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Abstract:

The investment instinct that has come from the past years and the developing technology provides new opportunities. The transaction volumes of cryptocurrencies, especially Bitcoin, which have entered our lives since 2008, have increased significantly in the last few years. The high volatility, high return, and high risk in cryptocurrencies attract some investors, although it is attractive to some. The primary purpose of this study is to investigate the usability of cryptocurrencies in portfolio management and how they will affect portfolio returns. Daily data from January 1, 2019, to December 31, 2020, were used in the study. The return, risk, and Sharpe ratios of portfolios created with stocks and new portfolios created by adding crypto money to the related portfolios were calculated. According to the study, portfolios that include cryptocurrencies have both higher risk rates and higher returns. It was concluded that the Sharpe ratios of the portfolios created in 2019 were high, and the portfolio performance was good.

Keywords: Cryptocurrencies, Portfolio Management, Sharpe Ratio.

JEL Codes: G10, G11.

Introduction

Within the framework of economic conditions, individuals may want to evaluate their earnings with minimum risk and high return. Investment strategies are

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updated with a dynamic approach from the past to the present, creating different opportunities. First of all, lands were seen as the best and reliable investment tools in the past, and later, with the establishment of Stock Exchanges, bond and stock investments emerged. Today, cryptocurrency exchanges are established, and investments are made in virtual currencies such as bitcoin, which is the pioneer of virtual money. Even if investment strategies change, two critical concepts always emerge; Minimum risk and high return.

Portfolio Management

A portfolio means wallet, and the invested part of financial assets is called portfolio (Oxford Dicnitionary, 2003). Portfolio management is the diversification and management of securities by targeting profit maximization of the investment to be made. In this context, the investor should compare the return and risk of the securities and create an optimal portfolio (Ceylan and Korkmaz, 2004).

Portfolio Management is followed by two theories to the Traditional Portfolio approach and the Modern Portfolio approach.

According to the traditional portfolio theory, portfolio management requires care and attention from the investor's point of view, depending on knowledge and experience, not one-sided. The traditional approach aims to maximize the benefit to the investor. Assuming that any consumer chooses the goods and services that will provide the highest utility, it is assumed that the investor likewise chooses a portfolio that will maximize his/her benefit preferences regarding risk and return. In other words, according to the emerging risk level, the investor tries to maximize the benefit he has determined (Bekcioglu, 1984). The first step in the traditional portfolio approach is to obtain information about the investor. This information helps the portfolio manager in determining the criteria for the portfolio. In this way, the most appropriate portfolio purpose can be revealed.

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To summarize, the stages in the traditional portfolio approach are as follows (Jones et al., 1977).

1. Collection of investor information,
2. Determining the purpose of the portfolio,
3. Investment policies,
4. Selecting the securities to be included in the portfolio.

The Modern Portfolio theory put forward by Harry Markowitz is based on his work titled "Portfolio Selection," published in 1952 (Markowitz, 1952). Markowitz stated a relationship between financial assets in portfolio diversification and that the expected return and risk will increase to a predictable level based on historical data (Gökgöz, 2006).

In Modern Portfolio Theory, risk cannot be reduced by simply diversifying. It has been revealed that the relationship between stocks is also effective on risk. Various models have been developed to eliminate the disadvantages, such as the complexity of the Markowitz Theory, the need for many data, and the computational difficulty. These models can be listed as Single and Multiple Index Models, Capital Asset Pricing Model, Arbitrage Pricing Theory. Appropriate diversification can be made with Modern Portfolio Management. In order to create optimal portfolios according to the Modern Portfolio approach, some statistical data such as expected return, standard deviation, variance, covariance, correlation are needed (Mortas and Garip, 2015).

With appropriate diversification, the portfolio's risk can be lower than the risk of the securities that make up the portfolio, and even theoretically, the risk can be eliminated. For this reason, it is avoided to include securities that have a high positive correlation with each other in the portfolio. If attention is paid to the

relationship between securities, the unsystematic risk of the portfolio can be reduced or even zeroed (Kapusuzoglu and Ipiciglu, 2013).

