efficiency of banking sector). The concept of efficiency established in 1951 in the study of Koopmans (1951), which noted that "the product is technically efficient, if the increase in production of a particular product requires a reduce production of another product at least, or adding one more input at least. The literature provides different methods to measure efficiency. Each frontier technique has its specific advantages and disadvantages and yields different efficiency estimates (see Bauer et al., 1998 for advantages and disadvantages

of each frontier technique). Among all the frontier techniques, DEA has emerged over the years as a most potent approach for measuring relative efficiency across banks due to its intrinsic advantages over others. This fact indicates DEA's significance, popularity, and relevance in banking efficiency analyses. Given the advantages of this method in the analysis, it will be used in this study to calculate technical efficiency. The DEA method assuming that the production frontiers either constant returns to scale CRS, or variable returns to scale VRS. It has been applied by Charnes et al. (1978), which has its roots from Farrell (1957). The CRS hypothesis is appropriate in the DEA only when all DMUs are operating by optimal scale (Coelli et al., 2005). This study will focus on output oriented approach to calculate the technical efficiency scours, considers the possible expansion in outputs for a given set of inputs.

Regarding the relationship between efficiency and banks' performance the literature reveals that some studies find a positive connection, others find a negative connection and few studies reject the relationship. Yong et al. (2017) test the impacts of risk, competition, and cost efficiency on bank profitability in a sample of Chinese commercial banks over the period 2003-2013. Results reveal that Chinese commercial banks with higher levels of insolvency risk have higher profitability measured by ROA and ROE. Besides, higher competition leads to lower profitability, and higher levels of cost efficiency have lower ROA in Chinese banks.

Priya and Velnampy (2013) aimed at finding the impact of changes in efficiency on profitability of banks in Sri Lanka over the period 2008-2012. Results confirm a significant relationship between the ratio of sales to total asset, the operating profit margin and ROE. In addition, the ratio of sales to total asset and operating profit margin and loan to total assets are significantly correlated with Net Profit Margin.

The importance of bank efficiency and performance has also been studied by Maredza (2014) who tries to examine the internal determinants of bank profitability the effect of bank efficiency over the period 2005-2011. The study found that high total factor productivity efficiency and capital adequacy produce higher profitability, while high cost inefficiency, diversification activities, large bank size, and high credit risk leads to lower profitability. In other words, there is a positive role of efficiency as a serious reason of profitability among banks. Mawutor and Fred (2015) assessed the efficiency and profitability of banks operating in Ghana over the period 2006-2011. The study revealed that 61% of the variation in the profitability of the banks are accounted for by the independent variables such as the liquidity level, leverage, productivity, credit risk and size of the banks.

Kumar (2008) examines the relationship between technical efficiency and profitability in the Indian public sector banking industry. Findings show that public sector banks can produce 1.13 times as much output from the same inputs, if they operate efficiently. An analysis of efficiency–profitability matrix based on the efficiency scores and Return on Assets (ROA) reveals that 13 banks that fall in the 'lucky' and 'underdog' quadrants have the technical efficiency score below the industry average. Werner and Moormann (2009) tested the empirical connection between efficiency and profitability in five large countries of the European Union over the period 1998-2005. The findings of the conducted static and dynamic regression analyses confirm that profitable banks operate with higher technical efficiency comparing to other banks. Therefore, banks following this strategic position were able to achieve higher excess returns during the analyzed period.

In addition, Erina and Lace (2013) examine the effect of the external and internal factors of bank performance on the profitability indicators of the Latvian commercial banks over the period 2006-2011. The authors conducted the survey of scientific literature, analyzed profitability indicators of commercial banks and concluded that profitability has had a positive effect on operational efficiency, as measured according to ROA, while according to ROE, negative effect on operational efficiency and credit risk. Hussainey et al. (2017) explore the effect of efficiency on the performance of Islamic banks all over the world using a sample of 151 Islamic Banks. Results confirm a positive connection between risk-based capital adequacy and the existence of Sharia auditing department and the performance of Islamic banks.

Afsharian et al. (2011) examine the effect of efficiency on the performance of publicly traded European banks over the period (2005-2009). The results confirm a positive relationship between technical efficiency and the banks' performance. Aguenaou et al (2017) examine Moroccan banks' financial performance over the period 2004-2014 using the CAMEL framework. Results show that capital adequacy, asset quality, earnings performance, and liquidity have a positive effect on banks' efficiency with capital adequacy having the most significant impact, while management efficiency is negatively related to efficiency.

Sharma (2018) explores the connection between efficiency and market performance. The findings confirmed the existence of a statistically significant relationship between operational efficiency and market performance of Indian banks. Further, operationally efficient banks generate more revenues to banks' investors. Meles et al. (2016) also find that intellectual capital efficiency affects the financial performance of US banks positively. In addition, the results show that human capital efficiency, a subcomponent of IC efficiency, has a larger impact on financial performance. Thus, the development of effective techniques of knowledge management, enhancing banks to accumulate the capital needed to fit to a permanently changing environment.

On the other hand, Kosmidou et al. (2008) evaluated the determinants of profitability of commercial banks in UK. They found that the coefficient of the cost to income ratio that was a proxy for efficiency was negative and significant. That suggested that efficiency in expenses management is a robust determinant of UK bank profits. Kosmidou (2008) and Pasiouras et al. (2006) also confirm this opposite relationship for Malaysia, Greece and Australia.

Palečková (2015) also explores the relationship between profitability and efficiency in the Czech banking sector over the period 2004–2014, but the study rejects the relationship between profitability and efficiency.

#### 3. Source of data and variables selection

To realize the objectives of the study, the study utilizes two sets of variables which have been collected from two distinct sources: First, the annual reports of association of Banks in Jordan; Second, the annual reports of each Bank which obtained from the Amman stock exchange. Thus, this study utilizing the Panel data of 13 Jordanian commercial Banks during the fiscal years of 2010 to 2017. The first set of variables includes input and output variables selected for computing various efficiency scores for individual Jordanian commercial Banks. However, the second set of variables includes the factors that explain the inter-bank differences in performance. This study employed the coding DMUi for each i<sup>th</sup> Bank as shown in Table 1.

#### Table 1

The symbol of eac	hł	Bank
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Bank Name	Code
Arab Bank	DMU1
Jordan Ahli Bank	DMU2
Cairo Amman Bank	DMU3
Bank of Jordan	DMU4
Housing Bank	DMU5
Jordan Kuwait Bank	DMU6
Arab Jordan investment Bank	DMU7
Jordan Commercial Bank	DMU8
Investbank	DMU9
ABC Bank	DMU10
Bank of Etihad	DMU11
Société Generale - Jordan	DMU12
Capital Bank	DMU13

Source: Prepared by authors.

## 3.1. Input and output variables for computing banks efficiency scores

It should be noted that there is no consensus on what constitutes Bank inputs and outputs (Sathye, 2003; Humphrey, 1985). In the literature on banking efficiency, there are mainly two approaches for selecting the inputs and outputs for a bank: first, the production approach as proposed by Benston (1965); and second, the intermediation approach as proposed by Sealey and Lindley (1977).

The output under production approach represents the services provided to the customers and is best measured by the number and type of transactions. Inputs in this approach include physical variables or their associated cost. This approach focuses only on operating cost and completely ignores interest expenses (Humphrey, 1985).

The intermediation approach considers banks as financial intermediaries managing funds between depositors and creditors. Berger and Humphrey (1997) suggested that the intermediation approach is best suited for analysing bank level efficiency, whereas the production approach is well suited for measuring branch level efficiency. Therefore, this paper will adopt the intermediation approach in selecting input and output variables to compute the technical efficiency scores for Jordanian commercial Banks. Table 2 provides the description of the selected output and input variables.

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#### Table 2

#### Description of output and input variables

V	ariable	Description
Outputs	net interest income	measured as the difference between interest earned and interest expanded.
Outputs	non-interest income	proxied by 'other income' earned from Bank's investments.
	physical capital	measured as the value of fixed assets.
Inputs	labor	measured as the number of employees.
	loanable funds	measured as the sum of deposits and borrowings.

Source: Prepared by authors based on the literature.

#### 3.2. Variables explaining inter-bank performance

The performance analysts are interested to know about the factors assigning the profitability differences among banks. In the present study, we have to examine the connection between efficiency and banks' performance. The dependent variables ROA, ROE and Tobin's Q ratios, are considered to assess the banks' performance during a period of study. This study considers three explanatory variables besides the two technical efficiency scores, which may exert an influence on the performance of a bank. Table 3 provides the description of these factors and their expected effect on the performance of the banks.

#### Table 3

Varia	ble	Symbol	Description	Expected Sign
Dependent Variables	Return on Assets	ROA	Financial Performance measure that shows the percentage of how profitable a company's assets are in generating revenue.	
	Return on Equity	ROE	Financial Performance measure that shows how well a company uses	

#### Description of the variables

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Varia	ble	Symbol	Description	Expected Sign
			investments to generate earnings growth.	
	Tobin's Q	TQ	Market Performance measure that shows firm assets in relation to a firm's market value.	
	Pure Technical Efficiency	PTE	measure of technical efficiency scores that identifies the efficiency of Bank i by its current inputs and scale.	Positive
Independent Variables	Relative Technical Efficiency	RTE	measure of scale technical efficiency scores that identifies the efficiency of Bank i relative to best practice Banks.	Positive
	Loans Market Share	LOANR	Loans of Bank i Total Loans of 13 Banks	Positive
	ATMs Coverage	ATM	Number of ATMs for Total number of ATMs fo	Positive
	Bank's Size	SIZE	Log Total Assets	Positive

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Source: Prepared by authors based on the literature.

It is assumed that if the Bank is not efficient relatively (relative to the best practice Banks), it may achieve the pure efficiency by its current inputs and operating size. larger market shares of loans, ATMs coverage and its spread, and Bank's size have positive effect on the performance and profitability of the bank. Expecting that higher market share of deposits and loans, with wide spread of ATMs, will enhance the providing of bank services for customers, which in turn support the banks performance and profitability.

#### 4. Methodological framework

As mentioned above, this study intends to apply the technique of DEA for computing the technical efficiency scores for individual Jordanian commercial Banks by output-oriented approach. After calculating the technical efficiency scores, this study carried out a regression analysis to estimate the effect of various technical efficiency scores (Pure and relative efficiency) beside the explanatory variables as mentioned above, on the performance of Jordanian commercial Banks measured by ROA, ROE and Tobin's Q. This paper employs ordinary least square (OLS) regression model to analyze the panel data and examine the performance of Jordanian commercial banks. The study determines which of the two models (fixed effect (FE) and random effect (RE)) is best fit by applying the Hausman test for random effects using E-views 9 software. Through literature review, this study constructs the three empirical regression models as below:

$$ROA_{it} = B_0 + B_1 PTE_{it} + B_2 RTE_{it} + B_3 LOANR_{it} + B_4 ATM_{it} + B_5 SIZE_{it} + U_{it}$$
(1)

$$ROE_{it} = B_0 + B_1 PTE_{it} + B_2 RTE_{it} + B_3 LOANR_{it} + B_4 ATM_{it} + B_5 SIZE_{it} + U_{it}$$
(2)

$$TQ_{it} = B_0 + B_1 PTE_{it} + B_2 RTE_{it} + B_3 LOANR_{it} + B_4 ATM_{it} + B_5 SIZE_{it} + U_{it}$$
(3)

Where i denote for each Bank in time t, B0 is the constant, Bj for j=1,2,3,4,5, are the estimated parameters, and U is the error term.

#### 5. Results and discussion

#### 5.1. Technical efficiency scores of Jordanian commercial banks

After applying the DEA technique, the scores of OTE and PTE by applying the two models CRS and VRS. The results show the technical efficiency scores by using the output oriented approach of each Bank in each year from 2010 to 2017. The results reveal the average of OTE ranged between 65% to 76%, where the lowest average of OTE score was in year 2014, and the highest average score was during the years 2012 and 2015. The average of PTE scores ranged between its lowest average 75% during the years 2016 and 2017, and the highest average 86% in year 2012. Results indicate that average of PTE scores were higher than average of OTE scores in general, that because there are differences between TECRS and TEVRS, and the TE scores under the assumption of VRS are higher than the scores of TE assuming CRS. That confirm the existence of inefficient Banks during the years 2010-2017. So that, this study calculates the relative technical efficiency RTE scores, to determine which Banks are technically efficient relative to the best practice Banks.

