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THE CROWDING-OUT EFFECT IN A SMALL DEVELOPING ECONOMY: A LESSON FROM COVID-19

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ABSTRACT

Purpose- COVID-19 has dealt a severe blow to public finance, and caused public debt to Gross Domestic Product (GDP) to pass the 100 percent mark. Given this, the objective of this paper is to examine the impact of bank lending to the government on bank credit to the private sector (crowding-out effect) in Jordan.

Methodology- This paper uses bank-level data during the period 2011-2020. Based on the collected data from the financial statements of all 13 conventional Jordanian banks, the Seemingly-Unrelated Regression (SUR) is applied to examine the determinants of their credit growth. The used independent variables are bank deposit growth, credit to the government, bank size, bank capital, bank income diversification, real economic growth, and inflation rate.

Findings- The 2020 financial statements show that the profits of Jordanian banks (return on assets) have decreased from 1.43 percent in 2019 to 0.74 percent in 2020. This decrease was mainly due to the increase in loan loss provisions. As far as the econometric results are concerned, it is informative to note that the impact of banks' lending to the government, in the form of government securities, is negative and significant, and in all estimated econometric versions.

Conclusions- While much of the determinants of bank performance are applicable to the Jordanian scene, it is encouraging to note that Jordanian banks have managed to finish the 2020 financial year well. However, it is argued that the government should use COVID-19 as a "trigger" point for change in the status of its poor public finance.

Keywords: Jordan, banks, profitability, net interest margin; bank size; seemingly-unrelated regression.
JEL Codes: G20, G21, G24.

1. INTRODUCTION

The impact of COVID-19 on the Jordanian economy is not over. The implications, however, have become clear. In 2020, the economy witnessed a decrease in real Gross Domestic Product (GDP) by 1.6 percent, and an increase in unemployment from 19.0 percent (4th Quarter 2019) to 24.7 percent (4th Quarter 2020). During these difficult times, the virus has forced the government to implement some fiscal (and monetary) policy measures. Regardless of what these measures are, the already existing weak status of public finance has become even weaker. For example, public debt (general government) to GDP ratio has increased from 95.2 percent in 2019 to 106.5 percent by the end of the 2020. In 2020, interest payments on public debt only, accounted for 15.6 percent of total public spending (excluding interest payments).

Within the context of the weak, and deteriorating public finances, it is known that debt (private and public), over time, plays an important role in facilitating investments and real economic growth and development. However, one can also argue that the rising public debt can crowd-out the private sector from the debt market. High and rising public debt can impede economic growth through various channels, including the crowding-out of private investment (Woo and Kumar, 2015 and Ostry et al., 2015).

The objective of this paper is to examine the performance of licensed banks in Jordan in terms of their credit growth. In more specific terms, using bank-level data, and the period 2011-2020, this paper examines the impact of public borrowing on bank credit to the private sector. If the impact is negative, the government should use COVID-19, and the resultant increase in public debt, as a "trigger point" for positive change, and remedy the poor status of its public finances. Otherwise, in future years, public debt will prove to be a source of economic instability, and an impediment to the growth performance of the economy.

The rest of the paper is structured as follows. In section 2, we briefly review the literature that examines the determinants of back credit. In section 3, we provide some information about public finance in Jordan and bank credit. In section 4, we outline the data and the used methodology, and present and discuss the results. Section 5 summarizes and concludes the paper.

2. BANK CREDIT: A LITERATURE REVIEW

For so long, the macroeconomic impact of public debt has been an issue that attracts the attention of financial economists. Indeed, public debt can impact (negatively) economies through various channels. These channels are summarized in a recently published by the European Central Bank working paper, and written by Burriel et al. (2020).

First, high public debt levels make economies particularly vulnerable to macroeconomic shocks. When governments maintain high debt levels, they cannot, for example, adopt counter-cyclical fiscal policy which is known for enhancing macroeconomic stability. In other words, high debt can exacerbate macroeconomic volatility, and restrain economic recovery and growth.

Second, high public debt levels can adversely impact economic growth through various channels including sovereign spreads, sovereign yields, future (higher) taxation, capacity to finance future public investments, and increased uncertainty in general. In addition, high public debt can crowd-out the private sector from the debt market, and hence, reduce private sector investments.

Within the context of the socio-economic implications of COVID-19, it is interesting to note that Burriel et al. (2020) state that "once the crisis is over and the recovery firmly sets in, keeping public debt at high levels over the medium term is a source of vulnerability in itself". Indeed, based on three dynamic stochastic general equilibrium (DSGE) models, their euro area simulation results indicate that countries with high debt can face, among others, a crowding-out of private debt in both the short-run and long-run.

The literature which examines the impact of public debt on private sector debt can be grouped under two main types. The first group examines the issue using individual countries' data and time series analysis such as vector auto-regression (VAR), structural vector auto-regressions (SVAR), autoregressive distributed lag (ARDL) co-integration, and vector error correction modelling (VECM). The second group of papers examine the crowding-out effect using bank-level data and panel data analysis. In addition, these papers use either single-country bank data or cross-country bank data.

Some of the recently published papers which use time series analysis include Akpansung (2018), Lidiema (2018), Manda (2019), Lee and Goh, (2019), and Mwakalila (2020). For example, Mwakalila (2020) examine the impact of public spending and public borrowing on credit to the Tanzanian private sector. Using quarterly data (2014-2018), the autoregressive distributed lag (ARDL) results confirm the negative impact of public debt on bank credit to the private sector.

As far as the papers that use panel data analysis are concerned, this literature regresses credit growth on a group of explanatory variables that include deposit growth, public debt, equity capital, bank size, bank income diversification, economic growth, and inflation rate. Again, some of the more recent papers are Ben Moussa and Chedia (2016), Ivanovic (2016), Awdeh (2017), Miyajima (2020), Nguyen and Dang (2020), and others.

Using a panel of 18 banks (2000-2013), Ben Moussa and Chedia (2016) examine the determinants of bank credit growth in Tunisia. Their results indicate that most of the known determinants of bank credit are not applicable to the Tunisian case. Similarly, Ivanovic (2016) uses a panel of 11 banks in Montenegro (quarterly data / 2004-2014). The results indicate that bank deposits and bank soundness increase bank credit growth. In addition, Awdeh (2017) looked at Lebanese banks (34 banks over the period 2000-2015), and the results indicate that deposit growth, GDP growth, inflation, and money supply, increase bank credit to the private sector. Public borrowing, on the other hand, negatively impacts bank credit. Bustamante et al. (2019), use quarterly data (2005-2017) to examine the determinants of the credit growth of 12 banks. The results indicate that well-capitalized, liquid, low-risk, and more profitable banks tend to lend more.

Miyajima (2020) uses a panel of 10 Saudi banks (2000-2015). The results reveal that deposits and equity capital increase bank credit. The results of this paper reveal some interesting conclusions. For example, it is stated that while lending by Islamic banks is more responsive to economic growth, less bank lending to finance the budget deficit increases credit to the private

sector. Finally, Nguyen and Dang (2020) looked at Vietnamese banks (2007-2019) in terms of their credit growth. Their dynamic panel regression results indicate that well-capitalized banks, high asset quality, and liquidity increase credit growth.

3. THE DATA, METHODOLOGY AND RESULTS

The banking sector in Jordan is composed of 13 conventional and 3 Islamic banks. As one might expect, the financial statements of the Islamic banks are different from the conventional banks. This is why, the analysis in this paper includes the 13 banks only, and the time period 2011-2020.

To examine the determinants of credit growth, the following model is estimated.

$$Credit_{i,t} = \beta_1 Deposit_{i,t} + \beta_2 Bonds_{i,t} + \beta_3 Equity_{i,t} + \beta_4 Size_{i,t} + \beta_5 Diversification_{i,t} + \beta_6 GDP_t + \beta_7 Inflation_t + \varepsilon_{i,t} \quad (1)$$

where, I refers to banks (1, …, 13), and t is the time period of 2011-2020.

The dependent and independent variables are measured as follows:
Credit = Percentage annual change in bank credit.
Deposits = Percentage annual change in bank deposits.
Bonds = Bank investment in government securities (bongs and treasury bills) divided by total bank credit.
Equity = Equity capital to total assets.
Size = The natural logarithm of total assets.
Diversification = Net commission income divided by interest income plus interest expense.
GDP = Real GDP growth rate.
Inflation = Inflation rate.

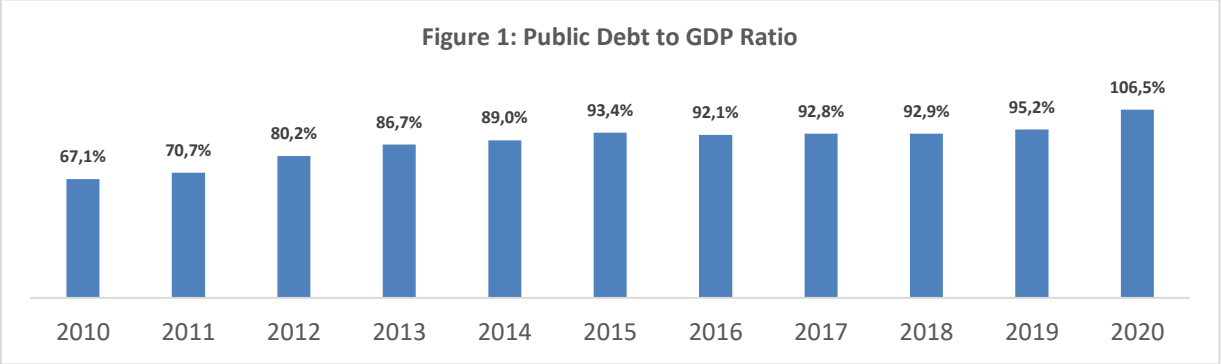
To estimate model 1, one can apply panel data analysis in its either fixed-effect form or random-effect form. However, the data involves 13 banks and 10 years. In other words, the results suffer from serial correlation in the estimated residuals. Indeed, this is the case based on the Durbin-Watson test. This is why, we estimate model 1 using the Period Seemingly-Unrelated Regression / pooled EGLS. This technique solves the period serial correlation, as well as the and period heteroskedasticity between the residual terms.

Below, we outline a number of observations about public finance and the banking sector in Jordan.

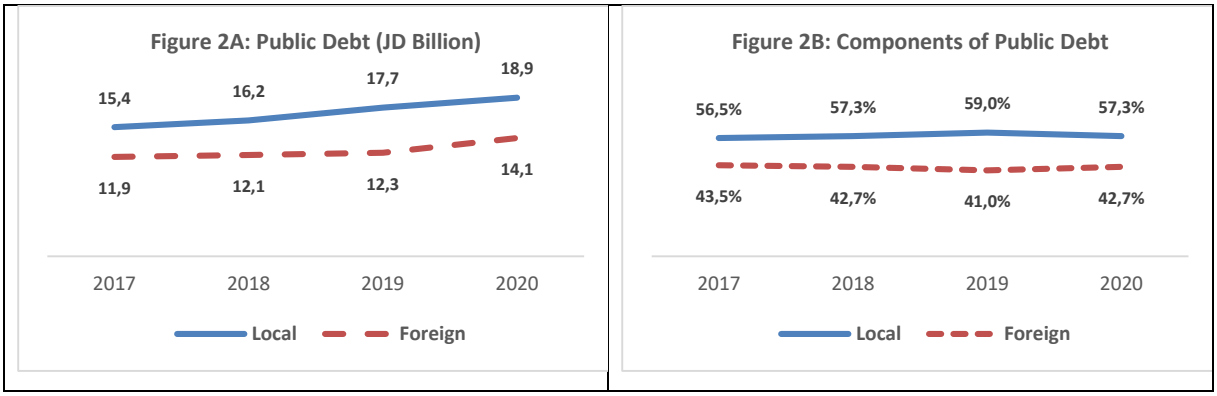
1. Public finance in Jordan is weak. The budget is consistently in deficit, with or without the received grants, mainly from the United States of America. In 2020, and as a result of COVID-19, local public revenues decreased, and total spending increased. In other words, the budget deficit to GDP ratio has widened and public debt increased from 95.2 percent of GDP in 2019 to 106.5 percent in 2020 (Figure 1).

Table 1: Public Finance in Jordan

Year	Local Revenues (JD Billion)	Grants (JD Billion)	Public Spending (JD Billion)	Budget Deficit / GDP (Excluding Grants)	Budget Deficit / GDP (Including Grants)
2010	4.261	0.402	5.708	-7.7%	-5.6%
2011	4.199	1.215	6.797	-12.7%	-6.8%
2012	4.727	0.327	6.878	-9.8%	-8.3%
2013	5.120	0.639	7.077	-8.2%	-5.5%
2014	6.031	1.237	7.851	-7.2%	-2.3%
2015	5.911	0.886	7.723	-6.8%	-3.5%
2016	6.234	0.836	7.948	-6.1%	-3.1%
2017	6.717	0.708	8.173	-5.0%	-2.5%
2018	6.945	0.895	8.567	-5.3%	-2.4%
2019	6.966	0.788	8.813	-5.8%	-3.3%
2020	6.238	0.791	9.211	-9.6%	-7.0%



2. On average, local public debt and foreign public debt have maintained their respective ratios to each other constant. Local public debt constitutes around 57 percent of total public debt (Figure 2B).