In portfolio management, determining portfolio performance criteria is one of the most important processes. The performance criterion is the criterion of which of the risky or less risky financial assets in the investors' portfolio can reach more accurate results. The Sharpe measure is calculated by dividing the risk premium by the portfolio's standard deviation. The Sharpe ratio is a single parameter portfolio performance measure. The Sharpe index is calculated with the following formula (Sharpe, 1966):

$$SR = \frac{\bar{R}_p - \bar{R}_f}{\sigma_p},$$

where $R_p - R_f$ represents the average portfolio return in excess of the risk-free rate computed over the entire out-of-sample period, and σ_p is the corresponding portfolio standard deviation estimated over the same investment period.

Blockchain System and Cryptocurrency

Bitcoin, a cryptocurrency, came to the fore for the first time with the article published by the pseudonym Satoshi Nakamoto in October 2008. It originated in his article "Bitcoin: The Peer-to-Peer Electronic Payment System." The term Bitcoin was the first architecture of digital money, influencing all financial markets. Bitcoin, which has been produced since 2008, is a digital currency that represents a new international currency in the world. Blockchain emerged as the technology behind Bitcoin. In its infrastructure, there is a blockchain system. Essentially, in Satoshi Nakamoto's article, although the term blockchain is not directly mentioned, it is expressed as a "a chain structure formed by the successive addition of blocks" (Nakamoto, 2008).

Some features of cryptocurrencies conflict with traditional financial systems at some points. In particular, the features of cryptocurrencies such as not being managed by a central authority, being subject to supervision, and eliminating intermediaries are such that they prevent the financial system from functioning effectively (Karaagac and Altinirmak, 2018).

As of August 1, 2021, a total of 5899 cryptocurrencies are subject to trading (coinmarketcap.com). The ten crypto currencies with the highest market capitalization are shown in Table 1.

Table 1: Cryptocurrencies

Cryptocurrency	Symbol	Market Cap (\$)	Quantity in Circulation	Market Share
Bitcoin	BTC	44.480.164.046	18.773.637	47%
Ethereum	ETH	296.465.227.782	116.933.972	19%
Tether	USDT	61.947.598.005	61.938.052.218	4%
Binance Coin	BNB	55.242.848.832	168.137.036	3%
Cardano	ADA	41.879.576.913	32.081.225.760	3%
XRP	XRP	33.549.131.091	46.312.443.360	2%
USD Coin	USDC	27.406.996.240	27.403.975.925	2%
Dogecoin	DOGE	26.677.079.196	130.680.456.088	2%
Polkadot	DOT	17.663.095.045	980.258.428	1%
Uniswap	UNI	12.709.507.456	587.377.243	1%

Although there can be significant ups and downs in the cryptocurrency markets, it has grown recently. On top of that, the investor can view the idea that cryptocurrencies can be added to the portfolio positively due to the return. In light of the studies carried out on this subject, the current study examines whether cryptocurrencies can contribute to portfolio diversification. It is also to test how they affect portfolio performances. In this direction, the study consists of six chapters, and the study is briefly mentioned in the introduction. In the

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second part, portfolio management, in the third part, the information about the blockchain system and cryptocurrencies are given. In the next part, the studies on the subject are given. Then, the method applied in the study and the data set used is introduced. Subsequently, the findings are presented and discussed. In the last part, the results obtained in the study are mentioned in general.

Literature Review

New approaches that will create the harmony of developing investment instruments have started. Especially in the portfolio diversification phase, cryptocurrencies have aroused curiosity about how they will affect the portfolio.

Carpenter (2016) examined the effects of Bitcoin on portfolio diversification. Compared to traditional assets, Bitcoin offers high returns despite high volatility. Therefore, although it attracted the investor's attention, it was emphasized that the withdrawals experienced due to a speculative bubble in 2013 could spoil the investor's confidence.