The average RTE scores ranged between its minimum score 82% in year 2014, and its maximum score 96% in year 2016. The best

practice was for DMU4 and DMU3, which are consider the benchmark of Jordanian commercial banking sector. Moreover, the standard deviation in year 2014 is at maximum 15%, whereas it is at minimum in year 2016. Based on RTE, the efficiency scores of the whole rest Banks were determined relative to DMU4. Accordingly, the rest of the Jordanian commercial Banks were distributed based on its distance from DMU4, their ranking according to the average RTE was as shown in Table 4.

#### Table 4

Bank	Code	Average RTE	Average Inefficiency	Rank
Bank of Jordan	DMU4	1	0	1
Cairo Amman Bank	DMU3	0.99	0.01	2
Jordan Ahli Bank	DMU2	0.96	0.04	3
Jordan Kuwait Bank	DMU6	0.95	0.05	4
Housing Bank	DMU5	0.93	0.07	5
Bank of Etihad	DMU11	0.93	0.07	6
Arab Jordan investment Bank	DMU7	0.92	0.08	7
Capital Bank	DMU13	0.89	0.11	8
Arab Bank	DMU1	0.85	0.15	9
Jordan Commercial Bank	DMU8	0.85	0.15	10
ABC Bank	DMU10	0.82	0.18	11
Investbank	DMU9	0.77	0.23	12
Société Generale - Jordan	DMU12	0.69	0.31	13
Average		0.89	0.11	
Max		1	0.31	
Min		0.69	0	
St.Dev		0.09	0.09	

#### Ranking of banks based on RTE scores

Source: Prepared by authors using E-views 9.

#### 5.1.1. Analysis inter-bank performance

After analyzing the technical efficiency scores, this study carried out a regression analysis to estimate the relationship between TE scores and Banks performance as mentioned before.

#### Testing stationary problem

To ensure the stability of the variables, this study used the (LLC) test which was used by Levin, Lin and Chu (2002) it takes the following formula:

$$\Delta Y_{it} = a_i + \rho Y_{i,t-1} + \sum_{k=1}^n \phi_k \Delta Y_{i,t-k} + \delta_i t + \theta_t + \mu_{it}$$
(4)

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LLC considers an appropriate test in a small sample, this model allows to existence of fixed effects in two directions (Two-way Fixed Effects), the first direction is  $a_i$  and it refers to the fixed effects for each country, the second direction is  $\theta_t$  and it refers to the fixed effects for each year (Baltagi, 2008). Fixed effects for each country is the most important as it allows the existence of a differentiation in the properties of countries. Moreover, LLC test assumed that (Cross-sectional Independent) between countries, under this assumption, the test uses the least squares method to estimate  $\rho$  parameter which takes the form of a normal distribution. The null hypothesis (H0) for LLC test indicates for existence of unit root (instability) in the data, if (t-probability<0.05), the data will be stationary (Asteriou and Hall, 2007).

#### Table 5

Variable	t-statistic	t-Probability	Stationary
ROA	-2.64	0.00	Level*
ROE	-3.68	0.00	Level*
TQ	-9.02	0.00	Level*
PTE	-4.30	0.00	Level*
RTE	-4.69	0.00	Level*
LOANR	-4.22	0.00	Level*
ATM	-7.01	0.00	Level*
SIZE	-4.54	0.00	Level*

Testing unit root problem

\*- stationary with individual effects

Source: Prepared by authors using E-views 9.

The results show that all variables are stationary in their level, which means reject H0meaning there is no unit root in study model's variables.

#### 5.1.2. Testing multi-collinearity problem

The study employed Variance Inflation Factors (VIF) to test correlations between the independent variables and the strength of that correlation. According to Robert (2007), as a rule of thumb is that the variance inflation factor (VIF) above 5 or the tolerance value (1/VIF) below 0.2 is an indication that there is a problem of multi-collinearity among the variables. The results are presented in Table 6.

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#### Table 6

#### Testing multi-collinearity problem

Variable	VIF	Tolerance Value 1/VIF
РТЕ	1.15	0.87
RTE	1.22	0.82
LOANR	1.08	0.92
ATM	1.04	0.96
SIZE	1.33	0.75
Mean	1.16	0.86

Source: Prepared by authors using E-views 9.

The above table shows that there is no VIF greater than 5 and the tolerance values were above 0.2; in turn reveals any of the independent variable included in this study is not explained by the other. Hence all variables can be retained in the model of this study.

#### 5.1.3. Testing serial correlation problem

Serial correlation can be tested by the Durbin-Watson (DW) statistic (Baltagi, 2008). More formally, the DW statistic measures the linear association between adjacent residuals from a regression model. The Durbin-Watson is a test of the hypothesis ( $\rho$ =0) in the specification:

$$uit = \rho uit - 1 + \varepsilon it \tag{5}$$

If there is no serial correlation, the DW statistic will be around 2. A rule of thumb is that DW statistic values in the range of 1.5 to 2.5 are relatively normal. The results are presented in Table 7.

#### Table 7

Models	DW statistic
ROA	2.16
ROE	2.07
TQ	1.98

Serial correlation test

Source: Prepared by authors using E-views 9.

The results show that DW statistic in our models are relatively normal and there is no serial correlation.

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#### 5.1.4. Regression analysis

This study applies a panel regression analysis to estimate the effect of pure and relative technical efficiency scores on the performance of Jordanian Banks measured by the three models ROA, ROE and Tobin's Q. To determine which model of effects FE or RE is appropriate to study's regression model, Hausman test was conducted. According to Chi-square statistics 25.89, 20.93, and 19.01 respectively, and its probability 0.000, 0.000, and 0.001 respectively, the Hausman test shows that FE is appropriate for the three regression models.

#### Table 8

	Model 1	Model 2	Model 3
Daufaunaanaa	WIGHER I	Widdel 2	Widdel 3
Variables	ROA	ROE	TQ
variables	0.01*	0.1.6%	0.01
Constant	-0.01*	-0.16*	-0.01
	[-4.98]	[-5.90]	[-0.51]
	(0.00)	(0.00)	(0.61)
РТЕ	0.02*	0.11*	0.01
	[6.27]	[3.97]	[0.53]
	(0.00)	(0.00)	(0.59)
RTE	0.01*	0.07*	0.02*
	[6.31]	[0.02]	[2.06]
	(0.00)	(0.00)	(0.04)
LOANR	0.03*	0.65*	0.35*
	[1.99]	[4.14]	[5.74]
	(0.04)	(0.00)	(0.00)
ATM	0.02	0.32*	0.21*
	[0.92]	[2.07]	[3.33]
	(0.36)	(0.04)	(0.00)
SIZE	0.01	0.01	0.01**
	[0.34]	[1.31]	[1.78]
	(0.73)	(0.19)	(0.07)
$R^2$	0.93	0.89	0.81
Adjusted R <sup>2</sup>	0.91	0.86	0.77
F-statistic	48.80	28.30	22.31
	(0.00)	(0.00)	(0.00)
Observations	104	104	104

#### Regression analysis by applying FE model

\*, \*\* indicate for significance level 5%, 10% respectively Source: Prepared by authors by using E-views 9.

The results of regression analysis in Table 8 revealed the three models of Banks performance. The first two models (ROA, ROE) interpret Bank's financial performance, and the third model (TQ)
interprets the bank's market performance. Pure technical efficiency PTE is statistically significant with positive effect on ROA and ROE. Meaning that the Bank efficiency calculated by its current inputs and scale enhance its profitability measured by the financial performance without considers the best practice Banks. On other hand, the pure technical efficiency has insignificant effect in Tobin's Q model. Because the bank current scale is not appropriate to achieve Bank's market performance.

The relative technical efficiency RTE or scale efficiency SE has positive significant impact on all Banks performance (ROA, ROE, and TQ). Means, efficient with the capital structure of the commercial banks where any increase in stock price will reflected in total equity because the stock price works as a mirror that reflect market performance for banks. Whereas our study ranked the Jordanian commercial Banks based on the relative efficiency to the best practice Banks, and the relative scale of each Bank influence its performance in the Banking sector. Based on, the Bank should take in consideration the practice of the best Banks to compete in market.

Besides, the market share measured by loans has positive significant impact on Bank's Financial and market performance (ROA, ROE, and TQ). While the loans facilities increase by 1%, the profitability increases as well by 0.03%, 0.65% and 0.35% respectively. Bank's facilities might result in high profit; high market share boosts a bank's market advantages helping the bank to boost profit and achieve economies of scale. Furthermore, the highest impact of market share on Banks performance was in ROE model. Lending might result in high Profitability as loans generate interest revenues that boosts the interest income and ROE. Since we have pure return on equity after paying tax and interest rate.

Results revealed the positive and significant impact of ATMs coverage share on Banks performance measured by ROE and TQ. Whereas its impact on ROA is insignificant. This is an indication that when the ATMs share of each Jordanian commercial bank increases by 1%, bank's return on equity will increase by 0.32%. and Bank's market performance will increase by 0.21%. This is consistent with expectations that the growing number of ATM attracts more clients, increases the stock price and enhances profitability.

On the other hand, bank's size has insignificant impact on ROA and ROE, and it has a weak positive impact (0.01%) on TQ at significance level 10%. Therefore, results indicate the size variable has

no particular impact on financial performance for commercial banks which means that the impact of size on financial performance is similar across commercial banks. Further, the size variable may have effect on Bank's market performance measured by TQ because TQ include capital structure which is related to the size. The components of TQ are total assets and total equity, and more equity means higher portion of total assets and higher size of Bank.

#### 6. Conclusion

Banking efficiency shows the banks' ability to structure its plans, strategies, and decisions to achieve maximum returns using the minimum costs and resources as managerial objectives that are being pursued by the top management. The current study aims at testing the link between technical efficiency and the performance of 13 Jordanian commercial banks for the period 2010-2017. For this purpose, the study used the DEA technique to measure the technical efficiency using CRS and VRS. Besides, the study tested the stationarity, the multi-collinearity, and the serial correlation.

Results reveal that pure technical efficiency PTE has positive effect on ROA and ROE but has insignificant effect in TQ. This might be since the bank current scale is not appropriate to achieve Bank's market performance. Besides, the relative technical efficiency RTE or scale efficiency SE has positive significant impact on ROA, ROE, and TQ. The market share measured by loans has positive significant impact on Bank's Financial and market performance. Furthermore, the highest impact of market share on Banks performance was in ROE model. Referring to ATMs, results show a positive and significant impact on ROE and TQ. Whereas its impact on ROA is insignificant.

On the other hand, bank's size has insignificant impact on ROA and ROE, and it has a weak positive impact on TQ. Therefore, results indicate the size variable has no particular impact on financial performance for commercial banks.

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# A FINANCIAL SYSTEMIC STRESS INDEX FOR ROMANIA

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#### Abstract

Detecting and measuring financial stress and its systemic risk channels have been one of the main concerns for authorities and financial supervisors especially after the financial crisis from 2008. In this paper, we aim to build a financial stress index (FSI) for Romania using monthly data from May 2005 to December 2019. The purpose of the indicator is to provide a quick, clear and intuitive assessment of the current state of the financial system. To do so, we compose 5 different sub-indexes using 9 variables which represent five different market segments: banking sector, money market, stock market, securities market and foreign exchange market. The results suggest that the financial stress index developed successfully captures the stress episodes observed in Romania in the past.

**Keywords**: financial stress index, financial crisis, composite indicator of systemic stress

JEL Classification: E44, E58, G10, G20

#### 1. Introduction

Currently, most central banks have as a fundamental objective defined in the law of organization and operation, price stability. However, against the background of the major financial and economic crisis that began in 2007, another concept came to the fore, that of financial stability, as well as the role that the central bank must play in preserving it.

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Financial stress can be defined as an interruption of the normal functioning of the financial system (ECB,2009). The importance of financial stress arises from its potential adverse effect on the real economy. Even if in some cases the high levels of financial stress are not necessarily followed by economic downturn it is still possible threat to the growth of the real economy. Because the financial stress is not an observable variable, several studies presented the need to build an index which reflects the actual state of stress in the financial system by combining different indicators of the financial market. The European Central Bank (ECB) and the Federal Reserve have created several indicators aiming to measure "the current state of instability, i.e. the current level of frictions, stresses and strains in the financial system". In addition to monitoring financial stability such an index can be used for activate or deactivate particular policy instruments (Johansson and Bonthron, 2013) and also for determine the timing of entry/exit of unconventional policy measures and strategies, such as the introduction and withdrawal of extraordinary liquidity support to the banking system (Holló, 2012)

The aim of this paper is to construct a financial stress index (FSI) for Romania based on several indicators of financial stress for the banking sector, money market, stock market, securities market and foreign exchange market. The results show that the estimated FSI captures the high stress periods observed in the past in Romania.