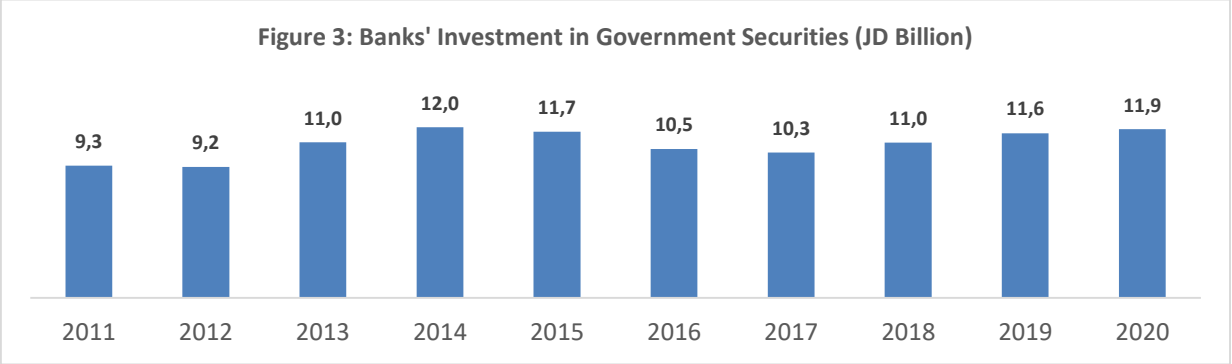


3. Based on the World Bank's database, the largest (smallest) banking sector, in terms of credit to the private sector to GDP ratio, is in Hong Kong (Afghanistan). In Jordan domestic credit by banks to GDP ratio is equal to 76.0 percent. This ratio is below the overall mean (81.3), and equal to the median (76.1 percent). Among Arab banking sectors, in Lebanon, Kuwait, and Qatar only, credit to GDP ratio is higher than in Jordan.

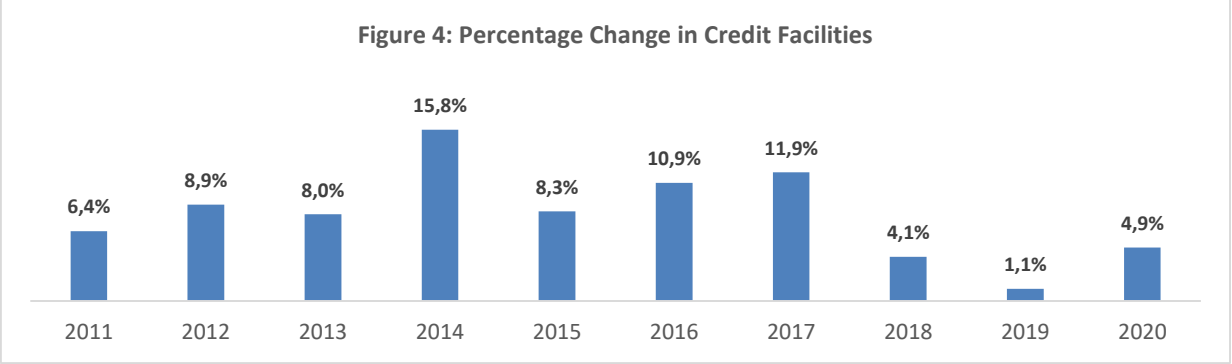
Table 2: Domestic Credit to Private Sector by Banks (% of GDP)

Country	Ratio	Country	Ratio	Country	Ratio
Afghanistan	3.4%	Morocco	62.9%	Lebanon	101.9%
Iraq	8.9%	Turkey	63.6%	France	102.2%
Sudan	9.5%	Tunisia	66.9%	Spain	102.3%
Tanzania	12.5%	Oman	73.5%	Japan	107.6%
Pakistan	17.9%	UAE	75.8%	Singapore	120.4%
Romania	25.6%	**Jordan**	**76.0%**	Sweden	131.9%
Egypt	26.0%	Italy	76.3%	UK	133.7%
Ireland	40.8%	Germany	78.3%	South Korea	143.1%
India	49.7%	Chile	82.0%	Cyprus	147.7%
USA	52.1%	Qatar	87.0%	China	159.4%
Saudi Arabia	54.0%	Finland	93.9%	Denmark	160.9%
Georgia	59.6%	Kuwait	94.0%	Hong Kong	226.3%
Mean			**81.3%**		
Median			**76.1%**		

4. It is clear that the involvement of the 13 listed Jordanian conventional banks in financing public spending has been increasing. These banks have increased their portfolio of government securities (treasury bills and bonds) from JD 9.3 billion in 2011 (Figure 3) to JD 11.9 billion in 2020 (about $17 billion). It is interesting to note that the Jordanian capital market (Amman Securities Exchange / ASE) has no secondary market for the treasury bills and bonds that the government issues. These securities are bought by licensed banks and the Jordan Social Security Corporation only. Once bought, they are held until maturity.



5. Since the 2011 financial year, the percentage change in the banks' credit to the private sector has fluctuated between 1.1 percent and 15.8 percent (Figure 4). It is worth noting that 2020 witnessed an increase of 4.9 percent, and this is higher than the 2019 increase (1.1 percent).



Below, we present some descriptive statistics about the dependent and independent variables, and present and discuss the empirical estimation results of model 1.

1. During the period 2011-2020, the annual credit to the private sector and bank deposits increased by 8.0 percent and 6.6 percent respectively. On average, the mean annual ratio of banks' investment in government securities to total credit facilities to the private sector (Bonds) is equal to 23.1 percent. Interestingly, the maximum value of this ratio is equal to 36.6 percent. In other words, in a given year, one bank's lending to the government 36.6 percent of its lending to the private sector. The income diversification of our sample of bank reveal some significant differences. Again the minimum and maximum ratios of net commission income to interest income minus interest expense are equal to 18.8 percent and 76.8 percent respectively.

Table 3: Dependent and Independent Variables / 2011-2020: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Deviation
Credit Growth	0.080	0.056	0.850	-0.194	0.126
Deposit Growth	0.066	0.037	0.583	-0.208	0.123
Bonds	0.231	0.220	0.366	0.017	0.224
Diversification	0.200	0.188	0.768	0.008	0.082
Equity	0.071	0.071	0.209	0.022	0.032
Size	21.589	21.493	24.026	19.704	0.914
GDP	0.019	0.022	0.034	-0.016	0.014
Inflation	0.024	0.033	0.049	-0.011	0.022

2. As expected, the impact of deposit growth on credit growth is positive and significant. The coefficients of this independent variable are consistently positive and significant in all of the five estimated versions.

3. The impact of banks' lending to the government, in the form of government securities, is negative and significant, and in all estimated versions. The values of this coefficient are equal to -0.037, -0.033, -0.039, -0.033, and -0.032.

4. The impact of capitalization (equity capital to total assets) on bank credit is not significant. From the literature, one can expect either a positive or a negative impact. For example, Berger and Bouwman (2009) argue that shareholders

tend to be reluctant to offer more loans when they invest more equity capital in their banks. The impact of capital on bank lending can be positive because higher capital enhances the capacity of banks to lend more (Coval and Thakor, 2005).

5. It is surprising that the impact of bank size on credit growth is negative and significant. However, this is probably due to the fact that smaller banks seek growth, and hence tend to lend more.

Table 2: Determinants of Credit Growth: 2011-2020

Variable	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
	(1)	(2)	(3)	(4)	(5)
C	0.047*	0.073*	0.065*	0.426*	0.425*
Deposit Growth	0.714*	0.710*	0.714*	0.718*	0.709*
Bonds	-0.037*	-0.033*	-0.039*	-0.033*	-0.032*
Diversification		-0.131*	-0.119*	-0.095*	-0.093*
Equity			0.109	-0.291	-0.201
Size				-0.016*	-0.016*
GDP					0.454
Inflation					-0.206
Adj. R^2	0.867	0.934	0.887	0.904	0.913
F-statistic	422.643*	611.461*	254.854*	244.720*	195.143*
D-W Statistic	1.966	1.919	1.882	1.919	1.926
* and ** imply significance at the 99 and 95 percent levels respectively.					

6. As far as the macroeconomic variables are concerned, while one would expect economic growth to result in more demand for credit by businesses and households (Arestis and Demetriades, 1997), this does not seem to be the case in Jordan. Similarly, the impact of inflation on credit is not significant. Similarly, while one would expect banks to reduce credit during inflationary periods (Huybens and Smith, 1999), this is not so in this case.

4. SUMMARY AND CONCLUSIONS

The Ministry of Health confirmed the first corona case in Jordan on 2 March 2020. In less than one year, and as result of the lockdown measures, and fall in economic activity, the government has felt the pressure. Indeed, the 2020 budget deficit widened, and public debt has become more than 100 percent of GDP.

Eventually, Jordan (and the world) will be free of COVID-19, and economic activity will return to normal. What is not normal, however, are the consistent budget deficits, reliance on foreign grants, and rising public debt, well before the virus. The virus has only heightened the urgency for reform (public finance).

The government must use COVID-19 as a "trigger point" for change in its fiscal space. It should examine the reasons behind the consistent budget deficits (spending and revenue sides) and adopt measures to lessen this problem. Within this context, the findings of this paper indicate that the impact of public borrowing on bank credit to the private sector is significant and negative. This is another reason why the government should fix its finances.

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VALUE INVESTING ANALYSIS OF BANKING SECTOR ON BIST-100

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ABSTRACT

Purpose- The main goal of this study is to apply the value investing criteria to a selected portfolio and to test the validity of basic value investment hypothesis. The return performance of the selected portfolio was examined over the other bank stocks in addition to assessing the risk and return criteria (Sharpe Ratio). The efficient ratio (Price/Book Value vs Price/Earnings ratios) in the formation of the selected portfolio is further explored. The paper aims to prove the existence of margin over P/B Value and P/E ratios to the banking sector in Turkey.
Methodology- A universe of 6 banks (3 state and 3 private) trading in BIST-100 were selected within the framework of this analysis. BIST-100, MATRIKS DATA™ database was used to compile data for six selected banking stocks, for the 95 months period between February 2011 to December 2018. The performance of the selected portfolio was benchmarked over the control portfolio for the relevant financial year.
Findings- In line with the results of the analysis and as observed in developed markets, the value investing strategies implemented for the selected banking shares listed in BIST-100, offer significantly high returns to the investors. Consequently, an investing strategy grounded on P/E ratio is more profitable than a value investing strategy relying on P/B ratio. The study thus demonstrates that the shares selected within the framework of the value investing concept garner superior returns compared to benchmark portfolio.
Conclusion- As observed in developed markets, the value investing strategies implemented for the selected banking shares listed in BIST-100 results in significantly high returns for the investors. An investing strategy grounded on P/E ratio is therefore more profitable than a value investing strategy relying on P/B ratio.

Keywords: Value investing, Price/Book value, Price/Earnings ratio, selected portfolio, benchmark portfolio.
JEL Codes: C87, G10, G11

1. INTRODUCTION

The basic concept of Value Investing is "Buying a business for far less than it is worth" (Browne, 2007), and it has gained prominence as an investment philosophy since the early 1930's. It is based on two principles: 1) Intrinsic value and 2) Margin of safety. Value investing consists of finding and buying securities that are priced below their intrinsic value.

Value investing strategies date back to the studies of Benjamin Graham and David Dodd (1934), premised on the idea of investing into undervalued but profitable shares. They proposed a clear definition of investment that is distinguished from what they deemed as speculation; "An investment operation is one which, upon thorough analysis, promises safety of principal and an adequate return. Operations not meeting these requirements are speculative". Klarman (1991) describes value investing as the investment strategy with a priority to deploy capital into undervalued stocks and to retain them until they reach intrinsic value, and the key point of the strategy is to invest into bargain and overlooked shares.

Applying the stock analysis method to the concept of value investing assists in determining a stock's real value at the time of purchase of the stock whose current share price is below its genuine value or worth. The theory is applicable to various markets and periods, though the market realization remains highly controversial. Contrary to the basic notion of Efficient Market Theory which posits that the price of a share reflects all the available information about the intrinsic value of the

share; it can be proven that a premium margin exists between the trading value and the intrinsic value. The focus of behavioural finance studies weighs heavily on the application of theories to reveal this disparity.