The remaining of this paper is organized as follows: the next section contains an overview of the relevant literature in the field of the topic researched, section 3 describes the methodology and data used, section 4 presents the results in a structured manner while the final section concludes.

#### 2. Literature review

Regarding financial stability, there is no generally accepted definition in the literature and no synthetic indicator to measure it. A broad definition refers to the ability of the financial system to attract and place funds effectively and to withstand shocks without harming the real economy. This first definition emphasizes the importance of prudential supervision. A narrower definition emphasizes the absence of crises and the existence of a certain level of stability in asset prices, including interest rates. This approach shows that central banks' interest rate policy is very important for financial stability. In this context, there may even be a conflict between the objective of price stability and that of financial stability.

Many studies have considered several indicators for measuring stress in financial markets. According to Louzis and Vouldis (2013) financial stress is a situation in which one or more segments of the market show the signs related to financial stress, namely increasing uncertainty and asymmetry of information. The main concern in developing financial stress indexes is that the indicators should be able to serve as an early warning indicator for slowdowns in the real economy (Islami and Kurz-Kim, 2013). The development of stress indicators for certain segments of the market and their combination into a composite index of systemic stress provides insights into the propagation channels of specific events (Louzis and Vouldis, 2012).

Financial stress indexes have been built for one country (Illing and Liu, 2006; Hakkio and Keeton, 2009; Morales and Estrada, 2010; and Holló, 2012) or for several countries (Cardarelli et al., 2011; Holló et al., 2012; and Islami and Kurz-Kim, 2013). In general, stress indicators for a single country combine more indicators into one statistic than multi-country stress indexes. This is not surprising in view of data availability. Most studies use market data, but some (Holló et al., 2012) use both mixed market and balance sheet data, while Morales and Estrada (2010) consider only balance sheet data.

Authors use different ways to combine indicators into a composite stress index. Whereas most studies take the average of standardized variables, others use principal components (Illing and Liu, 2006; and Hakkio and Keeton; 2009). More recently, Holló et al. (2012) employed portfolio theory-based combination schemes that considers the correlation structure of stress indicators in order to measure the level of systemic stress.

Financial stress indicators have been used for different purposes. Cardarelli et al. (2011) use their stress index for 17 advanced economies from 1980 to 2007 to study the relationship between financial stress and economic slowdowns. Their results suggest that periods of financial turmoil characterized by banking distress are more likely to be related with deeper and longer downturns than periods of stress principally in securities or foreign exchange market. Moreover, downturns associated with banking-related financial stress have a tendency to last at least twice as long as recessions that are not preceded by financial stress. Similarly, Cevik et al. (2013) developed a financial stress index for Bulgaria, the Czech Republic, Hungary, Poland, and Russia to assess the relationship between financial stress and economic activity. The impulse response functions based on bivariate VARs show a significant connection between financial stress and certain measures of economic activity.

Baxa et al. (2013) study whether and how the monetary policy of some central banks responded to periods of financial stress over the last three decades. Using the financial stress index built by Cardarelli et al. (2011), the authors discovered that central banks change their policy stances in the face of financial stress, but the size of such responses varies considerably over time.

Some papers try to identify leading indicators of financial stress. For example, Misina and Tkacz (2009) found that within a linear framework, the increase of domestic credit is the best forecaster of the stress indicator for Canada at all horizons, whereas asset prices tend to be better forecasters of stress when they allow for nonlinearities. Slingenberg and de Haan (2011) extend the study of Misina and Tkacz (2009) expanding the analysis to 13 OECD countries.

## 3. Data and methodology

The main advantage of FSI is that it is a dynamic analysis of the level of financial stability. This method has been proposed and developed in many studies and became more popular when it was used by the IMF in 2008 or by the ECB in 2010. Such an index can be constructed in different ways. Most of the existing stress indices are based on high frequency market data, but they differ depending on the selected variables (bank capitalization, credit ratings, increase in loan volume, interest rate margin or volatility of different asset classes), coverage and aggregation method. An important advantage of continuous stress indexes (or instability indexes) is that they can identify periods of small-scale stress, events that were not identified in previous episodes of the crisis and were neglected in studies based on binary variables.

The composite indicator that we constructed in this paper covers the five most important sectors of an economy's financial system: banking sector, money market, stock market, securities market and foreign exchange market. Each of these segments constitutes a sub-index of the composite indicator. The systemic nature of stress is captured by the correlations between stress components. The systemic risk is higher when the correlation between the stress indicators increases.

The use of a composite index has a number of benefits (Baxa et al., 2011). First of all, the evolution of financial instability caused by various factors is approximated. Second, the inclusion of additional variables in the stress index does not decisively affect the overall evolution. Third, the composition of the index allows the decomposition of the authorities' reaction to different subcomponents of the index.

In this paper, we select the financial variables which constitutes the composite index based on those used in various research papers on this topic such as Cardarelli et. all (2011), Holló et al. (2012), Louzis and Vouldis (2012), Islami and Kurz-Kim (2013), Babecký et al. (2013), Zigraiova and Jakubik (2015), Cambón and Estévez (2016). In the following will be presented the indicators related to each financial segment considered.

### **Banking sector**

The indicator of stress in the banking sector which is included in our FSI is the beta ( $\beta$ ) of the banking sector, calculated as follows:

$$\beta = \frac{COV(R_{TLV}, R_{BET})}{VAR(R_{BET})}$$
(1)

where,  $R_{TLV}$  is the monthly return of Transylvania Bank shares, and  $R_{BET}$  is the monthly return of stock market index BET. The covariance between was estimated through a multivariate GARCH model.

## Money market

A component of the FSI that shows the stress in the money market is the monthly volatility of the 3-month interbank interest rate ROBOR, derived from a GARCH (1,1) model. Another indicator representative for the money market is the slope of the yield curve, in this paper being calculated as the difference between deposit rate and lending rate. According to Cardarelli et all (2011) "banks generate income by intermediating short-term liabilities (deposits) into longer-term assets (loans). Therefore, when there is a negative term spread – that is a negative sloping yield curve – bank profitability is seriously jeopardized." The last measure for the money market included in our stress index is the spread between 3-month ROBOR and the key interest rate.

## Stock market

A lot of financial stress indexes include stock price volatility assuming that large fluctuations in stock prices show financial imbalances in the equity market (Hakkio and Keeton, 2009; Cardarelli et al., 2011). Our paper considers too price volatility. Therefore, following Cardarelli et al. (2011), time-varying volatility of the monthly return for the BET market index has been derived from a GARCH (1,1) specification. Further, to assess financial stress on the capital market, we take the monthly return of the BET index into account. The return was multiplied by -1 so that a sharp decrease of stock prices to be registered as an increase in the index.

#### Securities market

Regarding the securities sector, we considered two components of stress: inverse yield curve, calculated as difference between the short-term interest rate the long-term interest rate and the monthly return of value of transactions in government securities in the interbank secondary market.

### Foreign exchange market

In our index is also included the volatility of monthly changes in the real effective exchange rate (REER). Like BET price volatility, this indicator is derived using a GARCH (1,1) specification for the monthly return of the real effective exchange rate. A significant volatility of the REER shows that the economy suffers major corrections through the exchange rate, that can affect the stability of the financial system.

To build the aggregate index, the first step was to standardize the values of the individual indexes. Later we used the arithmetic average of these variables and so we obtain the composite index.

The data used are monthly time series and cover the period May 2005 - December 2019.

The GARCH (1,1) model used in this paper is the following:

$$\sigma_t^2 = \omega_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \tag{2}$$

where  $\sigma_t$  represents the conditional volatility,  $\omega_0$  is the long term average value,  $\alpha_1$  reveals the influence of random deviations in the previous period on  $\sigma_t$ ,  $\beta_1$  measures the persistence of shocks on volatility, whereas  $\varepsilon_t \sim N(0, \sigma_t)$ .

# Preliminary data analysis

In order to estimate the GARCH models we conduct a preliminary data analysis. Table 1 presents the descriptive statistics of the data.

# Table 1

	R_BET	<b>R_TLV</b>	<b>R_REER</b>	R_IST	R_Robor3M			
Average	0.00416	0.01036	0.00006	-0.00593	-0.00638			
MIN	-0.39577	-0.38728	-0.05409	-0.42439	-0.40385			
MAX	0.25297	0.33103	0.04213	0.62706	0.55174			
Standard deviation	0.07816	0.10045	0.01295	0.12023	0.11036			
Skewness	-1.20635	-0.74997	-0.12999	1.16772	0.70529			
Kurtosis	5.46042	2.38406	2.03130	7.01572	4.50950			

# **Descriptive Statistics**

Source: NBR, BSE, Eurostat, own calculations

In order to test the stationarity of the data used the ADF statistic test. The results are shown in Table 2. The variables are stationary.

# Table 2

#### **ADF test**

	R_BET	R_TLV	<b>R_REER</b>	R_IST	R_Robor3M			
Value	-4.87170	-4.70100	-5.86630	-5.15340	-4.89720			
Probability	0.01000	0.01000	0.01000	0.01000	0.10000			
Sources NPP DSE Eurostat own calculations								

Source: NBR, BSE, Eurostat, own calculations

In Table 3 are presented the results of the autocorrelation Box-Ljung test. The data series are autocorrelated.

# Table 3

# **Box-Ljung test**

	R_BET	R_TLV	<b>R_REER</b>	R_IST	R_Robor3M
Value	38,928	33,286	8,203	27,629	30,895
Probability	0,028	0,012	0,016	0,024	0,015

Source: NBR, BSE, Eurostat, own calculations

#### 4. Results

In Figure 1 we presented the evolution of the FSI during May 2005 - December 2019.

Figure 1



## **Financial Stress Index**

#### Source: Own estimations

In this paper we defined the high stress periods by periods when the FSI exceeds its mean by more than one standard deviation. Therefore, as can be seen from the chart, with the help of the index we were able to identify a period of financial instability in Romania, namely January 2008 – June 2009. The maximum value of the FSI index was 0.73 and was recorded in October 2008.

This period of financial stress corresponds to the financial crisis caused by the abundant liquidity created by the world's major central banks (FED, BOJ) and the desire of oil and gas exporting countries to limit the appreciation of the currency. The consequences of abundant liquidity were very low interest rates and their low volatility. Securitization, the tendency to underestimate the risk and the highly complex derivative financial instruments contributed to the worsening of the world economic situation. The effects of this crisis also extended to Romania and were amplified by the internal vulnerabilities caused by previous fiscal indiscipline.

During 2011-2019, the composite index decreased signaling the improvement of the financial stability. We have not identified any significant stressful period. The FSI slight and sharp increase is not persistent, its level is not so high like previously and rapidly jumps back to the lower values.

We can conclude that the index captures the high stress episodes seen in the past.

#### 5. Conclusion

This paper develops a financial market stress index (FSI) for Romania adopting monthly data between May 2005 - December 2019. The purpose of the indicator is to provide a quick, clear and intuitive assessment of the current state of the financial system. To do so, we compose 5 different sub-indexes using 9 variables that will represent five different market sectors: banking sector, money market, stock market, securities market, and foreign exchange market.

In order to construct our aggregate index, first we put the 5 individual indicators on the same scale. Further we used the average of the standardized variables to obtain the composite index. The results show that the estimated FSI captures the high stress episodes seen in the past in Romania.

Regarding future researches on developing financial stress index, they may include in the analysis other more advanced methods of aggregating individual indexes such as portfolio theory or moving average. Also, it can be analysed the connection between FSI and economic activity through different econometric methods. The sample of surveyed countries can be enlarged to identify mutual financial stressful periods.