The aim of this study is to prove the existence of this margin over Price/Book Value and Price/Earnings ratios in the banking sector in Turkey. To achieve this, the value investing criteria were applied to a selected portfolio to test the validity of the basic value investment hypothesis. The return performance of the selected portfolio was examined over the other bank stocks whilst evaluating the risk and return criteria (Sharpe Ratio). Furthermore, the efficient ratio (P/E vs P/B) in the formation of the selected portfolio is explored.

The analysis is based on P/E and P/B ratios considered as the basic multiples for the value investment strategy. Two different software were used for data processing in the study. MS EXCEL™ was used for portfolio selection, performance comparison and metric measurements. STATA™ 13.0 statistical data processing program was used for data modelling. One state and one private bank shares with the lowest P/E multiple were selected at the end of each financial year. The performance of the selected portfolio was benchmarked over the control portfolio for the relevant financial year.

The following section of this paper provides a literature review on value investing method and its application on different stock markets. Besides the data provided, the scope of the analysis and methodology are explained in Section 3, and Section 4 comprises of the findings and presents a brief conclusion of the study.

2. LITERATURE REVIEW

The considered positions of Bellone and Carvalho (2021) concerning "valuations of value stocks" spreads in relation to "their most expensive peers" are: (1) of complete regional and macro-sectors expansion, circa 2020. (2) Levels of value spreads compared with high favourability to the 2000, "Tech Bubble". (3) Compression of value spreads is projected forward with high probability, on the basis of 2001 value spreads peak. The conclusion Bellone and Carvallo draw when they categorically state the followings supports the findings established in "Value Investing Analysis of Banking Sector on BIST-100": "Value stocks are simply as cheap, relatively speaking, as they have ever been while the opposite is the case for expensive stocks. While irrational exuberance can be sustained or even extended for some time longer, compression of value spreads over the next few years is the more likely scenario. That should be positive for value stocks, small capitalization stocks and for diversified multifactor investing approaches." (Bellone and Carvalho, 2021).

Their stated positions above support the overriding prognosis of this paper in line with the results of the analysis observed in developed markets, that the value investing strategies implemented for the selected banking shares listed in BIST-100, have offered significantly high returns to the investors; Bellone and Carvalho expanded their perspective to caution against value investing capitulation as a probable "costly decision".

Blitz and Hanauer (2020) conclusion is in alignment with this study when they confirmed that: "Based on these results {they} conclude that {their} various enhancements to the standard value factor are effective at resurrecting the value premium. In other words, they resurrected the value premium". Their underlying rationale which reviewed "the valuation spread" of the nineties, based on a "mean-reversion of the year 2000 "valuation spread" resulted in what is described as "massive outperformance of value stocks over the growth stocks". Taken together with their further observations such as the establishment of "a significant positive relation between valuation spreads and the future value premium" by the other researchers of their citation and the interconnectedness with the "net spread widening" which happened over their sample periods - The divergence of "valuation multiples between value and growth stocks" – their inconsistence in the buying and selling of shares using arbitrage when significant amount of money has been "invested in value strategies" are disposed towards the raising of "the value premium." (Blitz and Hanauer, 2020).

Sharpe et al. (1993) conducted a research to compare the performance of value and growth shares in six developed markets including France, Germany, Switzerland, England, Japan, and USA. They select the P/B ratio to determine the portfolio of value and growth shares. The findings of their research demonstrate that the prominence of value-growth factors in the markets and the value shares offer superior performance than growth shares in all markets during the analysis period.

Lakonishok et al. (1994) examined the underlying reasons for the stronger returns offered by the value investing strategies to exemplify the controversial approach versus the conventional investment strategies adhered to by the bulk of the investor community.

Covering 21 stock exchanges including USA, Europe, Australia, and the Far East over the period between 1975-1995 and based on Price/Earnings, Price/Book, Cash Flow/Price and Dividend/Price ratios and the value stocks, the study conducted by Fama and French (1998) reveals that higher returns are obtained in comparison to growth stocks in all stock exchanges under

review. Furthermore, Price/Book ratio performance of value stocks surpasses similar performance of growth stocks in 12 out of 13 leading stock exchanges.

Håkansson and Kvarnmark (2016) investigated whether the 'magic formula' can yield superior investment returns depending on the risk taken. The concept of magic formula introduced by Joel Greenblatt, describes a systematic approach to successful stock investing. To examine the potential relation between the magic formula and superior investment returns, they tested the formula on the Nordic Stock Market between 2007 and 2016 and compared the returns of the portfolio to the benchmark OMX Nordic 40. They apply the Capital Asset Pricing Model together with the Fama-French Three-Factor Model to determine how the portfolio yields high returns in relation to each unit of risk. They reveal that although the magic formula portfolio was significantly less diversified than the OMX Nordic 40, it had performed better during the setback of 2008 and 2009.

The study conducted by Piotroski (2000) demonstrates that the firms with higher Return on Asset (ROA) and operational cash flows, better profit margins, higher asset turnover ratios; produce higher returns. Piotroski proposes a compound F-Score using eight basic indicators related to firm performance. The study demonstrates that the high performing shares are recognized better in a large group of shares having the lowest P/B ratios.

In another analysis, Mohanram (2005) confirmed the companies with higher P/B called 'growth shares' perform better than the other stocks.

Gönenç and Karan (2003) compared the returns between value shares to growth shares as well as small-scale portfolios to large-scale portfolios in Borsa Istanbul (BIST). Covering 1993-1998, value and growth stocks were selected in relation to P/B ratio, taken as sampling in the study. The results present superior performance of growth portfolios to value portfolios, which are highly unpredictable in developing markets.

Karcıoğlu (2017), analysis of 'value based portfolios' in three different periods covering 1996-2007, 2000-2011 and 2004-2015 supports the study's assessment that the efficiency of value investing strategies in different types of market conditions yield stronger returns in BIST relative to the returns observed in developed markets. Tripling of profitability in case of a longer duration is further reiterated. Based on an extensive data analysis, Srivastava, and Lev (2019) "show that value investing has generally been unprofitable for almost 30 years, barring a short resurrection following the dotcom bust." They "identify two major reasons for the failure of value investing: (1) accounting deficiencies causing systematic misidentification of value and particularly of glamour (growth) stocks, and (2) fundamental economic developments which slowed down significantly the reshuffling of value and glamour stocks (mean reversion) which drove the erstwhile gains from the value strategy." This research provides identification of the type of companies (stocks) that may still generate gains from value investing.

Lee (2014) reviews the theoretical foundations of value investing model, including (a) a noise trader framework for understanding that phenomenon and (b) an accounting-based valuation framework for reconciling the vast empirical evidence. He also evaluates the investment approaches of some well-known fundamental investors. He claims accounting information can help evaluate not only the first moment of a firm's future cash flows (i.e., the numerator of the future payoffs) but also its second moment (i.e., the riskiness of these payoffs). According to the author, as valuation theory shows, both elements are useful in evaluating the present value of a firm's future growth opportunities. Lee (2014, p.32) finally highlights buying "quality firms at reasonable prices and using historical-based accounting numbers to help investors achieve that task": It provides them an edge in their investing and help make markets more efficient as well.

Sareewiwatthana (2014) examines the concept of value investing, whereby PE, PEG, and PERG ratios are used for stock screening. The author concludes portfolios of low PERG using Standard Deviation as risk proxy provide better performances and PE displays the best screening, offering the highest returns during the period tested.

3. DATA AND METHODOLOGY

3.1. Purpose of Study

The main goal of this study is to apply the value investing criteria to a selected portfolio and to test the validity of basic value investment hypothesis. The study examines the return performance of the selected portfolio over the other bank stocks in cognizance of the risk and return criteria (Sharpe Ratio). In addition, the efficient ratio (P/E vs P/B) in the formation of the selected portfolio was explored.

3.2. Scope of the Analysis and Methodology

Graham (1949) proposes selection criteria based on firm's historical performance and financial standing to facilitate investment strategies of conservative investors. These criteria are as follows:

1. Business Scale: The aim of this criterion is to eliminate small businesses more vulnerable to market fluctuations.
2. Financial Adequacy: Current ratio should be 2x at minimum and long-term liabilities should not exceed net current assets. Additionally, the total indebtedness should not be above twice the book value for service companies.
3. Sustainable Profitability: The selected company should have recorded profits over the past 10 years.
4. Dividend History: The selected company should have constantly distributed dividends for the last twenty years.
5. Earnings Growth: Based on the last 10 years data, the average earnings per share (EPS) of the last 3 years should be compared to the average EPS of the first 3 years and EPS should have increased by 1/3.
6. Price/Earnings (P/E) Ratio: Current market price should not exceed 15x of the average profit of the last 3 years.
7. Price/Assets Ratio: Current market price should not exceed 1.5x of the latest book value. P/E x P/B ratio should remain below 22,5x as a rule.

In consideration of the fact that each sector has different business dynamics and financial ratios and for the sake of the analysis only shares from the banking sector have been selected. Banking sector is also a strong indicator of the macro backdrop and has a significant weight in BIST-100 Index. Homogeneous portfolio selection also secures to minimize the magnitude of standard deviations.

The analysis was based on P/E and P/B ratios considered as the basic multiples for the value investment strategy. The stocks were classified by their monthly P/E ratios[1]. BIST-100, MATRIKS DATA™ database was used to compile data for six selected banking stocks, for the 95 months period between February 2011 to December 2018. One state and one private bank share with the lowest P/E multiple has been selected by the end of each financial year. The performance of the selected portfolio was benchmarked over the control portfolio for the relevant financial year. The performance is calculated as follows:

Return Formula,

$$R = \frac{V_f - V_i}{V_i}$$

V_f = Ending period value (Including dividends)

V_i = Beginning Period value

P/E and P/B Calculations

As provided below, P/E ratio is calculated by comparing the market price of the stock to earnings per share. P/B ratio is calculated by comparing the market price of the stock to the book value.

$$\frac{P}{E} Ratio = \frac{Price\ per\ Share}{Earnings\ per\ Share} \qquad \frac{P}{B} Ratio = \frac{Price\ per\ Share}{Book\ Value\ per\ Share}$$

3.3. Data Analysis and Portfolio Selection

Two different software were used for data processing in the study. MS EXCEL™ was used for portfolio selection, performance comparison and metric measurements. STATA™ 13.0 statistical data processing program was used for data modelling.

The P/E ratios for the analysis period are presented below:

Table 1: Yearly P/E Ratios

Average P/E Ratio	2011	2012	2013	2014	2015	2016	2017	2018
VAKBN	6.90	7.30	8.25	7.20	6.16	5.35	4.80	3.40
SKBNK	6.76	6.91	8.11	11.26	8.86	18.83	12.14	12.39
ISCTR	7.52	7.93	7.60	7.91	7.38	6.39	6.00	4.55
HALKB	7.22	8.12	7.70	6.98	6.86	4.70	4.99	2.85
GARAN	9.56	10.24	10.89	12.02	10.56	8.28	7.41	5.42
AKBNK	10.70	12.70	10.03	10.81	9.81	8.86	7.53	5.15

[1] P/E Ratio announced on the last day of the relevant month.

Table 1 lists the private and state bank shares with the lowest P/E ratios on the yearly basis. Each year the lowest values are highlighted by red colour for both state and private banks. These shares form the 'value portfolio' and the return performance of the value portfolio will be measured against the other banking shares classified as the 'control portfolio'.

For example, the shares with the lowest P/E in 2011 have been selected as the value portfolio and the portfolio's performance is measured in 2012.

In Table 2, selected state and private banks are presented on the lowest P/E base.

Table 2: State and Private Banks on the Lowest P/E Base

Value Stocks	2011	2012	2013	2014	2015	2016	2017	2018
Public	SKBNK	SKBNK	HALKB	HALKB	VAKBN	HALKB	VAKBN	HALKB
Private	ISCTR	ISCTR	ISCTR	ISCTR	ISCTR	ISCTR	ISCTR	ISCTR

3.4. Performance Analysis and Benchmarking of the Value Portfolio

Average rate of returns of Value Stocks portfolio are compared with three different groups of assets to benchmark their performance. Control stocks are the remainder of the banking stocks after the Value Stocks are selected. Risk Free Treasury Rate refers for the annual rate of return of the Treasury bills and BIST 100 index average annually returns are referred as BIST 100 in the Table below.

Average rate of returns for the seven-year period between 2012-2018 are presented in Table 3.

Table 3: Yearly Average Rate of Returns on Portfolio Basis

ARR of Portfolio	2012	2013	2014	2015	2016	2017	2018
Value Stocks	78.2%	-8.4%	48.7%	-33.5%	16.4%	9.6%	-44.5%
Control Stocks	48.6%	-24.4%	38.3%	-23.4%	-3.5%	36.4%	-34.2%
Risk Free Treasury Rate	8.7%	8.0%	9.3%	9.3%	10.2%	11.1%	15.9%
Bist 100	45.2%	-11.3%	25.8%	-16.7%	9.9%	41.2%	-21.5%

Cumulative Returns of a 100-unit investment of Value Stocks vs Control, 10-Years Bond, BIST-100 for the end of 7 years are as follows:

Figure 1: Annual Returns of Value Stocks, Control Stocks, 10-Years Bond, BIST-100

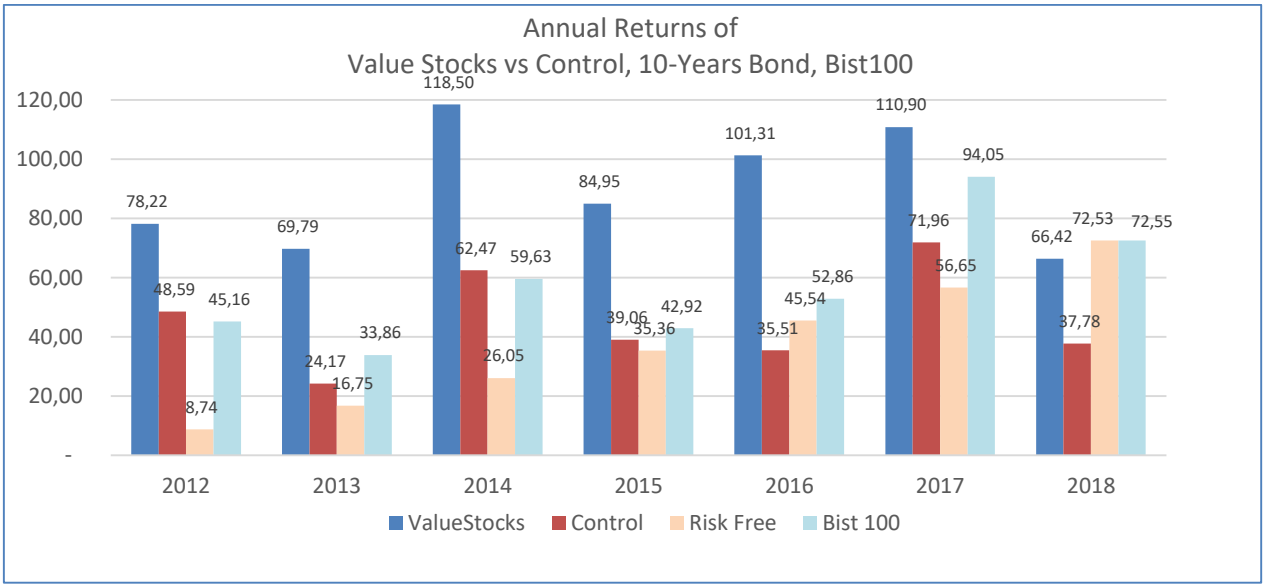

Table 4: Cumulative Return Index of Value Portfolio and Other Portfolios

Cumulative Returns Index	2012	2013	2014	2015	2016	2017	2018
Value Stocks	78.22	69.79	118.50	84.95	101.31	110.90	66.42
Control	48.59	24.17	62.47	39.06	35.51	71.96	37.78
Risk Free	8,74	16.75	26,05	35.36	45.54	56.65	72.53
Bist 100	45.16	33.86	59.63	42.92	52.86	94.05	72.55
Value vs Control %[2]	61.0%	188.7%	89.7%	117.5%	185.3%	54.1%	75.8%

According to the analysis;

1. Value portfolio has recorded higher returns relative to control portfolio in 2012, 2013[3], 2014 and 2016.
2. The cumulative return of the value portfolio has outperformed the control portfolio by 110%. (Value portfolio/Control portfolio – 1)
3. The banking sector shares have underperformed BIST-100 shares in 2018.

Value portfolio has lost its value by more than 2x than the market average in 2018. This performance leads to the idea of a Value Trap[4] that could occur in bear market conditions; however, the reliability of this argument needs to be tested in longer periods.

Fama and French (1992) have explained the major underlying driver of superior performance of value strategies with their higher risks. The investors receptive to invest into shares with lower P/E are awarded for the associated risks. (Pätäri & Leivo :2009).

Sharpe ratios of the portfolios have been presented in Table 5 in order to calculate risk and return sensitivity.

Table 5: Value Stocks - Sharpe Ratios on Portfolio Basis – Yearly

Sharpe Ratio	2012	2013	2014	2015	2016	2017	2018
Value Stocks	7,94	(2.28)	3,86	(6.32)	1,10	(0.14)	(5.88)
Control	4,32	(3.47)	2,98	(4.48)	(2.01)	2,98	(4.23)

As per the above-mentioned data, the value portfolio has recorded higher Sharpe Ratios during the years of positive returns (2012, 2013, 2016, excluding 2017) relative to the control portfolio. It is evident that our value portfolios provide higher returns compared with their risks.

3.5. Data Analysis for Growth Shares and Portfolio Selection

As commented earlier, P/E and P/B ratios were distinguished as the key multiples for value investing and investors seek lower P/E and P/B ratios. A similar analysis and methodology were applied to the growth portfolios comprised of growth shares with lower P/B ratios. The yearly P/B ratios as per the analysis, are presented in Table 6.

Table 6: Price/Book Ratios – Yearly

Average P/B Ratio	2011	2012	2013	2014	2015	2016	2017	2018
VAKBN	0.97	0.92	1.04	0.88	0.74	0.64	0.75	0.52
SKBNK	0.74	0.74	0.98	0.97	0.79	0.60	0.61	0.62

[2] *Average %110.*

[3] Lower loss.

[4] Value trap is a stock perceived to be cheaply priced because it has been trading at low valuation metrics and multiples such as profits, cash flows and P/B for an extended time period. These stocks receive interest from investors because they are considered as cheap relative to their historical valuation of the shares and relative to their peers. The value trap presents itself as the stock price continues to decline after the investor buys into the shares.

ISCTR	1.20	1.16	1.15	1.00	0.85	0.66	0.81	0.57
HALKB	1.87	1.80	1.64	1.21	0.90	0.58	0.66	0.36
GARAN	1.77	1.64	1.61	1.42	1.28	1.01	1.09	0.85
AKBNK	1.64	1.55	1.53	1.35	1.20	1.12	1.09	0.77

Table 7 represents the lowest P/B ratios by each public and private banks.

The growth stocks portfolios are conducted by the picked public and private banks are as seen in the below table.

Table 7: Growth Shares – Yearly

Growth Stocks	2012	2013	2014	2015	2016	2017	2018
Public	SKBNK	SKBNK	SKBNK	VAKBN	VAKBN	HALKB	SKBNK
Private	ISCTR	ISCTR	ISCTR	ISCTR	ISCTR	ISCTR	ISCTR

3.6. Performance Analysis and Benchmarking of the Growth Portfolio

Average rate of returns of growth Stocks portfolio were benchmarked against three different asset groups for performance evaluation. Control stocks cover the banking stocks not included in the value stocks. Risk Free Treasury Rate refers to the annual rate of return of the Treasury bills and BIST 100 index average annual returns are referred to as BIST 100 in the Table below. Average rate of returns of growth portfolio and other portfolios are provided below:

Table 8: Average Rate of Returns on Portfolio Basis

ARR of Portfolio	2012	2013	2014	2015	2016	2017	2018
Growth Stocks	78.2%	-8.4%	34.0%	-33.2%	16.4%	9.6%	-41.1%
Control	48.6%	-24.4%	45.7%	-23.6%	-3.5%	36.4%	-35.9%
Risk Free	8.7%	8.0%	9.3%	9.3%	10.2%	11.1%	15.9%
Bist 100	45.2%	-11.3%	25.8%	-16.7%	9.9%	41.2%	-21.5%

Figure 2: Cumulative Return Index of Growth Portfolio and Other Portfolios

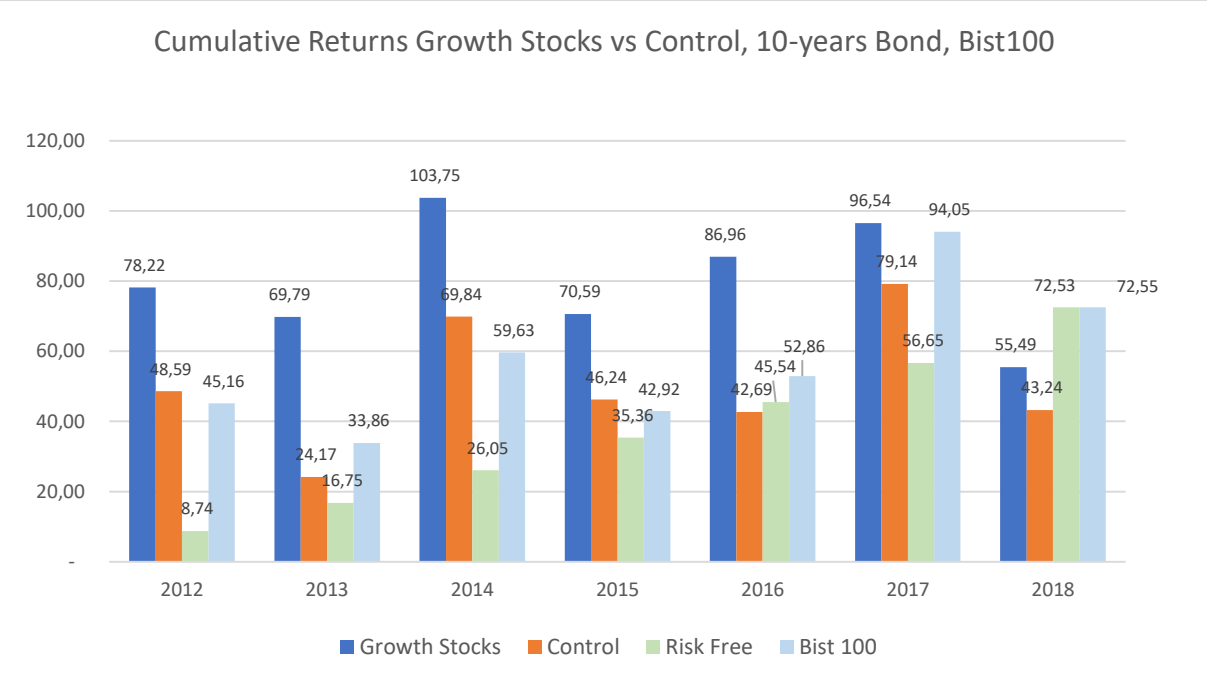

Table 9: Cumulative Return Index of Growth Portfolio and Other Portfolios

Cumulative Returns Index	2012	2013	2014	2015	2016	2017	2018
Growth Stocks	78.22	69.79	103.75	70.59	86.96	96.54	55.49
Control	48.59	24.17	69.84	46.24	42.69	79.14	43.24
Risk Free	8.74	16.75	26.05	35.36	45.54	56.65	72.53
Bist 100	45.16	33.86	59.63	42.92	52.86	94.05	72.55
Growth vs Control %	61.0%	188.7%	48.5%	52.7%	103.7%	22.0%	28.3%

Table 10: Sharpe Ratios - Growth Stocks – Yearly

Sharpe Ratio	2012	2013	2014	2015	2016	2017	2018
Growth Stocks	7.94	(2.28)	2.58	(5.47)	1.10	(0.14)	(4.76)
Control Stocks	4.32	(3.47)	3.62	(4.83)	(2.01)	2.98	(4.70)

As illustrated by the graphs and tables above, value investing portfolios have provided higher returns than growth investing portfolios.

3.7. Mathematical Modelling of Value Shares and Growth Shares

Besides the basic portfolio performance calculations, multivariable panel data regression modelling to elaborate the results and test the hypothesis in mathematical modelling was also applied.

Cross-sectional and time series which are two dimensions of panel data when regressed differs as a model from an OLS regression due to the information it makes available with respect to individuals and over time. Below is described the basic model of panel data;

$$y_{it} = \alpha_i + \sum_{k=1}^{k} x_{it} \ .\beta_{kit} + \varepsilon_{it}$$

Where:

i = 1…,N, N is the number of cross-sectional dimension (or individuals);

t = 1,…,T, T is the number of time dimension (or period).

Although, several panel data types are accessible; usually, fixed and random effects models are the ones mostly applied in analyses. However, in this study, only the fixed effects model was engaged and validated through estimation. Since the estimation by which the OLS (Ordinary Least Squares) hypotheses were conducted and were premised on the notion that the regression model is the same for both panel data and linear regression. (Bălă & Prada, 2014).