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# FINANCIAL INNOVATION PRACTICE, SACCO SIZE AND FINANCIAL SUSTAINABILITY OF DEPOSIT TAKING SAVING AND CREDIT CO-OPERATIVES IN KENYA

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#### Abstract

The study aimed at assessing the moderating effect of SACCO size on the nexus between financial innovation practice and financial sustainability which was anchored on transaction cost innovation theory. The population for the study was the Deposit Taking Saving and Credit Co-operatives in Kenya. The study adopted a philosophical paradigm of positivism and descriptive cross-sectional survey design where the sample size was 119 respondents out of which 113 responded. Emailed questionnaire and data collection sheet were used in data collection. The study found that the process innovation and service innovation are positively related to financial sustainability but not statistically significant. This study concluded that SACCO size is statistically significant in moderating financial innovation practice and financial sustainability of Deposit Taking Saving and Credit Cooperatives in Kenya. The study recommends that Deposit Taking Saving and Credit Co-operatives should continue to invest in new and promising process and service innovation strategies to continue realizing the benefits of financially sustainable enterprise.

**Keywords:** Process innovation, Service innovation, Financial Self-sufficiency, Total assets.

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# JEL Classification: G21, O32, P13

#### 1. Introduction

Financial sustainability is the ability of an organisation to continue offering services and meeting its current costs while attaining its goals for a foreseeable future. Financial innovation has been seen to be a solution to many financial problems such as increased costs and risks, thus improving its financial sustainability and competitive advantage (Gubler, 2011). After the global financial crisis of 2007/8, the financial system has encountered changes in their financial intermediation role and Savings and Credit Co-operatives (SACCOs) have not been left behind (Onwonga, 2016). In promotion of financial inclusion and financial deepening SACCOs worldwide recently have experienced major financial innovation in their effort of offering financial services to the marginalized persons and middle-income earners. This has been highly embraced in countries like Colombia. India. Brazil and USA (Duguma & Han, 2018). The financial innovations in SACCOs are of much importance more so to Africa in its fight against poverty as enshrined in sustainable development goals. Africa contribute to 48 percent of poverty level worldwide (Omilola & Lerven, 2019).

Since African SACCOs are members owned, they need to finance themselves without relying on grants and donor funding which are not fully sustainable (Tumwine, 2015). Thus, they need to have differentiated products and services that are customers centered so as to attract more members. Developing of innovated savings products have assisted Ethiopian SACCOs mobilize more deposits which assist them remain financially sustainable. SACCOs automation and digitization has made transactions paperless, easier and open in African countries like South Africa, Uganda, Malawi and Kenya. It reduces the SACCOs operational costs though widening its members size beyond borders (Duguma & Han, 2018).

Kenyan SACCOs have been in the forefront in Africa and ranked 11th position globally (WOCCU, 2018). The sector consists of Deposit Taking Savings and Credit Co-operative Societies (DT-SACCOs) and non-Deposit Taking Savings and Credit Co-operative Societies (Mugo et al., 2018). SACCOs that offer back office services activities are supervised by the Commissioner for Co-operatives. Additionally, those that offer front office services activities are licensed and regulated by SASRA but they have to be fully registered under the Financial Studies – 3/2020

Cooperative Societies Act CAP 490. A 6.3 percent of Kenyans are members of DT-SACCOs which employ over 250,000 people and over 60 percent of the population depends on SACCO related activities (FinAccess, 2016). They also contribute by 45 percent to the Kenya's gross domestic product. The asset base of these societies has grown from Kshs 442 billion in 2017 to Kshs 495 billion in 2018. Deposits have also increased from Kshs 305 billion in 2015 to Kshs 341 billion in 2018 (SASRA, 2018). This can be attributed to DT-SACCOs offering banklike services, such as current and saving accounts, debit cards, advances and money transfers. Front office services activities came about after banks regarded many rural areas as increasing their operation costs and the population was left un-banked (Njenga, et al., 2015).

Kenya has made herself a hub for financial innovations like agency and mobile banking which has assisted in financial deepening. DT-SACCOs has embraced this technology in offering their products and services such as cash deposits, withdrawal of cash and opening of accounts to the unbanked in the society which puts them in a better competitive position (Moki, et al., 2019). Additionally, they have invested more on internet and mobile banking as compared to use of automatic teller machines. Financial innovation has contributed to easy and quick access of information and services to the clientele and reduced the ever-increasing operation costs of the DT-SACCOs. Thus, DT-SACCOs that embrace financial innovation are more likely to be financially sustainable than those that don't (Njenga, et al., 2015). This has seen DT-SACCOs accept usage of innovated products like credit cards, feature codes, M-pesa and debit cards which provide a platform for e-commerce. Hence, leading to upgraded service delivery, enhanced efficiency, and condensed operational costs (Sum & Memba, 2016). Financial innovation is utilized by the DT-SACCOs that are in search of more returns as they minimize risks. This is witnessed by DT-SACCOs in Kenya upgrading from common bond to open bond to attract more deposits from large population of clients or members (Simiyu & Olweny, 2018).

## 2. Problem statement

Financial innovation practice increase has been found to reduce the transaction cost, thus leading to emergence of financially sustainable enterprise. This had led to DT-SACCOs investing heavily on financial innovation practices (Gubler, 2011; Duguma & Han, 2018). The government has also invested in an oversight authority that ensures they are compliant to financial innovation guidelines to maintain financial sustainability. Regardless of this, risk of theft or fraud by committee members has increased by 19.4 percent, fraud by nongroup member by 3.8 percent and members defaults by 5.23 percent (Njoroge, et al., 2019). This poses a threat to delivery of quality and affordable financial services to members with an aim of enhancing their standard of living. Additionally, achievement of sustainable development goals and vision 2030 objective of increasing financial inclusion is threatened thus posing great threat to the economy at large (Price Waterhouse Coopers [PwC], 2011). This is so because DT-SACCOs are one of the major sources of employment and capital for start-ups and business expansion. The increasing demise of 10.8 percent of the DT-SACCOs would lead to high rate of entrepreneurial decline and job loss hence the gross domestic product will decline (SASRA, 2017). Owing to all these, a solution is vital to avoid members losing value for their hard-earned money since deposits are not protected and DT-SACCOs do not have access to lender of last resort in case they are financially unsustainable. Nevertheless, large size SACCOs embrace financial innovation more than the small size, owing to the economies of scale enjoyed (Sebhatu, 2012). Hence, the objective of this study is to evaluate whether the SACCO size have a moderating effect on the nexus between financial innovation and financial sustainability of Deposit Taking Savings and Credit Cooperative Societies.

## 3. Literature review

The study is anchored on the transaction cost innovation theory by Hicks and Niehans (1983). The theory states that financial innovation is carried to reduce the transaction cost. Financial innovators respond to technology progression leading to financial services enhancement. In addition, financial innovation is reviewed from microscopic economic structure change viewpoint, where it aims at reducing transaction cost and risk resulting to earning more benefits. Financial innovation is seen as a catalyst to firm growth and performance (Gubler, 2011). Transaction cost innovation theory is based on an internet-related information technology which lowers an organisation operation costs as it allows wide access to internal database and important information quickly. Reduction of transaction cost in DT-SACCOs has seen financial innovation take place which is evident by introduction of internet, mobile and agency banking (Njenga, et al., 2015). Efficient coordination and administration have also been witnessed through automation and computerization of offices which is expected to improve the financial sustainability of DT-SACCOs (Kimotho & Muturi, 2019). Though Saving and Credit Co-operative Societies have not been left behind in use of financial innovation they need to improve their pace since telecommunication sector has started offering micro products which are appealing to clients. This may help them improve their market share for a foreseeable future.

Various empirical review based on study variables were established. Moki, et al. (2019) carried out a study on financial innovation strategy and financial performance of DT-SACCOs in Nairobi City County. Open system theory, financial intermediation theory and life cycle saving theory guided the study. Descriptive research design and causal research design were used in the study where the target population consisted of forty registered DT-SACCOs in the City County. The findings of the study indicated that there was a significant relationship between financial innovation and financial performance. Firms that did not implement financial innovation were bound to be delicensed due to their financial unsustainability. However, the study failed to mention those who responded to the questionnaires issued.

Ndwiga and Maina (2018) established that process innovation had a significant and positive nexus on financial performance while product innovation did not. Their study of financial innovation and financial performance of listed commercial banks in Kenya was based on two theories: constraint-induced financial innovation theory and transaction cost innovation theory. Cross-sectional survey research design was used. The eleven financial managers who were the study respondents were issued with a questionnaire. Secondary data was also collected using a data sheet from the annual reports of 2009 to 2016. The data of post global financial crisis were analysed using descriptive and inferential statistics, that is, multiple linear regression. The commercial banks were found to innovate their products and processes though this was not fully carried out. Product innovation consisted of new debit cards, credit cards, loan accounts and savings accounts while process innovation was based on use of mobile banking, internet banking and agency banking. The study concluded

that only process costing had a significant positive nexus. The recommendations made stated that more process innovation would reduce the operational costs, unproductive products need to be dropped thus making them banks financially sustainable. The study however, relied on two types on financial innovation while there are other types of innovation. Thus, the study needs to incorporate all other types of financial innovation so as to arrive at a concrete conclusion and recommendations as well.

Sum and Memba (2016), carried out a study on the effect of financial innovation on the financial performance of DT-SACCOs in Kenya, a case of Kiambu County. The independent variables for the study were product innovation, process innovation, service innovation and institutional innovation while dependent variable was the financial performance with return on assets, liquidity ratio, core capital to total assets and non-performing loans to total gross loans being its parameters. A questionnaire was used to collect the data. Financial innovation was found to have a significant relationship with financial performance as evidenced from regression model. To better the financial performance of the SACCOs the study recommended that they adopt different financial innovation since all types of financial innovation were found to enhance financial performance. The study has no clear direction on how they arrived at the sample size used in addition to the anchoring of the theories to the study variables.

Tsuma et al. (2015), in their study on the effect of financial innovations on financial performance of SACCOs in Kenya were guided by the transaction cost innovation theory. The objective of the study was to determine the effects of process innovation on financial performance of SACCOs in Kenya. Descriptive research design was adopted with data being gathered using structured questionnaires. The findings of the study revealed that the SACCOs had embraced financial innovation but not fully. Additionally, correlation analysis results indicated that there is a strong positive relationship between process innovation and dividend per share when used as a proxy for financial performance. The study further established that technological innovations such as internet banking and connectivity, ICT, and computer technology, have led to lower operational costs in the Saving and Credit Co-operative Societies. This has led to improved enhanced competence, better service delivery, operational performance among many others. However, the study scope was weak as it looked only on process innovation while there are other types of

innovations in Saving and Credit Co-operative Societies. The researcher did not portray how Kakamega Teachers' Co-operative Society limited is representative of Saving and Credit Co-operative Societies in Kenya, thus the study results cannot be used to represent all Saving and Credit Co-operative Societies in Kenya.

#### 4. Conceptual framework



Source: Authors' illustration

# 5. Research methodology

The philosophical paradigm of positivism with a descriptive cross-sectional survey design was used in the study. In selecting the sample size, the study used the 5 clusters of DT-SACCOs based on original field of membership; the government-based DT-SACCOs, teachers-based DT-SACCOs, farmers-based DT- SACCOs, private based DT-SACCOs and community-based DT-SACCOs. This resulted to 119 respondents. The primary quantitative data was collected by use of an emailed questionnaire while secondary data was collected from the audited DT-SACCOs financial statements and SACCO reports. The computed Cronbach's Alpha Coefficient of 0.764 attested the reliability of the questionnaire. Binary logistic regression model was used in establishing the relationship between the independent variables and the dependent variable. In determination of the variation of binary response variable Cox and Snell's R-square was used. However, Nagelkerke's R-Square was used to test the strength of the relationship of the independent variable and dependent variable. The goodness of fit of the model was tested using Hosmer and Lemeshow test. Wald test was carried out to test the significance for individual independent variables at 5% significance level for the P-values.

# 6. Results and discussions

This section presents the results and discussions of response rate, the descriptive results, and the hypothesis test.

#### 6.1. Respondents' response rate

A total of 119 questionnaires were distributed and out of that, 113 questionnaires were returned and analysed. This gave response rate of 95%. A response rate above 60 percent is considered to be good, 70 percent to 85 percent is very good while above 85 percent is excellent (Marsden & Wright, 2010). Thus, the response rate of 95 percent was considered to be excellent for the study. The data collected was analysed and used in making important interpretation in line with the study objectives.

#### 6.2. Financial innovation practice descriptive results

The study descriptive results are exemplified in this section. The study sought to determine the influence of financial innovation practice on financial sustainability of DT-SACCOs. The respondents were required to indicate their level of agreement and disagreement in relation to the statements, with strongly agree allocated the highest score of 5 and strongly disagree a lower score of 1.

The descriptive statistics were computed. The findings revealed that DT-SACCOs have embraced financial innovation through regularly digitization of services as well as members receiving services via unstructured supplementary service data which had a mean score of 3.70 and 3.20 out of 5, respectively. In addition, new products are regularly generated to satisfy customer needs which scored 3.01. This has been necessitated by the need of DT-SACCOs to mobilize more funds from new members to remain financially sustainable as they improve members welfare. Nevertheless, DT-SACCOs are yet to fully make use of internet banking, electronic fund transfers and to computerize the finance records as their scores were moderate at mean of 2.73, 2.39 and 2.00, respectively.

The parameters used were measuring similar construct. Principle component analysis was used to reduce observed variables into factors to improve construct validity. Test for multicollinearity was first carried out. The calculated correlation matrix determinant was 0.45 which is more than recommended value of 0.00001 thus, indicating absence of multicollinearity between variables. The Kaiser-Meyer-Olkin and Bartlett's measure of sampling adequacy was used to determine whether factor analysis is appropriate for the study. The computed value for the Kaiser-Meyer-Olkin measure of sampling adequacy was 0.647 while Bartlett's test of Sphericity at approximated Chi-square of 337.796 and 15 degrees of freedom it was highly significant with a P value of 0.000 and thus, appropriate for factor reduction.

Principal components method of extraction and varimax rotation was further carried out. The components with an Eigen value greater than one were retained (Field, 2013). Two factors (service innovation and process innovation) were extracted which explained 73.931 percent of the variance of financial innovation practice. The variables were further used in the logistic regression.

# 6.3. Financial innovation practice and financial sustainability binary logistic regression

The null hypothesis to test that there is no relationship between financial innovation practice and financial sustainability of DT-SACCOs was carried out. The researcher assessed the individual effects of the independent sub-variables. The following equation was used to test the hypothesis.

$$Logit [p] = ln \frac{p}{1-p} = \beta_0 + \beta_1 P I + \beta_2 S I$$
(1)

Where: P is the probability that a DT-SACCOs will be financially sustainable;  $\beta 0$  is constant;  $\beta 1$  and  $\beta 2$  are the coefficients from the log of the odds ratio function; I and SI are the predictor variables (process innovation and service innovation).

The omnibus test against the model with only a constant was significant at a Chi-square of 17.149 with 4 degree of freedom and a P value of 0.002 (P=0.001< 0.05), indicating the capability of predicting the response variable. To test the strength of the nexus between independent variable and dependent variable -2 Log likelihood and Pseudo R squared was used. The study results indicated that -2 Log likelihood was 69.270, Cox and Snell R square was 6.2 percent and Nagelkerke R square was 12.6 percent. Nagelkerke R Square indicated that 12.6 percent of the variations were elucidated by the study variables.

Hosmer and Lemeshow test, was conducted to determine whether the model was a good fit. The results of the test had a Chisquare of 5.368,7 degrees of freedom and a P value of 0.615. Wellfitting models show non-significance on the Hosmer and Lemeshow

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goodness-of-fit test. This desirable outcome of non-significance indicates that the model prediction does not significantly differ from the observed (Yang & Miller, 2008). The Hosmer and Lemeshow statistic have a significance of 0.615 which is greater than 5 percent significance level. This means that it is not statistically significant and therefore the model is quite a good fit for the fitted logistic regression. However, the classification table indicated that the model predictions were correct 102 out of 113 times for an overall success rate of 90.3 percent which is greater than the recommended 50 percent, thus it can be replicated. The binary logistic regression results are shown in Table 1 where each variable coefficient of Regression (B), Wald statistic and Odd ratios (Exp (B) are produced.

#### Table 1

			•				
		В	S.E.	Wald	Df	Sig.	Exp(B)
Step 1a	Process innovation	.183	.099	3.375	1	.066	1.200
	Service innovation	.455	.334	1.851	1	.174	1.576
	Constant	-2.260	1.860	1.477	1	.224	.104

#### Variables in the equation

a. Variable(s) entered on step 1: Process innovation, Service innovation.

The model for the study:

Logit of (Financial sustainability) = -2.260 + 0.183 process innovation + 0.455 service innovation. The log of odds of a DT-SACCO being financially sustainable was positively related to process innovation and service innovation. Thus, an increase in one unit of predictor variable will lead to an increase in financial sustainability by its coefficient. The odd ratio (Exp (B) indicates the overall effect on response variable of increasing the predictor variables. The study established that process innovation was not statistically significant in prediction of financial sustainability of DT-SACCOs (Wald statistic value = 3.375 with 1 df, a P = 0.066 > 0.05 and an odd ratio = 1.200). This disagrees with the studies carried out by Ndwiga and Maina (2018) and Tsuma et al. (2015), who found that process innovation had a significant relationship with the response variable. They noted that process innovation had the capability of reducing the operational cost hence resulting to a financially sustainable enterprise. The results further established that service innovation was not statistically

significant in prediction of financial sustainability of DT-SACCOs (Wald statistic value = 1.851 with 1 df, a P value = 0.174>0.05 and an odd ratio of 1.576). The study findings are in contrast with Sum and Memba (2016) research which found out that service innovation significantly influences the financial sustainability of DT-SACCOs.

# 6.4. Moderating effect of SACCO size on financial innovation practice and financial sustainability

The study tested whether SACCO size had any moderating effect on financial innovation practice and financial sustainability of DT-SACCOs. The test on moderation effects presents a hierarchical regression results for the moderation effects of SACCO size on financial innovation practice and financial sustainability. The moderation effect was hierarchically analysed as indicated in equation 2, 3 and 4.

$$Logit [p] = \beta_0 + \beta_1 P I + \beta_2 S I + \varepsilon$$
(2)

$$Logit [p] = \beta_0 + \beta_1 P I + \beta_2 S I + \beta_3 S Z + \varepsilon$$
(3)

$$Logit [p] = \beta_0 + \beta_1 P I + \beta_2 S I + \beta_3 S Z + \beta_4 P I^* S Z + \beta_5 S I^* S Z + \varepsilon$$
(4)

Where:  $\beta 0$  is a constant;  $\beta 1$ ,  $\beta 2 \beta 3$ ,  $\beta 4$  and  $\beta 5$  are coefficients; P is the probability that a DT-SACCOs will be financially sustainable; PI and SI are the predictor variables (process innovation and service innovation); SZ - Sacco size.

The results of moderation effect of SACCO size on the financial innovation practices and financial sustainability are indicated in Table 2.

# Table 2

	Model 1			Model 2			Model 3		
Predictors	Beta <sup>a</sup>	Wald	Р	Beta <sup>a</sup>	Wald	Р	Beta <sup>a</sup>	Wald	Р
(Constant)	-2.260	1.477	.224	4.086	.039	.843	-135.331	1.790	.181
PI	.183	3.375	.066	.270	.709	.373	4.378	2.663	.103
SI	.455	1.851	.174	.520	1.690	.194	11.902	.348	.555
SZ				825	.095	.758	15.175	1.763	.184
PI*SZ							472	2.337	.126
SI*SZ							-1.323	.346	.556
Nagelkerke R <sup>2</sup>	.126			.128			.224		

**Hierarchical Regression Results** 

Source: Data analysed by authors.

The results of the moderation indicate that the predictor variables interacted when combined and they were insignificant at 5 percent. The model changes on the strength of relationship was from 12.6 percent to 12.8 percent with introduction of the moderator SACCO size. However, with interaction, Nagelkerke R Square changed from 12.6 percent to 22.4 percent which had the highest influence. This means that there was significant increase in the variations which was determined by the study variable. Therefore, from the study results it is evident that the relationship improved as various interactions were introduced in the models. A continued improvement of the Nagelkerke R Square with the introduction of a moderator and the interactions in the model indicates the significance of the moderator in the study (O'Connell, 2006). The study therefore rejects null hypothesis that, SACCO size is not statistically significant in moderating financial innovation practice and financial sustainability of DT-SACCOs in Kenya. This in agreement with Opalo (2014) who observed that SACCO size have a significant positive moderation effect on the response variable. In contrary Onwonga (2016) who adopted size as a moderator and indicated that it has no moderating effect between the independent variable and dependent variable.

#### 7. Conclusion and Recommendation

The study concluded that process innovation and service innovation was not statistically significant in prediction of financial sustainability of a DT-SACCOs. Since they exhibited a positive relationship with the response variable, they were found to be in support of transaction cost innovation theory. Financial innovation in DT-SACCOs is aimed at reducing transaction cost and risk and earning more benefits. However, SACCO size is statistically significant in moderating financial innovation practice and financial sustainability of DT-SACCOs in Kenya. The study made various recommendations. DT-SACCOs should continue to invest in new and promising process innovation strategies to continue realizing the benefits that accrue from it e.g. improved customer satisfaction and operational costs reduction. This will caution the DT-SACCOs from financial distress or bankruptcy as they will be financially sustainable. The DT-SACCOs should invest in advertising their process innovation strategies to attract more members thus reducing the unbanked population in the country.

To better manage and serve the many members of the DT-SACCOs well all finance records should be computerized and digitized for easier access by members at an affordable cost. This assist in facilitating real time transaction in the enterprise. Since the members of the DT-SACCOs are the unbanked studies have shown that they do not have access to feature mobile phone, hence, the use of unstructured supplementary service data (USSD) should be embraced. The mobile service providers, however, should improve their network coverage reach to all parts of the country. This will assist the DT-SACCOs access those seven counties with no DT-SACCOs presence, hence increased financial inclusion.

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# CAPITAL STRUCTURE AND FINANCIAL PERFORMANCE: CASE STUDY FROM PAKISTAN PHARMACEUTICAL SECTOR

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#### Abstract

The main purpose of this research is to find out the relationship between capital structure and the firm's financial performance of the listed Pharmaceutical companies in the Pakistan Stock Exchange. A further specific objective is to find out the relation of debt-equity with gross profit, earning per share, and return on capital and return on equity. This research determines that Capital Structure is adversely linked with the profitability, it suggests that a decrease in the profitability of the organizations is due to an increase in debt capital & vice versa, further the results proclaims that capital is not dramatically significant and impacting, hence results in records that debt to equity is nothing to do with ROE, increasing or decrease in debt or equity financing would affect ROE.

**Keywords:** Return on Capital, Return on Equity, Debt to Equity, KSE-100 Index

JEL Classification: G32

#### 1. Introduction

The pharmaceuticals companies play a pivotal role in every country both from the perspective of the contribution of the health in the gross domestic product and of the contribution to strengthening

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country health index (healthy life expectancy). Pakistan has around 780 small and large pharmaceutical manufacturing units (including around 25 multinationals units) which meet more than 60% of aggregate demand of pharma products, and this industry is classified in two major segments domestic companies and multinationals.

In Pakistan, the Pharmaceutical industry records significant growth in the recent decade compared to the early 2000s. The rationale behind such magnificent development in the industry is accounted for substantial huge investment in Research & Development in each of unit.

The credit not only goes for the huge investment in R&D but also regulatory bodies within Pakistan as well as international guidelines & standards, which probably directs entities to work as Good Manufacturing Practices (GMP) not only on the national forum as well as international. In the present when the world is enjoying the taste of advanced technology one side but on the opposite, it has several technological threats to entire mankind and animals, but not to worry. where scientists work for technological advancement on one side and the next side, they do experiments to meet health-related threats. Meanwhile, in Pakistan, the industry is ready to respond to any of these threats on its best, industry has significant development to produce good hygienic several health-related products from a modest tablet to a refined Biotech, Oncology, and Value-Added Universal mixtures.

The industry has maintained reasonable growth in recent years, despite a general downturn in economic activity and an increase in civil strife. A recent official survey has estimated that average annual growth is 14% and noted that the industry is entirely in the private sector and that 70% of total sales come from local production, with the remainder being imported.

As per the last statistic in 2018 the annual export of pharma products is around \$197.62 million which is significantly very high and this was predicted to rise around approx. 6.15% at the end of 2020. Further recent statistics also proclaims the significant contribution of pharma products in the GDP of Pakistan which is more than 1%.

There are 30 Foreign Firms in Pakistan, which contribute around two-thirds of total local production and employ about 25,000 people. There are twelve firms from the USA, nine from the UK, five companies from Germany, three are Swiss companies, and others are from Japan, Holland, and France. These companies are said to have ensured that Pakistani-produced pharmaceuticals have a high product quality with operational efficiency, underscoring the valuable role of such firms operating in Pakistan.