The value portfolios and growth portfolios were designed and conducted for 7 years, in a row, in the study. Then the dummy variables which refer to both value stocks (Appendix I) and growth stocks (Appendix II) were applied to the model. The endeavour was to measure if the selected portfolios are outperforming the control group by calculating the coefficients of the dummy variables in the model. The analysis concludes that, a value portfolio which comprised of banking stocks that have been selected on **Price-to-Earning** criteria, outperforms the Control Group by ~%15.

```
-------------------------
     lnClose |      Coef.
-------------+-----------
          FK |   .0032365
       lnPDDD |   .1869638
        DOSK |   .0023803
     Private |          0
       value |   .1499873
       _cons |    1.50748
             '
```

The analyses reveal similar results for growth stocks. The growth stocks selected on Price-to-Book criteria, outperforms the Control Group by ~%9.8.

lnClose	Coef.
FK	.0006442
lnPDDD	.1874643
DOSK	.0025554
Private	0
Growth	.0976227
_cons	1.542349

The four types of variation produce R Square results which when observed shows the impact is less strong to the desired R2= .29 for Value Stocks and R2 = .20 for growth stocks, respectively. Yet, since refinement of the model is permissible through additional variables which correlation becomes essential for the in-between variation, meaning there is a major effect of value stocks and growth stocks on portfolio performances.

To rely on the data and analysis of Appendix I&II, it was also required to test heteroskedasticity in cross-sectional time series whether our data was stationary and **not** obviously following a trend which drags the variance of the serial and exhibit the results that the null hypothesis of a unit root can be rejected. Accordingly, to test statistics, we applied Dickey-Fuller Test (a Fisher Type Test) as seen **(Appendix III)** to our data. With using 0 lags of "log of closing prices", it can be rejected that the null hypothesis of data has a unit root assumption at common statistically significant levels. Thus, it was concluded that the data series of "log of closing prices" are being stationary for using statistical modelling methods under the assumption of ***(p < 0.05)*** confidence level.

4. DISCUSSION AND CONCLUSION

As a contribution to the literature on BIST, Turkey, the study's evidence that value portfolio lost its value by more than 2x than the market average in 2018, indicating a value trap that could occur in bear market conditions; the reliability of the argument advanced by the study could further benefit from being tested for longer periods. Moreover, in relation to the results that are given to the R Square for the four variation types with the observation of a correlation less strong than the desired R2 =.29 for Value Stocks and R2 = .20 for growth stocks; the model can be refined through an addition of more variables in relation to the major effect of value stocks and growth stocks on portfolio performances. The analysis is based on P/E and P/B ratios considered as the basic multiples for the value investment strategy. The stocks were classified by their monthly P/E ratios. BIST-100, MATRIKS DATA™ database was used to compile data for six selected banking stocks for the 95 months period between February 2011 to December 2018. One state and one private bank share with the lowest P/E multiple have been selected by the end of each financial year. The performance of the selected portfolio was benchmarked over the control portfolio for the relevant financial year.

In line with the results of the analysis and as observed in developed markets, the value investing strategies implemented for the selected banking shares listed in BIST-100, have offered significantly high returns to the investors. An investing strategy grounded on P/E ratio is more profitable than a value investing strategy relying on P/B ratio. The results of the study have indicated that selected shares referred to the value investing concept have yielded superior returns compared to benchmark portfolio. It is observed that the value stocks portfolio has provided a higher return (%15) than the growth stocks portfolio (%9,8). As a reservation, such an investment strategy could increase risks in bear markets and could mislead investors to value traps thus risk averse investors should have a cautious approach to follow value investing strategies in adverse market conditions.

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APPENDIX I: Value Stocks Multivariable Regression Mode

. xtreg lnClose FK lnPDDD DOSK Private value, fe
note: Private omitted because of collinearity

Fixed-effects (within) regression		Number of obs	= 594
Group variable: Bank_ID		Number of groups	= 6
R-sq: within = 0.1429		Obs per group: min	= 99
between = 0.2908		avg	= 99.0
overall = 0.1138		max	= 99
		F(4,584)	= 24.34
corr(u_i, Xb) = 0.2186		Prob > F	= 0.0000

lnClose	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]

```
-------------+----------------------------------------------------------------
          FK |   .0032365   .0040097     0.81   0.420    -.0046387    .0111116
      lnPDDD |   .1869638   .0290911     6.43   0.000     .1298279    .2440997
        DOSK |   .0023803   .0021756     1.09   0.274    -.0018928    .0066533
     Private |          0  (omitted)
       value |   .1499873   .0254973     5.88   0.000     .0999097    .2000649
       _cons |    1.50748   .0446244    33.78   0.000     1.419836    1.595124
-------------+----------------------------------------------------------------
     sigma_u |  .68471442
     sigma_e |  .20816592
         rho |  .91539272   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5, 584) =   643.96           Prob > F = 0.0000
```

A fixed-effect multiple regression model was run to predict natural log (ln) value of Shares Closing Price's (lnClose) from Price-to-Equity (FK), ln Market-to-Book ratio (lnPDDD), Return-on-Equity (DOSK), Value Stocks (value) as dummy variable. These variables statistically significantly predicted lnClose, $F(4, 584) = 24.34$, $p < .0005$, $R2 = .29$ (between).

APPENDIX II: Growth Stocks Multivariable Regression Model

```
. xtreg lnClose FK lnPDDD DOSK Private Growth, fe
note: Private omitted because of collinearity

Fixed-effects (within) regression           Number of obs      =       594
Group variable: Bank_ID                     Number of groups   =         6

R-sq:  within  = 0.1127                     Obs per group: min =        99
       between = 0.2076                                    avg =      99.0
       overall = 0.0756                                    max =        99

                                            F(4,584)           =     18.54
corr(u_i, Xb)  = 0.1680                     Prob > F           =    0.0000

------------------------------------------------------------------------------
     lnClose |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          FK |   .0006442   .0040385     0.16   0.873    -.0072876    .0085759
      lnPDDD |   .1874643   .0296131     6.33   0.000     .1293032    .2456254
        DOSK |   .0025554    .002215     1.15   0.249     -.001795    .0069057
     Private |          0  (omitted)
      Growth |   .0976227   .0265402     3.68   0.000     .0454969    .1497484
       _cons |   1.542349   .0449971    34.28   0.000     1.453974    1.630725
-------------+----------------------------------------------------------------
     sigma_u |  .69252946
     sigma_e |   .2118049
         rho |  .91446163   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(5, 584) =   580.94           Prob > F = 0.0000
```

A fixed-effect multiple regression model was run to predict natural log (ln) value of Shares Closing Price's (lnClose) from Price-to-Equity (FK), ln Market-to-Book ratio (lnPDDD), Return-on-Equity (DOSK), Growth Stocks (Growth) as dummy variable. These variables statistically significantly predicted lnClose, $F(4, 584) = 18.54$, $R2 = .20$ (between).

APPENDIX III

. xtunitroot fisher lnClose, dfuller lags(0)
(2 missing values generated)

Fisher-type unit-root test for lnClose
Based on augmented Dickey-Fuller tests

Ho: All panels contain unit roots Number of panels = 6
Ha: At least one panel is stationary Number of periods = 99

AR parameter: Panel-specific Asymptotics: T -> Infinity
Panel means: Included
Time trend: Not included
Drift term: Not included ADF regressions: 0 lags

		Statistic	p-value
Inverse chi-squared(12)	P	18.8214	0.0929
Inverse normal	Z	-1.7400	0.0409
Inverse logit t(34)	L*	-1.6581	0.0533
Modified inv. chi-squared	Pm	1.3924	0.0819

P statistic requires number of panels to be finite.
Other statistics are suitable for finite or infinite number of panels.

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THE PERFORMANCE OF BANKS IN A DEVELOPING COUNTRY: HAS COVID-19 MADE ANY DIFFERENCE?

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ABSTRACT

Purpose- The full implications of COVID-19 are yet to be seen. However, it has become clear that the virus has hit the supply and demand sides of economies, impacted banks and stocks markets, and led to significant decreases in the global flows of capital. Within this context, the purpose of this paper is to report on the performance of Jordanian banks in 2020, and examine the determinants of their performance.
Methodology- To realize the objectives of this paper, the performance of all listed Jordanian banks (13) during the period 2010-2020 is examined in terms of return on assets (ROA) and net interest margin (NIM). Using the Seemingly-Unrelated Regression (SUR), the dependent variables (ROA and NIM) are regressed on independent variables that include equity capital, bank expenses, size, income diversification, loan loss provisions, lending to the government, and economic growth.
Findings- The 2020 financial statements show that the profits of Jordanian banks (return on assets) have decreased from 1.43 percent in 2019 to 0.74 percent in 2020, or by about 48 percent. As far as the econometric results are concerned, it is interesting to note that while loan loss provisions impact bank profitability in a negative and significant manner, this "cost" is passed-on, at least partly, to bank customers in the form of wider costs of financial intermediation (NIM).
Conclusions- While the known determinants of bank performance are applicable to the Jordanian banks, it is encouraging to note that these banks have managed to finish their 2020 financial year in a good shape. Indeed, this is the result of their strong financial positions that enabled them to increase their loan loss provision by large proportions.

Keywords: Jordan; Banks; Profitability; Net Interest Margin; Bank Size; Seemingly-Unrelated Regression.
JEL Codes: G20, G21, G24.

1. INTRODUCTION

The role of banks and stocks markets has led to, not only the publication of some theoretical models, and numerous applied research papers, but also resulted in academic contention. Well-known figures in economics like Bagehot (1873), Schumpeter (1912), Robinson (1952), and Lucas (1952) could not agree on the importance of finance per se. These disagreements, notwithstanding, the fact remains that banks and stock markets encourage and pool savings, allocate capital, monitor investments, helps investors in the management of the risk of their portfolios, and others (Levine, 2004).

Banks across the globe, have been investigated in terms of many aspects. Among others, these include the determinants of the performance of banks (i.e. accounting profit, net interest margin), determinants of credit growth, measurement and determinants of bank competition, determinants of non-performing loans, impact of bank competition on the stability of financial systems, determinants of banks' capital, and the impact of foreign banks on the performance / behavior of local banks.

It is unfortunate that COVID-19 has proved to be a human and economic tragedy. In economic terms, however, the virus has impacted, not only the demand and supply sides of the affected economies, but also their financial systems, and the global flows of capital, including remittances and Foreign Direct Investment (FDI).

The Jordanian economy, like many others across the globe, has been impacted by COVID-19. Within this context, the primary objective of this paper is to report on the 2020 performance of Jordanian banks relative to previous years, and to examine the determinants of their return on assets and net interest margin.

The rest of the paper is composed of three sections. Section 2 contains a review of the literature which examines the determinants of bank performance in terms of return on assets and net interest margin. In section 3, the data and methodology are outlined, and the results are presented and discussed. Finally, section 4 summarizes and concludes the paper.

2. BANK PERFORMANCE: A BRIEF SUMMARY OF THE LITERATURE

The literature that examines the determinants of bank performance is simply huge. However, following any effort, one realizes that almost all published papers regress a measure of bank performance on a number of factors. The two commonly used dependent variables are return on assets and net interest margin. As far as the explanatory variables are concerned, they include a multitude of measures including bank size, capital adequacy, overhead costs, credit risk, economic growth, and others.

The pioneering papers that looked at the performance of banks include Ho and Saunders (1981), Allen (1988), McShane and Sharpe (1985), Agbanzo (1997), Demirguc-Kunt and Huizinga (1999), Saunders and Schumaker (2000), and Demirguc-Kunt and Huizinga (2000). Following the publication of these papers, numerous empirical papers looked at the performance of banks across the globe. These papers examine the performance of banks in single countries or across-countries.

Some of the recently published papers include Chortareas et al. (2011), Naceur and Omran (2011), Fungacova and Poghosyan (2011), Gurbuz et al. (2013), Trujillo-Ponce (2013), Nassar et al (2014), Helhel (2015), Shami et al (2015), Yaseen et al. (2015), and Hashem (2016), Topak and Tırmandıoglu (2017, Al-Homaidi et al. (2018), Almaqtari et al. (2019), Batten and Vo (2019), Omet (2019), Al-Homaidi et al. (2020), Caliskana and Lecunab (2020), Jadah et al. (2020), Le and Ngo (2020), Le and Nguyen (2020), Saif Alyousfi (2020), and Farooq et al. (2021).

Le and Ngo (2020), for example, examine the determinants of banks' return on assets and net interest margin in 23 countries (2002-2016). Based on their Generalized Method of Moments (GMM) methodology, the results indicate that the number of issued bank cards, number of automated teller machines, and the number of sale terminals positively affect bank profitability. However, the results also indicate that these factors widen bank net interest margin.

Jadah et al. (2020) examine the determinants of bank profitability in Iraq. Based on their data (18 banks / 2005-2017), and panel data methodology (fixed effects), their results indicate that while bank size, equity capital to total assets, real GDP growth rate positively impact the return on assets of banks, they have a significant and positive impact on net interest margin as well. Interestingly, the results indicate that total loans to total assets widen net interest margin, but have no impact on bank profitability.