#### 2. Problem statement

The importance of capital structure has been certified by different members of academies, like Durand (1952), Modigliani & Miller (1958), Weston (1963), and Solomon (1963) by supporting financing decision importance on the profitability of any organization. The organization needs to identify the right combination to get the maximum return to its stakeholders amongst the different capital combinations.

An optimum capital structure refers to giving a maximum return to the shareholders. The Finest Capital Structure means good progress and development of the company, so it needs appropriate awareness and good care to get the finest capital structure (Weston, 1973).

There are various researches which strongly witness substantial correlation amid Entities' Profitability and their Capital Structure here again to testify this rolling theory few of basic research question have been developed as below.

- 1. Whether or not Net Profit Margin is significantly impacted by Debt to Equity Ratio?
- 2. Whether or not an Entity's Profitability is significantly impacted by Debt to Equity Ratio?
- 3. Whether or not Earnings per Share (EPS) is significantly impacted by Debt to Equity Ratio?
- 4. Whether or not Return on Equity (ROE) is significantly impacted by Debt to Equity Ratio?

The main purpose of the research is to find out the role of capital structure concerning firms' profitability specifically in the Pharmaceutical sector of Pakistan which is listed in the Pakistan equity market. Moreover, the research will similarly employ the conclusions that would reveal the significant robust association among debt to equity proportion and the rest of the variables as aforementioned in research queries. Hence, the core objectives of the study.

- 1. To find how Net Profit Margin is significantly impacted by Debt to Equity Ratio?
- 2. To find how Entity's Profitability is significantly impacted by Debt to Equity Ratio?

- 3. To find how Earnings per Share (EPS) is significantly impacted by Debt to Equity Ratio?
- 4. To find how Return on Equity is significantly impacted by Debt to Equity Ratio?

#### 3. Literature review

The magnificent piece of work was done on the capital structure by Modigliani and Miller (1958). This subject received extensive attention in finance and academic researchers started a debate on Capital Structure. The number of studies has been done to show how the capital construction is related or dissimilar to profitability and the performance accordingly firm's financial unlike changes in circumstances. Few researchers identified that no capital structure is perfect for the individual firm and some researchers come to the conclusion that the percentage of liabilities borrowed which is unrelated to the firm. The purpose of all researchers is to identify the best capital structure to boost the earnings of the organization.

Avino and Lazar (2020) introduced quite a considerable set of alternative strategies which drastically can drive healthy benefits from available information of time vary pricing disclosure debt and Equity market including their mix or co-integration. Further the author not only given theory but practically implemented developed models on the US & European capital market by taking a sample of various obligors. Findings reveal outperformed arbitrage practices of trading meanwhile in the financial crisis. Moreover, these new strategies stagnate at a steady correlation along with capital market return rather than standard capital structure arbitrage.

Chivandire et al. (2019) researched to find out how the mobile industry can be effect by debt of equity financing (Capital Structure), they assessed to understand the role or capital structure mixed influenced on entities' financial performance and further elaborated short term financing is preferred by the mobile operator rather long term financing. The study strongly suggests to the industry that searches on the other robust ways which significantly impact the firm's profitability and the regulatory bodies are supposed to take a good measure which can enhance this sector's profitability in context to provide a healthy operating environment by good code of governance.

Das and Kim (2017) shadow banking framework contains Special Purpose Vehicles (SPVs) that need high external financing, illiquid long-development resources subsidized transcendently by short-development debt and dug liabilities, are known as the capital structure of the SPV. Qualities bring to an antagonistic riddle among senior-note holders, who tackle for an ideal rollover strategy dependent on the other senior tranches with changing rollover dates. This rollover strategy is, thus, considered by capital-note holders (i.e., financial specialists in the value tranche) while picking the capital structure (i.e., the debt-to-asset proportion) of the SPV. Rollover hazard increments in the quantity of time tranches, bringing about a lower harmony level of debt and greater expense of debt. The normal existence of the SPV may likewise be abbreviated. We propose an agreement-based capital structure that moderates these issues and is Pareto-improving for value and debt holders in the SPV.

Sharma and Gupta (2017) researched on the revenue generation techniques by enhancement of operating and net operating income which is based on set targets by venture capitalists for the postfunding of entrepreneurs on their specific ventures. In the very first segment, research modelled to finance capital expenditures by total funds raised from debt or equity, then segregate the model in another block to illustrate the comparison between trading entities and within in the same industry while each parameter kept same likewise same size, same earnings and almost same capital structure, the crux of the entire research is to come with the findings which can elaborate the part of capital formation on the performance of the organization.

McDonald (2016) came up with the glorious research where they have studied persistently increase in bond's demand by investors to financing their capital structure and financer response related to this brutal demand. Financing companies are very confident of issuance fund/loans to obligors when there is a rise in bond's demand and fund use significantly increases or decreases when the demand of bond found on boom rather stagnate. Debt always remains cheap financing cost of capital firms rely on debt financing when there is less spread amid the corporate yield and treasury rates. Managers make persistent efforts to adjust debt issuance base on the relative cost of debt, findings revealed that debt financing is demanded by the investors especially in the examination of capital structure.

The firm with more debt financing is earning less profit compare to the firm which uses equity financing. Interest payment on debt financing reduces the profit (Eriotis et al., 2002). The study has also shown the inverse association amongst debt ratio and profitability where an increase in debts the profit of the firm will decrease or vice versa. Studies of Shah and Khan (2007), Rafique (2011), Masnoon and Saeed (2012) show relatively similar findings that here is an inverse connection amid profitability and debts which means if debt financing will increase profit will decrease or vice versa. A study of Nimalathasan and Brabete (2010) was conducted on manufacturing companies in Sri Lanka and illustrates that the debt to equity ratio is positively related to profitability.

Sri Lanka Business companies of CSE show the negative connection among the debt to equity and firm monetary performance (Pratheepkanth, 2011). Another research which has conducted on the Petroleum Industry of Pakistan describes that there is a positive effect of debt and equity on profitability (Ali et al., 2012). Research on Mumbai Stock Exchange Manufacturing Company shows that there is an affiliation between debt/equity and profitability, more use of debt means more loss in the firm profitability (Singh, 2013). Research which was conducted on Registered Sugar companies of KSE shows the perfect effect of long-term debt on firm profitability. Further Researcher advised that firms are supposed to use long term liability as part of firm capital in response to increasing the firm responsibility (Saeed and Badar, 2013).

Rehan et al. (2019) studied how capital structure impacts on the firm performance in the cement industry of Pakistan, and their result proved the significant impact of capital structure on firms' profitability.

The connection amid ownership structure, capital structure, and the firm performance between different trades of a business applying the example of the French manufacturing organizations establish that there is no adverse association of profitability and leverage (Margaritis and Psillaki, 2010). The debt to asset ratio and the interest coverage ratio is related meaningfully with the profit of the organization. Moreover, it is also witnessed that debt and equity ratios are adversely connected with profitability (Chisti et al., 2013).

Few results show a positive association between the capital structure and profitability and few others show that there is an adverse association between variables (Chakraborty, 2010). Organization capital structure is the arrangement of its financial available resources to run the business and the main element to show how the business runs its operations. Important resources for all the organizations, suppliers of finance will apply the control over the organization, but
leverage is a dangerous resource for the organization. Debt and equity are the two main classes for financing.

Tailab (2014) studies the factors which affect the profit of United States companies with the outcome of leverage account increase and age a declining impact on return on assets (ROA). On the other hand, the size of liquidity in sales has a favourable effect on the profit of United States companies. But the irrelevant relation is found amongst the size of assets and ROA. The study that the capital structure effect on the profitability of United States Companies related to energy that the full debt has an important impact on ROE and ROA.

Gill et al. (2011) attempt to cover the results of Abor (2005) around the correlation amid capital structure and profitability. The sample has been taken from the service and manufacturing organizations listed companies in New York Stock Exchange (NYSE). The result of the experiment shows a positive relation in short-range debt to total assets and profitability.

Figure 1



#### 3. Conceptual framework

Source: Singh and Singh (2016); Rehan, et al. (2019); Sadiq and Sher (2016)

# **Research Hypothesis:**

H1 Debt/Equity has a significant impact on the Net Profit Margin H2 Debt/Equity has a significant impact on Earnings per Share H3 Debt/Equity has a significant impact on Return on Capital Employed H4 Debt/Equity has a significant impact on Return on Equity

## 5. Methodology

Entire research is based on the phenomenal concept from generated theory, which ultimately brings the research into a positivism research approach where we retest the hypothesis.

This study is solely grounded on a quantitative data set, from various archival sources. Deductive Research Approach is used to test the previously generated theory.

The data was collected from the most authentic, reliable, and useful archival database in Pakistan, by nature data is secondary and quantitative and the rest of the statistics was composed of The Pakistan Stock Exchange.

In Pakistan Stock Exchange, there are 11 listed companies in the pharmaceuticals sector, and we have taken 7 companies. We have ignored the entities which were having a persistent loss in the recent few years because that may ruin our findings and also we could not get the data of companies where we can't find the required numbers as per our described variables.

Data were collected from 2007 to 2018 (12 years) on an annual basis entire data was collected from the Pakistan Stock Exchange and respective annual reports of sampled companies; used data in this research is archival secondary data.

There are several assumptions without them simple regression cannot be used, one of the data should be stationary, to make data stationery we have used Unit Root Test. In the unit root test, there are several levels which witness data stationery such as level unit root, first difference unit root, and second difference unit root, our most of the variable are unit root on the level and first difference.

To understand population structure we used descriptive statistics where the value of mean and standard deviation illustrated robust population structure, as mentioned above pre-requisite for pooled regression or simple regression there are assumptions, another one there should not be multicollinearity amongst independent variable themselves, hence to determine this, we have employed test of Pearson correlation in the second segment of the research and the third segment, we have developed a simple pooled regression model to come up with findings, moreover, EVIEWS 9 was employed for equation modelling in this research.

# 4. Findings and discussions

Initially, in the first segment which is solely based on population structure, we used descriptive statistics with mean & standard deviation for every single variable. Group of dependent variable comprised of Earnings Per Share, Net Profit Margins, Return On Equity, and Return On Capital Employed and independent variable is Debt to Equity Ratio, as mentioned above Pooled Regression Analysis are used to reach meaningful finding in this research.

#### Table 1

Variables	Statistics	Probability	Level
DE	37.9068	0.0005	Zero Level
EPS	-6.89834	0.0000	Zero Level
NPM	-1.65819	0.0486	Zero Level
ROCE	-3.20274	0.0007	Zero Level
ROE	-5.12774	0.0000	Zero Level

Levin, Lin & Chu test

To testify the data for unit root, there are developed hypotheses, where are Null Hypothesis: Unit Root is found in Panel Data Set and Alternative: Here is no Unit Root in Panel Data Set. Therefore aforementioned test claims unit-roots of the data set, the table above clearly illustrate that there is no unit root in the panel data set, most of the variables are stationary whether on level or first difference but not on second difference, as the probability is less 0.05 or 5% which claims that do not reject alternative hypotheses. We have completed the first assumption of the Pooled Regression Equation method and can precede equation modeling.

# Table 2

Variables	Fixed	Random	Probability	Appropriate Model
EPS-DE	-8.80245	-7.23085	0.1083	Random Effect
NPM-DE	-0.0436	-0.04601	0.3362	Random Effect
ROCE-DE	-0.08406	-0.08315	0.9167	Random Effect
ROE-DE	-0.02707	-0.03175	0.5825	Random Effect

Hausman Test

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After running pooled regression, there are further processes that drag the research on appropriateness, whether the research model fits the fixed effect of random effect, coming to these crucial decisions we are to use the Hausman test, which is the significant measure to choose the model. Null Hypothesis witnessed model appropriateness with Random Effect and Alternative reports model appropriateness with Fixed effect, hence in the above-mentioned table, all of the p-values are greater than 0.05% or 5% which means that all of the four models are best fitted with Random Effect Data Appropriateness.

				Table
Dependent Variable:	EPS			
Method: Panel EGLS	(Cross-section ra	ndom effects)		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	22.7531	5.1852	4.3881	0
DE	-7.2309	-7.2309 3.2512 -2.2241		0.0289
Weighted Statistics				
<b>R-squared</b>	0.0559	Mean depende	ent var	6.4496
Adjusted R-squared	0.0444	S.D. dependen	t var	16.1355
S.E. of regression	15.7735	Sum squared	resid	20401.8
F-statistic	4.8531	Durbin-Watso	on stat	1.0145
Prob(F-statistic)	0.0304			

Model 1

The regression model 1 demonstrates that EPS (Earning per Share) has a huge impact or impact on DE (Debt to Equity). The Probability value is .00289 which is under .05 or 5% that implies dependent variable (EPS) Earning Per Share impacts or effects on debt to equity or D.E or can impact on E.P.S (Earning Per Share) just 4.85% and other portion of percentage effects on hidden factors which is also part of this model that means external factors are influencing on 95.15%. The Prob. (F-statistic) is additionally noteworthy that is 0.0304 which is under 5% or .05 and the Derbin Watson-detail demonstrates 1.01. This model states that earning per share has a critical impact on debt to the equity that implies Capital structure impact on Profitability in the pharmaceutical sector which is recorded in Pakistan Stock Exchange. Financial Studies – 3/2020

# Model 2

## Table 4

Dependent Variable: NPM					
Method: Panel EGLS (Cross-section random effects)					
Variable	Coefficient	Std. Error	t-Statistic	Prob.	
С	0.141	0.016	8.7931	0	
DE	-0.046	0.0095	-4.8477	0	
Weighted Statistics					
R-squared	0.2357	Mean depend	ent var	0.03697	
Adjusted R-squared	0.2256	S.D. depender	nt var	0.05024	
S.E. of regression	0.0443	Sum squared	resid	0.14905	
F-statistic	23.4367	Durbin-Watso	on stat	1.09079	
Prob(F-statistic)	0				

Table 4 illustrates the substantial adverse correlation amid Debt to Equity ratio and NPM (Net Profit Margin), this also witnesses a single unit positive change in Debt to Equity will deduce 0.046 unit change in net profit margins. Generally speaking as much a firm gauge debt financing as much debt to equity ratio rises and similarly, they have to pay off financial obligation which will be reflecting in profit and loss account by decreasing net profit that clearly means as much a firm increases debt financing as much net profit will be decreasing.

# Model 3

				Table 5
Dependent Variable: ROC	E			
Method: Panel EGLS (Cro	oss-section rando	om effects)		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
С	0.3135	0.0267	11.7592	0
DE	-0.0831 0.0207 -4.0087		0.0001	
Weighted Statistics				
R-squared	0.1785	Mean depende	ent var	0.13472
Adjusted R-squared	0.1676	S.D. dependen	nt var	0.10846
S.E. of regression	0.0985	Sum squared	resid	0.72802
F-statistic	16.3014	Durbin-Watso	on stat	1.66960
Prob(F-statistic)	0.0001			

The regression model 3 demonstrates that ROCE (Return on Capital Employed) is a noteworthy impact or impact on DE (Debt to Equity). The Probability value is .0001 which is under .05 or 5% that implies dependent variable ROCE impact or effects on debt to equity or DE or can impact on ROCE (Return on Capital Employed) just 16.30% and other portion of percentage effects on hidden factors which is also part of this model that means external factors are influencing on 83.70%. The Prob. (F-statistics) is .00012 which is under 5% or .05 and the Durbin Watson-detail demonstrates 1.66. This model tells that ROCE has a critical impact on debt-to-equity that implies Capital structure has a critical influence on Productivity in the pharmaceutical segment which is listed in the Pakistan Stock Exchange.

M	oa	lel	4	

Table 6 **Dependent Variable: ROE** Method: Panel EGLS (Cross-section random effects) Variable Coefficient Std. Error t-Statistic Prob. С 0.2342 0.0209 11.2074 0 DE 0.0175 -0.0318 -1.8166 0.0733 Weighted Statistics **R-squared** 0.0424 Mean dependent var 0.13670 Adjusted R-squared 0.0296 S.D. dependent var 0.08817 S.E. of regression 0.0869 Sum squared resid 0.56582 **F-statistic Durbin-Watson stat** 3.3183 1.83647 **Prob(F-statistic)** 0.0725

The regression model 4 demonstrates that ROE has an insignificant impact upon DE (Debt-to-Equity). The Probability value is .0733 which is more than .05 or 5% which implies the dependent variable (ROE) Return on Equity has no impact or effects on debt-to-equity or D.E further result shows that the R-square is only 4% and the f-statistics value is 3.33%. The Prob. (F-statistic) is additionally noteworthy that is .07 which is more than 5% or .05 and the Durbin Watson-detail demonstrates 1.83. This model states that ROE has no substantial effect on debt to the equity that implies Capital structure does not impact Profitability in the pharmaceutical sector which is recorded in Pakistan Stock Exchange.

# Table 7

# Correlation

Correlation Analysis						
Correlation	DE	EPS	NPM	ROCE	ROE	
DE	1					
EPS	-0.026015	1				
NPM	-0.556552	0.131238	1			
ROCE	-0.433966	0.453419	0.465727	1		
ROE	-0.234697	0.430605	0.614642	0.781156	1	

Above mentioned correlation model shows an adverse relationship amid Debts-to-Equity, i.e. independent variable and Profitability (EPS, NPM, ROCE, and ROE), i.e. dependent variable.

# 5. Discussions

The purpose of the study was to evaluate the impact of capital structure on firms' profitability in the Pharmaceutical industry of Pakistan. Therefore, we have taken Net Profit Margin, Earnings per Share, Return on Capital Employed, and Return on Equity, as dependent variables, and debt to equity ratio as the main independent variable. There are four individual models that determine the impact of the capital structure on the firms' profitability.

# Hypothesis 1: Debt/Equity significance effect on net profit margin.

The alternative hypothesis HI has accepted and Ho hypothesis is rejected. This answer to research question 1: What are the correlation between debt-to-equity and net profit margin? The results revealed that the debt-to-equity and net profit margin has a negative relationship with each other means the debt/equity ratio will be increased net profit margin will be decreased or vice versa. This result is matching with earlier research of Singh and Singh (2016), Eriotis et al. (2002).

# Hypothesis 2: Debt/Equity significance effect on earnings per share.

The alternative hypothesis HI has accepted and Ho hypothesis is rejected. The results revealed that the debt-to-equity and EPS has a negative relationship with one another means debt/equity ratio will be increased EPS will be decreased or vice versa. The study is matching with the previous research result of Salim and Yadav (2012).

# Hypothesis 3: Debt/Equity significance effect on return on capital employed.

The alternative hypothesis HI has acknowledged and Ho hypothesis is rejected. The results revealed that the debt-to-equity and ROCE has a negative relationship with each other means debt/equity ratio will be increased ROCE will be decreased or vice versa. This result is matching with earlier research of Murtala et al. (2018).

# Hypothesis 4: Debt/Equity significance effect on return on equity.

The alternative hypothesis HI has rejected and Ho hypothesis is accepted. The results revealed that debt-to-equity and ROE have a negative but insignificant correlation with each other at 5% but at 10% they have a substantial negative correlation that means the debt/equity ratio will be increased ROE will decrease or vice versa. The study is matching with the previous research result of Saeedi and Mahmoodi (2011).

This study includes only secondary data and restricts on one specific industry. Furthermore, the period considered is only 12 years. To keep the previous points in mind the research can do further research in this area by adding more industry, which also can increase the period of time and may include primary data which makes results more reliable. Research can add some more variables i.e. intervening moderating and also some more independent and dependent variables like; debt to assets and the weighted average cost of capital (WACC) as independent and gross processing margin (GPM), ROA, Tobin's q as the dependent variable.

Capital structure is not all about debt to equity of an organization; it is also concerned about the managerial operations of the organization. The stability of the process should exist between debt and equity, as it plays an important role in the profitability of any organization.

# 6. Conclusions

The purpose of this research is to explore the association of capital structure and profitability of the pharmaceutical firms which are listed in the Pakistan Equity Market showing profit in our desired period of study i.e. 2007-2018 which are based on eighty-four observations and analysed with the help of pooled regression model. The research concludes that a combination of debt-to-equity has a substantial effect on profitability and negatively associated with the profitability of the firm which means that a decrease in profitability of the firm is caused by an increase in debt-to-equity ratio.

Most of the findings in the research reconfirms previous research but in different countries and different time horizons, interestingly few of the logical observation had been driven in this research to give an edge to understand the mix of capital structure in emerging pharmaceutical industry in Pakistan, hence prudent asset financing in this industry gauge healthy competitive edge to the entities within the pharmaceutical sector in Pakistan.

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# THE RESPONSE OF FINANCIAL MARKET INDICES TO COVID-19 PANDEMIC

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#### Abstract

Indices are a crucial part of the global investment business. The main objective of the study is to determine the impact of COVID-19 on stock indices to analyse financial markets' response. The study applied a log-log simple regression model to analyse the effects of COVID-19 on stock indices by using EVIEWS. The result shows that COVID-19 has a substantial negative impression on market indices. In addition, critical analysis findings are benchmark index like the S&P 500, and Dow Jones Industrial Average has plummeted. On the other hand, indices like FTSE 100, NIKKEI 225, NASDAQ 100, SSE 50, DAX, HENG SENG, MOEX.ME and SENSEX have shown a negative percentage change. Moreover, Global stock markets have posted the biggest fall since the 2008 financial crises. It was recommended that future researchers should conduct different stock indices and sample period, the impact of COVID-19 on economic factors like GDP, inflation, interest rate, and effects of COVID-19 on credit markets.

**Keywords**: Response, financial market indices, COVID-19, pandemic, China

JEL Classification: G01, G15, G19

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# 1. Introduction

SARS (Severe Acute Respiratory Syndrome) in 2003, a new virus named "2019-nCoV" (novel Coronavirus), has identified the first time in Wuhan, a city of China, in December 2019. Later on, novel coronavirus (2019-nCoV) referred to the new name "coronavirus disease 2019" by World Health Organization (WHO), while the coronavirus study group (CSG) of the international committee proposed "SARS-CoV-2" as name to novel coronavirus (Guo et al. 2020). The coronavirus disease causes a respiratory illness with symptoms of flu, cough, and fever. In more severe conditions, difficulty in breathing ends with fatal. The hazardous side of this COVID-19, it is spread very vastly from human to human by via droplets inhalation and physical contact. According to the WHO (World Health Organization) report at the end of January, China has 9,720 confirmed cases of COVID-19. With 213 deaths and 106 confirmed cases in 19 countries spread by travel to and from Wuhan. With this dispersion rate, WHO declared a global health emergency in the mid of January (World Health Organization, 2020).

World Health Organization (WHO) shared some statistics about the COVID-19 epidemic outbreak at the end of the first quarter of 2020. The origin-country of epidemic China has 82,545 confirmed cases with 3,314 deaths. Infectious disease blowout very fast in the European region: Italy, with 101,739 confirmed cases, and 11,591 deaths, Spain has 85,195 confirmed cases, and 7,340 deaths, followed by Germany with 61,913 confirmed cases, and 583 deaths, and France with 43,977, and 3,017 deaths. COVID-19 has infected 22,145 people in the United Kingdom. The USA has lead in this epidemic outbreak with 140,640 definite patients, and 2,398 deaths. All over the world, it was challenging by COVID-19 epidemic outbreaks with 7,500,890 confirmed patients, and 36,405 deaths (World Health Organization, 2020).

The dispersion of coronavirus much more than SARS and MERS even infected cases of SARS in a month are less than coronavirus affected cases within a week. According to the current situation fatality rate of coronavirus about 2.2% less than SARS, about 10%, while MERS had around 35% fatality rate (Kelland, 2020).

The objective of the study is to determine the impact of COVID-19 on stock indices to analyse financial markets' response to novel coronavirus (COVID-19).

### 2. Literature Review

The increase in economic activities regionalization and financial market liberalization started since the 1980s caused integration among world economies. Recently due to infectious disease COVID-19, worldwide capital markets are unstable. The epidemic outbreak covered 208 countries to date updated due to which a completely locked down in around the world. The interruption in economic activities like production, supply chain value, household spending, and services facilities caused the economic supply and demand shocks.

The U.S security and Exchange commission terminated stock exchanges trading for 15 minutes four times in March to bring out the market from panic trading. Before this, in 1987 and 1997, stock trading had halted due to the market crashed.

When S&P 500 has dripped more than 7% from the previous close, the trading stopped during the opening hour on March 9, 12, 16, and the mid of the day on 18th March. The trading of Dow and NASDAQ has shut down in the response of the S&P 500 pause. As the Dow and S&P 500 prices have plunged, the Chicago Board of Exchange's volatility has increased (Hartman, 2020).