As far as Jordanian banks are concerned, Yaseen et al (2015) looked at the impact of foreign banks on the performance of local banks in terms of net interest margin, and competition. Using all 13 listed Jordanian banks and five foreign banks (2000-2010), the results indicate that foreign banks have no impact on either the cost of financial intermediation nor bank competition. In addition, the fact that 6 of the 13 Jordanian banks offer cash prizes (lottery) to the depositors, Shami et al (2015) examine the impact of this marketing strategy on their performance during the period 2002-2012. Interestingly, the results clearly indicate that while the distribution of lottery prizes has a significant and positive impact on bank profitability, this marketing tool widens net interest margins. In other words, the cost of offering prizes is "passed-on" to bank customers by widening net interest margin.

Finally, it is also worth mentioning that Omet (2019) examines the income of income diversification (in terms of sectoral distribution of credit and non-interest income) on the performance of Jordanian banks. Again, based the all 13 listed banks, and the period 2009-2017, the results indicate that while income diversification positively affects bank profitability, diversification widen significantly net interest margin.

3. THE DATA, METHODOLOGY, AND ESTIMATED RESULTS

As mentioned in the first section, the objective of this paper is to look at how COVID-19 impacted the performance of listed Jordanian banks in 2020, and to examine the determinants of their return on assets and net interest margin.

To realize the objective of the paper, the analysis includes all 13 listed Jordanian banks. In addition, the annual data that is used in the econometric estimations covers the period 2010-2020. The Islamic banks (3 in total) are not include in the analysis as their financial statements are different from traditional banks. The collected data is used to estimate two main models:

$$ROA_{i,t} = \beta_1 Equity_{i,t} + \beta_2 Expense_{i,t} + \beta_3 Size_{i,t} + \beta_4 Bonds_{i,t} + \beta_5 Diversification_{i,t} + \beta_6 Provisions_{i,t} + \beta_7 GDP_t + \varepsilon_{i,t} \quad (1)$$

$$NIM_{i,t} = \beta_1 Equity_{i,t} + \beta_2 Expense_{i,t} + \beta_3 Size_{i,t} + \beta_4 Bonds_{i,t} + \beta_5 Diversification_{i,t} + \beta_6 Provisions_{i,t} + \beta_7 GDP_t + \varepsilon_{i,t} \quad (2)$$

where, i refers to banks (i = 1, …, 13) and t refers to time period (t = 1, …, T = (2010-2020).

The definitions of the two dependent variables are as follows:
ROA = Profit before taxes divided by total assets (return on assets).
NIM = Net interest margin = [(Interest income – Interest expense) / Total assets].

The definitions of the seven independent variables are as follows:
Equity = Equity capital to total assets.
Expense = Operating expenses / (interest income – interest expense).
Size = Natural logarithm of total assets.
Bonds = Investment in government securities to total credit.
Diversification = Net commission income / (interest income – interest expense).
Provisions = Loan loss provisions to total credit.
GDP = Real GDP growth rate.

To estimate the above-mentioned two models, we use the Period Seemingly Unrelated Regression / pooled EGLS. This technique corrects for period serial correlation and period heteroskedasticity between the estimated residuals. Indeed, this is important given the fact that the data involves 11 years and a cross section of 13 banks only. In addition, it is worth noting that this method uses the residuals which are calculated from the first stage estimates to estimate the feasible GLS specification.

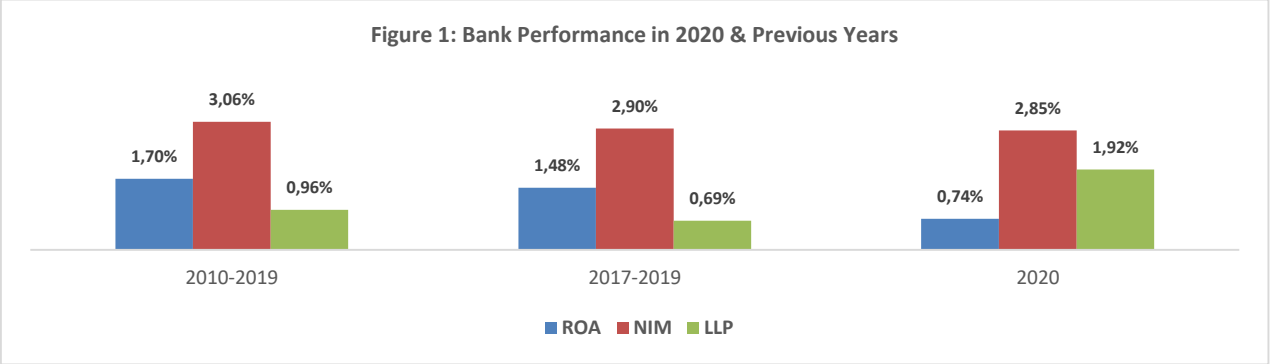
The estimated results are reported in Tables 1 – 4. Below, we outline and discuss the following observations.

1. The overall mean of the return on assets (ROA) decreased from 1.43 percent in 2019 to 0.74 percent in 2020 or by 48.3 percent (Table 1). While the mean net interest margin (NIM) of the 13 banks did not change in any significant proportion, loan loss provisions (LLP) increased from 0.76 percent in 2019 to 1.92 percent in 2020, or by 152.6 percent. In addition, it is interesting to note that during the period 2010-2020, the financial year 2020 witnessed the lowest ROA, narrowest NIM, and highest LLP.

Table 1: Return on Assets and Net Interest Margin: Annual Mean Values

Year	ROA	NIM	Loan Loss Provisions
2010	1.87%	3.19%	1.30%
2011	1.57%	3.10%	1.72%
2012	1.75%	3.21%	1.55%
2013	1.87%	3.03%	0.88%
2014	2.01%	3.09%	0.72%
2015	1.83%	3.11%	0.66%
2016	1.63%	3.13%	0.65%
2017	1.48%	2.93%	0.82%
2018	1.53%	2.88%	0.50%
2019	1.43%	2.88%	0.76%
2020	0.74%	2.85%	1.92%

2. During the period 2010-2019 (2017-2019), the mean value of return on assets (ROA) was 1.70 percent (1.48 percent). In 2020, this measure fell to 0.74 percent (Figure 1). In other words, the impact of COVID-19 on Jordanian banks was significant. Similarly, during the period 2010-2019 (2017-2019), the overall mean value of loan loss provisions (LLP) was equal to 0.96 percent (0.69 percent). In 2020, this measure increased to 1.92 percent. In other words, the impact of COVID-19 on the LLPs was significant. This sudden increase in provisions, indicates that Jordanian banks, on average, chose this option to manage their increased credit risk. Indeed, the increase in LLPs is one major reason behind the decrease in the 2020 return on assets. The cost of financial intermediation (net interest margin) did not reflect any significant changes between the period 2010-2019, 2017-2020, and in 2020.



3. On average, the mean values of the dependent and independent variables are close to their respective median values. In other words, the probability distribution of all the variables is normal. In addition, it is informative to note that all variables reflect significant variability. Indeed, the differences between the minimum and maximum values of each variable are large. For example, the minimum and maximum values of diversification (net commission income / (interest income – interest expense)) are equal to 5.9 percent and 76.8 percent respectively (Table 2).

Table 2: Dependent and Independent Variables: Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Deviation
ROA	0.016	0.017	0.036	-0.002	0.007
NIM	0.030	0.030	0.044	0.011	0.007
Equity	0.072	0.071	0.209	0.022	0.033
Expense	0.577	0.565	0.845	0.314	0.110
Size	21.555	21.447	24.026	19.652	0.934
Bonds	0.208	0.202	0.366	0.008	0.074
Diversification	0.203	0.189	0.768	0.059	0.100
Provisions	0.010	0.009	0.045	0.000	0.013
GDP	0.020	0.023	0.034	-0.016	0.013

4. It is interesting to note that the overall mean value of bonds (bank investment in government securities to total credit) is equal to 20.8 percent. However, in some banks, this ratio is much higher. The maximum value of this ratio is equal to 36.6 percent. Within this context, it is also useful to note that in Jordan, there is no secondary market for government securities (treasury bills and bonds). These securities are bought by the banks and the Jordan Social Security Corporation, and held until maturity.

5. Listed Jordanian banks do not realize benefits from scale economies. The coefficients of bank size (Size) and equity capital (Equity) are not significant when the dependent variable is return on assets (Table 3), and in both periods (2010-2019 and 2010-2020). However, these coefficients are negative and significant when the dependent variable is net interest margin (Table 4). In other words, larger banks and higher capitalized banks tend, on average, have narrower net interest margins.

Table 3: Determinants of Return on Assets (ROA)

	2010 - 2019		2010 - 2020	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
C	0.026	1.338	0.029	1.942***
Equity	0.016	1.037	0.019	1.492
Size	0.001	0.545	0.001	0.616
Expense	-0.039	-9.911*	-0.038	-9.011*
Bonds	-0.004	-2.030**	-0.003	-1.612
Diversification	0.007	1.589	0.004	1.189
Provisions	-0.362	-5.196*	-0.339	-7.439*
GDP	0.219	8.215*	0.106	10.234*
Adjusted R-Squared	0.864			
F-Statistic	118.412*		184.377*	
D-W Statistic	2.003		2.009	
*, **,*** indicate significance at the 99%, 95%, and 90% levels.				

Table 4: Determinants of Net Interest Margin (NIM)

	2010 - 2019		2010 - 2020	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
C	0.085	4.814*	0.078	5.240*
Equity	-0.024	-2.044**	-0.023	-2.180**
Size	-0.002	-2.715*	-0.002	-2.717*
Expense	-0.009	-7.241*	-0.008	-6.775*
Bonds	-0.021	-8.153*	-0.018	-8.226*
Diversification	-0.012	-7.270*	-0.012	-7.427*
Provisions	0.031	1.824***	0.052	3.501*
GDP	0.109	2.856*	0.062	6.096*
Adjusted R-Squared	0.584		0.559	
F-Statistic	26.873*		26.816*	
D-W Statistic	1.866		1.815	
*, **,*** indicate significance at the 99%, 95%, and 90% levels.				

6. Bank expenses (operating expenses / interest income – interest expense) are significant and negative in their impact on return on assets (Table 3). It is interesting to note that the impact of bank expenses on net interest margin is also negative and (Table 4). This implies that banks do not pass-on the "higher" expenses to their customers by widening their cost of financial intermediation.

7. Bank investment in government securities (bonds) impacts bank performance (ROA) negatively and significantly (Table 3). This is expected given the lower interest income on these securities. However, it is informative to note that for the period 2010-2020, the coefficient of this variable become insignificant. Naturally, this is due to the sudden decrease in the profitability of all banks in 2020. In addition, it is interesting to note that bank investment in government securities has a negative and significant impact on net interest margin (Table 4). This indicates that the "lower" risk of the portfolio of some banks, as a result of their investments in government securities, is passed-on, at least partly, to their customers, in the form of lower cost of financial intermediation.

8. Bank diversification (net commission income / (interest income – interest expense) has no impact no impact on bank performance (ROA). However, diversification has a negative and significant impact on net interest margin (Table 4). This indicates that some of the benefits that banks realize from the diversification level of their assets are passed-on, at least partly, to their customers, in the form of lower cost of financial intermediation.

9. As expected, loan loss provisions impact bank profitability in a negative and significant manner. The coefficients of this variable during the periods 2010-2019 and 2010-2020 are equal to -0.362 and -0.339 respectively (Table 3). On average, the cost of loan loss provisions are passed-on, at least partly, to bank customers in the form of wider costs of financial intermediation (Table 4).

10. The impact of real growth (GDP) on bank profitability is positive and significant. However, given the sudden decrease in the return on assets in 2020, it is interesting to note that the coefficient of this sign for the period 2010-2020 (+0.106) is much lower than in the period 2010-2019 (+ 0.219). However, the positive impact of economic growth on the performance of banks is not passed-on, even partly, to bank customers in the form of narrower cost of financial intermediation (Table 4).

4. SUMMARY AND CONCLUSIONS

In economic terms, COVID-19 has impacted the demand and supply sides of the affected economies. The virus has also dealt a serious blow to stock markets and banks across the globe. Within this context, this paper has looked at the performance of the Jordanian banking sector in two measures (return on assets and net interest margin).

On average, while most of the empirical results are expected, they are encouraging. First, the overall mean return on bank assets has collapsed from 1.43 percent in 2019 to 0.74 percent in 2020. However, what is encouraging is the fact that this decrease in profitability was the result of the equally increase in loan loss provisions. Indeed, loan loss provisions to total credit facilities increased from 0.76 percent to 1.92 percent in 2020.

As far as the determinants of bank performance are concerned, the results are similar to the international literature. However, the interesting finding is related to loan loss provisions. This measure impacts bank profitability in a negative and significant manner. The coefficients of loan loss provision during 2010-2019 and 2010-2020 are equal to -0.362 and -0.339 respectively. This "expense", however, is passed-on, at least partly, to bank customers in the form of wider costs of financial intermediation (NIM). Once the world (and Jordan) is free of COVID-19, the cost of financial intermediation is expected to narrow.