FTSE 100 had been gaining since 2011, presently just within a month index has plunged to its lowest level. To avoid the severity of damages, governments and central banks restricted the economic activity. Investor anxiety affects Wall Street, impels it into a fast bearmarket. Dow Jones Industrial Average company's share prices fell by more than 20% from its latest peak. Dow jones has plummeted by 12.9%, index worn-out by almost 3000 points on 16, March referred to worst day. World second-largest economy was fighting against COVID-19 in late January, china's global supply chain disrupted when the central city Wuhan locked down. Asian powerful economy suffers from a fall in GDP since 1976. By the fall in shares prices world, the wealthiest people have lost \$1tn. Italian debt suffered its biggest selloff since 2011 (Wearden, 2020). The U.S and German bond market has also suffered 10-year bonds yields fell by 20 points in the first week of March. Almost 7000 stock in global equities has lost \$6trillion of their market value at the start of March. Half of the German market, half of Japanese, nearly 80% of South Korean shares, and emerging markets have moved in bear-market (Wilkes, World Economic Forum, 2020).

Like the 2008 recession where stock markets had crashed, and interest rate reduction strategies were implemented, global financial

crises have been seen in 2020 due to COVID-19. US Federal Reserve and bank of Canada have reduced interest rates from 1.75% to 1.25%, bank of England reduced from 0.75% to 0.25% within the first two weeks of March (Yik, 2020). The Managing Director of IMF, Kristalina Georgieva, declared global growth would be a drip in 2020 below the preceding year due to COVID-19. Low income and emerging economies will get \$50 billion by the IMF to tackle the financial emergency. According to estimation, one-third of economic losses will suffer as a direct cost, while two-thirds will be indirectly affected by the harsh circumstances for business and financial markets (Georgieva, 2020).

As the spread of COVID-19 in China, it has restricted activities like traveling, transportation, labour mobility, and working hours in February, therefore, output decline. Global financial uncertainty caused the assumption that global GDP growth will be low and might be below zero in the first guarter of 2020. It might be possible global growth declined 1/2 percentage in this year based on 2019. Countries like Japan, Korea, and Australia are interrelated with china though their economic activities like production, imports, exports, and supply chains also suffer from infectious disease (Organisation for Economic Cooperation and Development, 2020). The Chinese exports reduced by 2% on annual based due to Manufacturing Production Manager's index (PMI) dropped by 22 points in February. According to today's statistics, Chinese manufacturing intermediates' inputs trade covered 20% of global trade. COVID-19 has a disruption in Chinese manufacturing inputs that are crucial to the global value chain. The interruption in china's supply chain has affected many companies' production around the world (United Nations Conference on trade and development, 2020). The financial markets have undergone restrictions due to coronavirus outbreak, Euro Stoxx 50 plummeting 8.3% to its lowest level. Australia manages A\$17.6 billion against coronavirus dispersion to avoid severe recession (Shalal, 2020).

Financial markets and several industries have revealed severe adverse conditions in response to COVID-19. Eurostoxx 50 has dropped by 50% while S&P 500 reduced by 18% from its peak in mid-February, this decrease in index points critical than SARS. European countries and the U.S have locked down to prevent the virus spreads; therefore, GDP growth and output plummeted. Tourism in Italy has fall 40% to 80% while in France, 30% to 40% due to the epidemic situation (Demertzis et al. 2020). Germany's financial market also feels panic. DAX blue-chip stock index dropped by 8 % (updated till 10th March) its worst day since from 9/11 attack. Germany's industrial state, North Rhine-Westphalia, has 1200 confirmed cases of infectious disease, which contributed 20% to the country's productivity.

To tackle financial panic, the government facilitates company financing, credit collateral, and tax relief (Ferguson, 2020). This is the worst quarter for Asia-Pacific stock markets since 2008. Japan Nikkei index has plunged by 20%. Australian S&P/ASX dropped by 24% while Indian Sensex index points fell 28% (Wilkes, The Guardian, 2020).

#### 3. Research Methodology

The present study is undertaken to investigate the impact of the COVID-19 on the financial market's indices from the 1st of January to 31st of March 2020 in China, USA, UK, Japan, Germany, Hong Kong, Russia and India.

Time series data are collected from www.finance.yahoo.com, www.investing.com, and www.worldmeters.info. The independent variable is the number of COVID-19 confirmed cases, and the dependent variables are the stick indices. The study use DJI, GSPC and NDX from USA, FTSE100 from UK, NIKKEI225 from Japan, DAX from Germany, SSE50 from China, HENGSENG from Hong Kong, MOXE.ME from Russia, SENSEX from India as a sample of stock indices. To examine the nature of relationship correlation test analysis carried out. The study applied a log-log simple regression model to analyse the effects of COVID-19 on stock indices by using EVIEWS.

The following statistical equation was used to determine the significant impact of an independent variable on the dependent variable:

$$\ln Y = \alpha 0 + \beta 1 \ln X + \varepsilon \tag{1}$$

Where,  $\ln Y$  is the natural log of Dependent Variable,  $\ln X$  is the natural log of Independent Variable. The  $\alpha 0$  is constant, and  $\beta 1$  is the coefficient parameter,  $\varepsilon$  is error term.

### 4. Empirical results and discussion

# Table 1

Correlation and Regression results between COVID-19	
confirmed cases and financial market Indices	

Dependent Variable: DJI	Correlation	Coefficient	R-squared	Adj. R-squared	t-statistic	prob.
USA(CNFC)	-0.489611	-0.038501	0.827046	0.823366	-14.99159	0.0000
Dependent Variable: GSPC						
USA(CNFC)	-0.490543	-0.034485	0.823838	0.82009	-14.82564	0.0000
Dependent Variable: NDX						
USA(CNFC)	-0.436039	-0.025848	0.740481	0.73496	-11.58035	0.0000
Dependent Variable: NIKKEI225						
JAP(CNFC)	-0.743763	-0.083538	0.770544	0.763373	-10.3663	0.0000
Dependent Variable: FTSE100						
UK(CNFC)	-0.500029	-0.043484	0.846819	0.843083	-15.05516	0.0000
Dependent Variable: DAX						
GER(CNFC)	-0.565361	-0.045365	0.836125	0.832314	-14.81198	0.0000
Dependent Variable: SSE50						
CHN(CNFC)	-0.358255	-0.012285	0.158358	0.13923	-2.877282	0.0062
Dependent Variable: HENGSENG						
HK(CNFC)	-0.728409	-0.040471	0.522099	0.511709	-7.089016	0.0000
Dependent Variable: MOXE.ME						
RUS(CNFC)	-0.321044	-0.032249	0.588366	0.577811	-7.46621	0.0000
Dependent Variable: SENSEX						
IND(CNFC)	-0.715961	-0.064277	0.890752	0.888021	-18.05932	0.0000

Source: Regression analysis

Table 1 shows the correlation and regression results between COVID-19 confirmed cases and financial market indices. The correlation analysis reveals that -0.489611 value indicates a significant negative relationship between USA COVID-19 cases and the DJI index. While 0.0000 value of probability means COVID-19 has a significant impact on DJI. The higher the R-squared 0.827046, indicate better the model fits data. GSPC and NDX indexes have a significant negative relation to COVID-19 with -490543 and -0.436039, respectively. Probability of less than 0.05 interprets the considerable impact of independent on a dependent variable with higher R-squared 0.823838 and 0.740481. COVID-19 profoundly influences NIKKE1225 due to a high correlation -0.743763. The coefficient of COVID-19

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indicates that by each additional case of the virus, NIKKEI225 reacted with -8.35%. FTSE100 index decreases 4.34% with the one other COVID-19 case in the UK. Critical analysis reveals that all countries COVID-19 confirm cases have a significant impact on their respective stock indexes with negative correlation. But China SSE50 index shown a very low coefficient for COVID-19, it responds just -1.22% with an added case. Lowest R-Squared 0.158358 specifies weak fitness of model for COVID-19 confirm case and SSE50 index. After that, Russia and Hong Kong also have a low coefficient of -3.22% and -4.04%, R-squared 0.588366, and 0.522099, respectively, compared with the USA and the UK.

# Table2

Indicies	2019	Jan		Feb		Mar		Q1	
	price	price	% change	price	% change	price	% change	price	% change
DJI	28,538.44	28,256.03	-0.99	25,409.36	-10.07	21,917.16	-13.74	21,917.16	-23.20
GSPC	3,230.78	3,225.52	-0.16	2,954.22	-8.41	2,584.59	-12.51	2,584.59	-20.00
NDX	8.733.07	8.991.51	2.96	8.461.83	-5.89	7.813.50	-7.66	7.813.50	-10.53
		-,		.,		,			
NIKKEI225	23.656.62	23.205.18	-1.91	21.142.96	-8.89	18.917.01	-10.53	18.917.01	-20.04
		.,		,				.,	
FTSE100	7.542.40	7.286.00	-3.40	6.580.60	-9.68	5.671.96	-13.81	5.671.96	-24.80
				.,		.,			
DAX	28.10	27.10	-3.57	24.95	-7.93	20.59	-17.47	20.59	-26.73
SSE50	3.063.22	2.932.49	-4.27	2.821.04	-3.80	2.689.38	-4.67	2.689.38	-12.20
						,		,	
HENGSENG	28,189,75	26.312.63	-6.66	26,129,93	-0.69	23,603,48	-9.67	23.603.48	-16.27
	20,200.70	10,011100	0.00	10,110.00	0.05	20,000110	5107	20,000110	2012/
MOEX ME	107 75	109 94	2 03	99.08	-9.88	97 25	-1 85	97 25	-9 74
	10/11/0	205154	2.00	55100	5100	57125	1.05	57125	5174
SENSEX	41,253.74	40,723.49	-1.29	38,297.29	-5.96	29,468.49	-23.05	29,468.49	-28.57

Indices Prices and % change of first quarter, 2020

Source: www.finance.yahoo.com

Table 2 shows the Indices Prices and % change in the first quarter, 2020. There are three major indices: DJI, GSPC and NDX in

the United States mutually exertion as security market indicator series. The empirical data revealed a continuous downfall from January 2020 to March 2020 with an increasing trend in benchmark index S&P500 and DJI. At the end of the first quarter of this year, DJI has dropped 6,621.28 points with -23.20% changes while the S&P 500 move from 3.225.52 points to 2.584.59 with 20% decrease. In the first month of the year, NDX has gain 2.96% after that index plunged by 10.53% due to COVID-19. The drip in NIKKEI 225 by -1.91% in January indicates the impact of the epidemic outbreak started in China. After the dispersion of the virus outside china, NIKKEI 225 proceeds with a decrease of 8.89% in Feb and 10.53% in March. In general, FTSE 100 is a leading indicator of the United Kingdom's (UK) financial markets. FTSE 100 is the most popular and widely used market index in Europe. This year starts with 7,286 points of FTSE 100, but on the 31st March, the exposed index of 5,671.96 points has collapsed 24.80%. DAX is the main stock index in Germany; index price fell from 28.10 to 20.59 in the Q1 (Quarter 1). SSE 50 related to Shanghai Stock Exchange, china was in the lead of an epidemic outbreak in the first two months, so that's why at the end of the third month, SSE 50 shown overall 12.20% negative change. Aggregate fall in Q1 by HENG SENG is 16.27% directs the Hong Kong stock market and fronts crises. Russian stock market index MOEX.ME displayed gain in January, then a negative % change point out loses. There is a major drop of 8,828.80 points in March, with an -23.05% change in SENSEX trading in the Bombay stock market.

The decreasing pattern in prices declared, there are stock market crises all over the world. The negative % change in the Q1 column specifies all the indices have collapsed. This is an excellent recession time period since 2008 crises, global countries adopting some precautionary measures like; trading halt, decrease in interest rates, ease in collateral policies, and relaxation in credit policies, government central banks funding to control and limit global crises.

# 5. Conclusion

Based on the findings, there is a significant negative relationship between COVID-19 and stock indices. This means that financial market indexes decrease with an increase in COVID-19 cases. Moreover, the impact of COVID-19 on financial markets is significant because all the sample indices are responding noteworthy

in inversely proportional. Empirical results elaborate the SSE50 index responding less adversely as compared with other indices. COVID-19 has severe effects on global financial markets; even the developed economies exchanges responding slumped.

Based on the results, the researchers hereby recommend for future researchers should conduct with different stock indices and sample period, the impact of COVID-19 on economic factors like GDP, inflation, interest rate, and effects of COVID-19 on credit markets.

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