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THE SUSPICION OF MANIPULATION IN BITCOIN RETURNS: AN INVESTIGATION WITH BENFORD'S LAW

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ABSTRACT

Purpose- Bitcoin is a blockchain-based digital currency that can be generated via data mining. Several complex computational methods along with random processes have been utilized in the production of that currency. Nonetheless, it is an important research question whether this process, which have been taking place in a entirely digital platform, involves manipulation. Accordingly, the amount of Bitcoin in circulation would involve manipulation as much as the Bitcoin price and returns do.

Methodology- Related tests are performed to detect compliance with Benford's Law in the analyses conducted on the issue. Distribution frequency of the digits can be determined by Benford's Law in order to determine whether the random digital database is manipulated. In order to detect any possible manipulation in Bitcoin returns, the Chi-Square test is performed

Findings- With the daily Bitcoin price data obtained over the period between 02.02.2012 - 10.02.2020 its found out that Bİtcoin prices comply with Benford's Law reference distribution.

Conclusion- According to the results of the analysis, it is concluded that the Bitcoin returns comply with Benford's Law. Therefore, there is no possible manipulation on the Bitcoin returns throughout the study period.

Keywords: Benford's Law, Bitcoin, Detection of Fraud, Digital Analysis, Manipulation.
JEL Codes: D41, E42, E31, G12

1. INTRODUCTION

Since the Lydians used gold in trade for more than 2500 years, money had been very crucial as a store of value and a means of exchange for economic and social development. The forms of money have constantly been changing based on technological improvements. The precious metals with specific values associated with their own material contents have been replaced by symbolic base metals and completed with self-valued paper-based notes.

As the revolution of information technology advanced, and especially following the introduction of credit cards in the 1960s, financial transactions became much more virtual (Dodgson, Gann and George 2015, p. 325). Digital money, which has emerged as a new technology in recent years, stands for a medium of exchange in the electronic environment and the means of payment stored in a fully digital format as a measure of value.

The foundation of digital currencies is based on cryptographic improvements. The capacity to secure communication has forced many researchers to create digital currencies, but they did not succeed in their first trials due to their centralization, precious metal support, counterfeiting, and double spending problems. However, these problems have been solved by creating digital signatures in a suitable technological architecture as the ultimate success of decades of developments and technological cryptography practices (Poyser 2017, p. 6).

Digital values that allow cryptographic/cryptographically safe operations and additional virtual money supply are called crypto-currencies. Crypto-currencies are alternative currencies, they are digital, and they are also virtual money. With crypto-currencies, individuals or institutions can expenditures or exchanges as they do with real money. The amount of crypto-

currencies as well as how and when they would be introduced to the market are determined at the very beginning of the system's implementation. No third party or intermediary exists, except for the sender and the recipient, since the system is safe in storing and transferring the cryptocurrencies. Furthermore, no government, institution or company can neither produce cryptocurrencies nor can confiscate anyone's cryptocurrencies (Çarkacıoğlu 2016, p. 8-9).

Upon examining the cryptocurrencies, it is basically possible to consider a distinction between Bitcoin, as the most popular currency, and the others. As a matter of fact, other crypto-currencies that entered the market following Bitcoin, which was the first cryptocurrency, were described as alternative cryptocurrencies since they were inspired by Bitcoin and named as "altcoins". All altcoins serve as alternatives to the Bitcoin. There are two kinds of altcoins. Altcoins, created by utilizing Bitcoin's original open-source protocol, were designed as new coins possessing different features along with alterations in Bitcoin's basic code. Litecoin sets an example of such altcoins. Other types of altcoins include the ones which were not based on the open-source protocol of Bitcoin but have their own protocols and distributed ledgers.

Well-known examples of such altcoins are Ethereum and Ripple (Houben and Snyers 2018, p. 29). As of March 2019, 2,526 altcoins are in circulation, and this amount is subject to increase day by day.

Bitcoin was first coined by Satoshi Nakamoto's article entitled "Bitcoin: A Peer-to-Peer Electronic Cash System" published in 2008. The study, in which Bitcoin was described, explained how the blockchain technology, as the infrastructure of cryptocurrencies, was prepared by the developers and how the system worked. Moreover, the most important feature of the cryptocurrency in the article is that it is based on mathematical rules and based on computer algorithms, rather than trust in the authorities that have the power of printing money (Nakamoto 2008, p. 1-8).

The first Bitcoin transfer was realized between Satoshi Nakamoto and a programmer named Hal Finney on January 12, 2009, after Nakamoto published Bitcoin Whitepaper on January 30, 2008. As of October 2009, the New Liberty Standard has announced the first Bitcoin Exchange rate as $ 1 = 1,309.03 BTC. As of May 2010, the first shopping with cryptocurrency was carried out in the BitcoinTalk forum along with the payment of 10,000 Bitcoin by Laszlo Hanyecz. In July 2010, the first Bitcoin Stock Exchange, namely, Mt. Gox was established. The market value of the total Bitcoin in circulation as of August 2010 exceeded $ 1 Million. By February 2011, Bitcoin was equalized to $ 1 for the first time ($ 1 = 1 BTC). In April 2011, along with the sale of Bitcoin in Euro and British Pound, the market value reached $ 10 million. As of March 2013, the market value of Bitcoin exceeded $ 1 billion. Bitcoin, which exceeded $ 10,000 as of November 2017, reached $ 20,000 in December 2017. In March 2021, along with the production of 18,660,000 Bitcoins, 88.8% of totally 21,000,000 Bitcoins were produced. Bitcoin has reached the age of 12 as of January 2021 and has a market value of nearly $ 1 trillion.

There is a great deal of uncertainty about the extent to which Bitcoin is being used as an exchange instrument and investment asset (Jermann 2018, p. 1). It is suggested that the infrastructure of crypto coins, especially Bitcoin, cannot be manipulated and distorted since a mathematical and technological system is utilized. Nonetheless, the Bitcoin ecosystem, which is claimed to be unmanipulated and undistorted by innovations in technical design, has frequently been a target for financially motivated criminals (Gandal et al. 2017, p. 1). On the other hand, there are three different ways to obtain Bitcoin. The first one is to survey new mines and the second one involves purchasing in a stock exchange and the last one is to accept Bitcoin in Exchange of goods and services (Doğan, Buyrukoğlu and Kutbay 2018, p. 26).

Since the second and third ways are related to the amount of Bitcoin in circulation, there is an increasing number of question marks in minds regarding whether or not newly generated Bitcoins involve any manipulation in terms of quantity and price.

Different digital analyses can be performed by using various techniques on financial market transactions. Digital analysis techniques provide opportunities to simplify and accelerate the course of the analyses. Benford Analysis, one of the most widely used mathematical techniques in economics and finance, looms large with its practicality and low cost. Benford Analysis is based on the fact that the probability of occurrence of digits in randomly formed numbers differs at each place (Benford 1938, p. 551). With Benford's Law, the frequency distribution of digits and digits formed by intervening in the database can be determined. Since the frequency of occurrence of numbers does not comply with Benford's Law; it is revealed that there is a change over the digits data, the data deviate from the natural distribution, and manipulation exists. With the Benford analysis, it can be determined whether or not manipulation in securities traded in capital markets exists.

There are a variety of manipulation methods commonly used in stock exchanges. Although the procedures in these methods usually have a legal appearance, they lead to manipulation whenever they are carried out in a coordinated manner serving a specific purpose. It is also possible to use different methods in each case. Therefore, it is not possible to consider the limited criteria of manipulations (SPK 2003, p. 12). Since the use of the transaction volume in detecting the process-based manipulation may not be sufficient to explain manipulation, therefore it is thought that it would be a more accurate approach to investigate the manipulation of the prices arising in the market as a result of the transactions.

This study aims to determine whether or not any manipulation in the Bitcoin returns exists. To this end, it is examined in detail with the Chi-Square conformity test to determine whether or not the distributions of the daily Bitcoin returns over the period from 02.02.2012 to 10.02.2020 comply with Benford's Law.

Within the scope of the study, and the Bitcoin currency, as well as other cryptocurrencies, are primarily examined. Then, empirical studies in the literature examining manipulation on financial assets and manipulation on a limited number of cryptocurrencies are reviewed. Afterward, the dataset and methodology used are explained, and the findings obtained from the analysis are presented. In the last section, the findings of the analysis are interpreted, and various evaluations are made.

2. LITERATURE REVIEW

Initially, the empirical studies examining the manipulation issue in the securities markets are reviewed. In the last part, practical studies explicating the issue of manipulation in Bitcoin and other cryptocurrencies are introduced.

Ley (1996), one of the seminal studies which was conducted on the manipulation of securities markets, investigated the daily actual returns over the period between January 1900 - June 1993 for the Dow Jones Industrial Average Index (DJIA), and over the period between January 1926 - June 1993 for the Standard and Poor's Index (S&P). According to the results of the study, it is determined that the figures in one-day yield series of stock index indexes are in compliance with Benford's Law. Shengmin and Wenchao (2010), in which the issue of manipulation in index returns was analyzed utilizing different country datasets, examined the distribution of the first digits of two main Chinese stock market indexes (Shanghai Stock Exchange Composite Index and Shenzhen Stock Exchange Component Index) regarding their compliance with Benford's Law. It is concluded that the return series of both indexes practically comply with the Benford law. In addition, the probability of occurrence of the digit "9" in the first digits distribution of the SSE index was found to be higher than expected. Alagöz and Ay (2001), one of the similar studies conducted on the issue in Turkey, tested the data of totally 227 companies trading in Istanbul the Stock Exchange as of 2002 consisting of monthly purchase-sale amounts in US Dollars which vary between the digits "3" and "8" in terms of their compliance with Benford's Law. According to the results of the study, no significant differences were found upon comparing the expected values of Benford's Law with the observed values.

Akkaş (2015a), which was conducted on the issue of manipulation in the daily gold returns, examined the daily gold returns over the period 01.03.2005 - 08.28.2015 comparatively in two parts; before 2010 when gold prices rose too high and after 2010. The results of the study concluded that the returns for 2007 and 2014 did not comply with Benford's Law. Similarly, Akkaş (2015b), in which the manipulation of foreign exchange rates was investigated regarding Benford's Law, tried to determine whether the digits patterns of USD/TL and EUR/TL exchange rates over the period 01.01.2003 -12.31.2014 complied with the second-order distribution of Benford's Law. As a result of the study, it was concluded that the digits patterns of USD / TL in 2003, 2004, 2008, 2010 and 2014, and of EURO / TL in 2005, 2006, 2007, 2009 and 2012 complied with the second-order distribution of Benford's Law.

In the study conducted by Uzuner (2017) investigating the manipulation in the banks traded in the stock exchange, the conformity of the first quarter consolidated balance sheets of the banks traded in the BIST throughout the first quarter of 2013 was examined. It was determined that the majority of the distribution of the first digits in the amounts of the accounts in the balance sheets of the relevant banks, whereas some of the accounts were different upon abiding by Benford's Law.

Chan, Liu and Xue (2013), in which the issue of manipulation in a limited number of cryptocurrencies in the literature was examined, investigated whether or not Bitcoin transaction data over the period from 11.26.2013 at 11:26:59 PM to 11.30.2013 at 09:42:41 AM comply with the first- and second-order distribution of Benford's Law. It was concluded that the deposit and withdrawal amount in general comply with the expected frequency distributions of Benford's Law. In a similar study investigating Bitcoin theft and fraudulent Bitcoin operations, Cipp, Phillips, and Mai (2013) investigated the compliance with Benford's Law by using all Bitcoin operations as a dataset over the period from the beginning of the network to 04.07.2013. According to the results of the study, it was determined that Bitcoin transaction data fitted very closely to Benford's Law frequency distribution.

In Wist (2019), the comformity of Bitcoin price and volume data obtained over the period between 04.28.2013 - 02.11.2018 with Benford's Law was tested. The results of the study indicated that the data closely comformed with Benford's Law.

In Peterson's (2020) study, all of the daily closing prices of Bitcoin over the period between July 2010 - May 2020 were analyzed using Benford's Law, with annual periods. It was concluded that Bitcoin was manipulated at 95% confidence intervals in 2013, at 95% in 2018, and at 98% in 2019.

Cong et al. (2019), in which the manipulation in different cryptocurrencies was investigated, examined the compliance of Bitcoin, Etherum, Ripple and Litecoin transaction data with Benford's Law. Transaction data obtained from 29 major cryptocurrency exchanges over the period between 09 July 2019 - 03 November 2019 were utilized in the analysis. According

to the results of the study, it was determined that the trading volumes of those cryptocurrencies were in line with Benford's Law for regulated exchanges. On the unregulated exchanges, it was determined that approximately 30% of the trading volume did not comply with Benford's Law.

In Veres' (2019) study, in which manipulation in a different cryptocurrency, Etherum, was investigated, analyzed all transactional data obtained from the Ethereum network until December 21, 2018 using Benford's Law. It was determined that the digits distribution of Etherum's transactional data did not comply with Benford's Law.

Amiram, Lyandres and Rabetti (2021) investigated the manipulation in Bitcoin, Etherum and Tether transactions of four different stock exchanges. Accordingly, the transaction data of these cryptocurrencies on Binance, Okex, ZB and Bibox stock exchanges over the period between June 2013 - September 2019 were compared with the Benford's Law reference distribution. It was determined that the transaction data complied with Benford's Law.

In studies focusing on the issue of manipulation in Bitcoin, the subject is explicated with Bitcoin transaction volumes. In this study, it is examined whether or not any manipulation exists using "daily returns" of Bitcoin, unlike other studies.

3. DATA AND METHODOLOGY

In the study conducted to determine whether or not any manipulation exists in the Bitcoin returns, the daily Bitcoin returns over the period from 02.02.2012 to 10.02.2020 constitute the dataset of the study. The data are obtained from BTC/USD daily returns found on the website www.investing.com. Daily returns are calculated using the formula $\frac{t_n - t_{(n-1)}}{t_{(n-1)}}$ as the rate of return between two consecutive days. For the data to be suitable for the analysis, the rates of return are multiplied by 1000. Since there were no numbers that begin with zero in the analysis, 160 data are excluded from the analysis. Therefore, the number of observations is 3000.

The fact that the study is conducted merely on the Bitcoin's daily returns excluding the period prior to the year 2012 and other digital payment instruments via merely a single analysis method constitutes the constraints of the study.

The seminal studies on Benford's Law were conducted by Simon Newcomb (1881) and Frank Benford (1938). Newcomb (1881) explained his observations and conclusions about the frequencies of the use of digits. Newcomb realized that the first pages of the logarithmic chart used in the calculations were more worn-out than the last pages. Newcomb found that the probability of occurrence of the numbers that began with the digit "1" were higher than that of the numbers that began with the digit "2", whereas the probability of occurrence of the numbers that began with "2" was higher than that of the number that began with "3" in the logarithmic table. Similarly, he asserted that the smaller digits are used more frequently than, the larger digits. Newcomb provided the basis of the subject mathematically. After Newcomb, as of 1938, a physicist named Frank Benford in General Electric also found more worn pages than others in logarithmic tables. Benford (1938) studied the frequency distributions of 20,229 samples from different databases and calculated the mean values of these databases. The probability of occurrence of the digits in places has been entered into the literature as Benford's Law. Benford's Law is based on calculations of the probability of occurrence of the digits in the places of a number. The probability of occurrence of the digits in the first places of numbers is calculated as follows (Benford 1938, p. 554);

For the first digit of the numbers;

$$\text{Probability}\,(d_1) = \log\,(1 + \frac{1}{d_1});\; d_1 = (1,2,3 \dots 9) \qquad (1)$$

Following is a list of numbers for each place value indicating the probability ofoccurrence in a number according to the calculation above:

For the probability of 1; $\log\,(1 + \frac{1}{1}) = 0.30103$ (*2)*

For the probability of 2; $\log\,(1 + \frac{1}{2}) = 0.17609$ (*3)*

For the probability of 3; $\log\,(1 + \frac{1}{3}) = 0.12493$ (4)

For the probability of 4; $\log\,(1 + \frac{1}{4}) = 0.09691$ (5)

For the probability of 5; $\log\,(1 + \frac{1}{5}) = 0.07989$ (6)

For the probability of 6; $\log\,(1 + \frac{1}{6}) = 0.06695$ (7)

For the probability of 7; $\log\ (1+\frac{1}{7}) = 0.05799$ (8)

For the probability of 8; $\log\ (1+\frac{1}{8}) = 0.05115$ (9)

For the probability of 9; $\log\ (1+\frac{1}{9}) = 0.04576$ (10)

For the second digit of the numbers:

$$\text{Probability}(\mathrm{d}_2) = \log\ (1+(d_1 d_2) - \log\ ((d_1 d_2);\ d_2 = (1,2,3 \dots 9) \quad (11)$$

With the help of Benford's Law, the probability of distribution of digits found in all places can be analyzed. According to the Law, the probabilities of distribution of numbers tend to converge upon moving from left to right in the places.

Chi-square test is used to determine whether or not the distribution of daily Bitcoin returns complies with Benford's Law. Chi-square test is used to test whether or not the random probability distributions converge to a presumed theoretical distribution (Pearson 1900, s.157-175). In the Chi-Square test, the procedure applied to calculate the difference between observed and expected frequencies is as follows.

$$\boldsymbol{x^2} = \sum_{i=1}^{9} \frac{(Pg,i-Pb,i)^2}{Pb,i} \quad (12)$$

P g,i: observed frequency for i digit

P b,i: expected frequency for i digit

H_0: Observed values have similarities with the Benford Law's reference distribution.

H_1: Observed values do not have similarities with the Benford Law's reference distribution.

For the Chi-Square test; the degree of freedom is $v = r - 1 = 9 - 1 = 8$. Since the significance level is 0.05, the critical value of the Chi-Square test is calculated as 15.505. Accordingly, if the Chi-Square test statistic exceeds 15.505, then the null hypothesis (H_o) can be rejected.

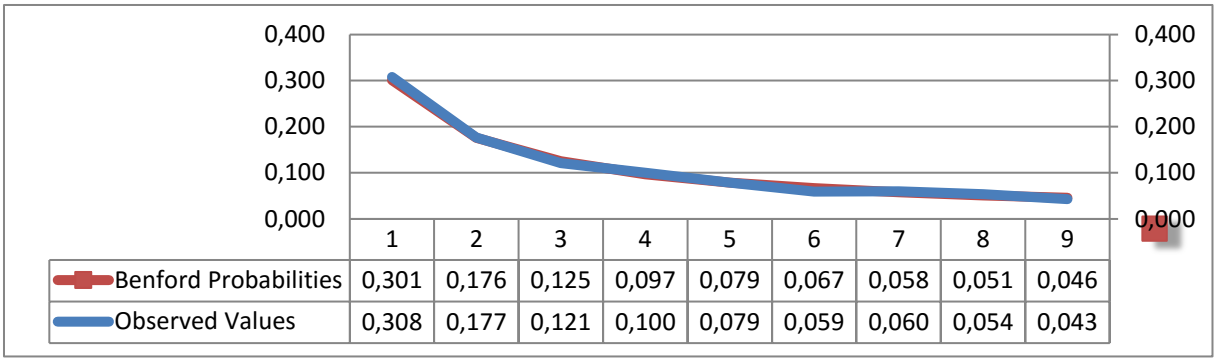
Bitcoin prices are determined by the equilibrium of supply and demand in the market. Nevertheless, the new Bitcoin supply can be realized by using mathematical algorithms in predetermined amounts at the system's inception. Unless generated Bitcoins are included in the market circulation, they are unable to influence the Bitcoin price. The volatility of Bitcoin prices and returns depend on whether or not natural and unnatural processes are included in the system. Excessive Bitcoin sales would influence the Bitcoin price and returns, even though there is no Bitcoin sale or production due to an excessive increase in production quantity. This can lead to manipulation of the Bitcoin price and returns. According to this approach, possible manipulations can be examined with Benford's Law. At this point, incompliance of the frequency of occurrence of the digits in Bitcoin returns with Benford's Law may reveal differences in digits data, deviation from the natural distribution of data and existence of manipulation.

4. FINDINGS

Within the context of the study, to detect any possibility of manipulation in Bitcoin returns, the Chi-Square test is performed to determine whether or not the distribution of Bitcoin returns calculated with daily Bitcoin price data obtained over the period of 02.02.2012 - 10.02.2020 comply with Benford's Law. Prior to performing the Chi-square analysis, the comparison between the distribution rates of the observed data of the Bitcoin returns used in the analysis and the reference distribution of Benford's Law is shown in Figure 1.

Upon examining Figure 1, it is seen that the observed data of daily Bitcoin returns corresponds to the digits probabilities of Benford's Law in 9 digits, and there is no significant discrepancy. It can be stated that digits 1, 3, 4, 6, 7, 8 and 9 are slightly below or above the required value, whereas the other digits 2 and 5 are almost exactly compatible. However, the measurement of the compliance of the observed and expected values; in other words, whether or not the deviations are within an acceptable range can be determined by the result obtained from the Chi-Square test.

Figure 1: Observed Values of Bitcoin Returns and Benford Probabilities



The results of the Chi-square test to determine the compliance of the observed data of daily Bitcoin returns with the reference distribution of Benford's Law during the period of 02.02.2012 - 10.02.2020 are presented in Table 1.

Table 1: Chi-Square Test Results

First Digits	Observed Values	Frequency	Expected Values	Benford Prob.	Proportional Diff.	Chi-Square
1	925	0.308	903	0.301	0.007	0.536
2	530	0.177	528	0.176	0.001	0.008
3	364	0.121	375	0.125	0.004	0.323
4	299	0.100	291	0.097	0.003	0.220
5	238	0.079	237	0.079	0.000	0.004
6	176	0.059	201	0.067	0.008	3.109
7	179	0.060	174	0.058	0.002	0.144
8	161	0.054	153	0.051	0.003	0.418
9	129	0.043	138	0.046	0.003	0.587
TOTAL	3000	1	3000	1	0.031	5.349

*Chi-Square Test Critical Value: 15.505

The Chi-Square distributions were calculated as 5.349 in the compliance test. The value obtained from the analysis is smaller than the critical value of the Chi-Square test (15.505). According to Chi-square test results, it is concluded that the difference between the frequencies of Bitcoin returns and the theoretical possibilities of Benford's Law would be assumed to be random at the accepted significance level.

Furthermore, in accordance with the findings obtained from the analysis, the absolute proportional difference between the observed data and of the Law is 0.031 on average. In order to calculate the mean of this difference which constitutes the general sum, it is necessary to divide the value by 9. According to the above data, the observed rate deviates from the Benford ratio (0.031/9=0.0034) by 3.4 per thousand. However, it is considered that approximately 3.4 per thousand deviation in the database consisting of 3000 data is very low. The very low mean of deviation in these 9 digits indicates that the data abides by Benford's Law at very close frequencies. As a result of the analysis, compliance of the frequency of occurrence of the digits in Bitcoin returns with Benford's Law, absence of any difference on the digits data, and inexistence of deviation from the natural distribution of the data connote the absence of any external intervention. Therefore, during the period from 02.02.2012 to 10.02.2020, it is considered that there is no manipulation in daily Bitcoin returns.

5. CONCLUSION

Due to the cryptocurrencies' rapid entry into the financial system which connotes a different payment/investment instrument; those currencies are approached prudently by individuals, institutions, and governments. There are many

individuals and organizations interested in the Bitcoin currency, which has an increasing trend in terms of usage and prevalence. Along with its increasing popularity, there is an increasing number of question marks in minds regarding whether or not Bitcoin is not priced correctly; in other words, any manipulation of Bitcoin returns exists.

There is a limited number of empirical studies in the literature conducted on manipulation in Bitcoin and other cryptocurrencies, which highly attract attention in the financial system. The issue of manipulation in Bitcoin are examined with Bitcoin transaction volumes. Unlike other studies, it is examined whether or not manipulation exists by using Bitcoin returns in this study. This situation increases the importance of the research study.

In order to determine whether or nor any manipulation exists in Bitcoin returns, the Bitcoin data are analyzed using the daily Bitcoin data throughout the period from 02.02.2012 to 10.02.2020, and Chi-Square test is performed to detect whether or not the distribution of Bitcoin returns complies with Benford's Law. According to the results of the analysis, the hypothesis suggesting that the Bitcoin returns are the same as the Benford Law's reference distribution is accepted. Therefore, it is concluded that there is no manipulation in the Bitcoin returns throughout the study period. The absence of difference over the digits data indicates that the distribution of Bitcoin returns exhibit natural distribution and there is no manipulation. The results obtained from the analysis, compared to Chan, Liu, and Xue (2013), Cipp, Phillips, and Mai (2013), Wist (2019) and Cong et al. (2019) which investigated possible manipulations using Bitcoin transaction data, can be said to have reached similar outcomes in general.

Upon considering the large fluctuations in Bitcoin prices, it is crucial for investors and stock exchanges to make sure that there are no fraudulent transactions. The fact that the prices are formed according to the natural supply-demand balance would not change the fact that Bitcoin is an investment tool with high volatility. In this context, investors can only be recommended to prefer Bitcoin investment following the risk and return optimization processes.

The application of Benford's Law in the analysis can provide significant contributions such as cost and time savings. Nonetheless, it is thought that it would be more fruitful to use more than one audit technique concurrently rather than merely utilizing Benford's Law. This can be the subject of future studies.

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