Trimborn, Li, and Härdle (2017) examined that they could generate extra income by including a total of 39 crypto shares in portfolios of S&P 100 component stocks, US bonds, and commodities. With the method they developed, called Liquidity Bounded Risk-Return (LIBRO), it was concluded that the portfolio performance of cryptocurrencies increased.

Karaagac and Altinirmak (2018) aimed to investigate the interaction of the prices of 10 cryptocurrencies with the highest total market values on each other. The study using Johansen Cointegration Test and Granger Causality Test concluded that Bitcoin, Litecoin, and Bitcoin Cash are a Granger cause.

Symitsi and Chalvatzis (2019) examined the performance of Bitcoin in various portfolios using daily data from September 2011 to July 2017. As a result of the study evaluated under four different strategies, they stated that Bitcoin could add

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value to portfolios. However, if investors include several economic instruments in their portfolios, the inclusion of Bitcoin may not provide significant benefits.

Kajitazi and Moro (2019) investigated the role of the cryptocurrency Bitcoin in the US, European and Chinese financial asset portfolios. In each scenario, they compared the portfolios without adding Bitcoin and then adding it. For this, they adopted the backward mean CVar approach. As a result of the study, it was observed that the portfolio performances with Bitcoin added increased. However, it is emphasized that it is due to the increase in returns and the performance of Bitcoin in 2013 rather than the decrease in volatility.

Weiyi Liu (2019) examined investability using historical data of ten significant cryptocurrencies in the market. He also explored the role of cryptocurrencies in portfolio diversification. As a result of the study, it was concluded that portfolio diversification among different cryptocurrencies affected the investment results positively.

Corbet, Akhtaruzzaman, and Sensoy (2020) investigated the effects of portfolio diversification on daily Bitcoin data, global industry portfolios, and bond indices between 2011 and 2018. A low dynamic conditional correlation was found between the industry portfolios of 11 sectors and the bond index and Bitcoin. They also concluded that Bitcoin provides an efficient hedging mechanism for many industrial sectors and bonds.

Gül (2020) examined the effects of cryptocurrencies on portfolios created by using daily data between 7 August 2015 and 23 January 2020 to investigate the usability of cryptocurrencies in portfolio performance. As a result of the study, it was concluded that cryptocurrencies affect portfolio performance in portfolio diversification.

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Esteves (2020) investigated whether the effect and volatility of Bitcoin on the portfolio was a crucial variable in portfolio choices between 2012 and 2019 for a total of 16 periods. As a result of the analysis, it was concluded that Bitcoin could be added to efficient and diversified portfolios, but it performs poorly in some performance periods.

Bakry et al. (2021) investigated the performance of Bitcoin under different portfolio optimization frameworks. The portfolios with and without Bitcoin added were compared, and it was stated that it could be added for diversification under normal market conditions. However, they stated that it gives a confident assurance in terms of a reliable portfolio and that there may be a possibility of loss due to extreme market conditions.

Analysis

Method and Dataset

This study, it is aimed to investigate the effects of the portfolio on return and risk by diversifying cryptocurrencies in portfolio management. Arçelik (ARCLK), Aselsan (ASELS), Coca Cola (CCOLA), Ereğli Iron and Steel (EREGL), Karel Elektronik (KAREL), Kent Food (KENT), Koç Holding (KCHOL), Koza Gold (KOZAL), Türk Telekom (TTKOM), Turkcell (TCELL), Tüpraş (TUPRS), Şişecam (SISE) a total of 12 stocks and Bitcoin (BTC), Ethereum (ETH) and Ripple (XRP) with the highest market value at the time of the study. Three cryptocurrencies were included in the study.

Equal shares are given to each asset in the portfolio created. Portfolio 1, Portfolio 2, Portfolio 3, Portfolio 4, and Portfolio 5 are equally weighted as stocks only. Cryptocurrencies are included in Portfolio 6, Portfolio 7, Portfolio 8, Portfolio 9, and Portfolio 10 portfolios and distributed equally.

Table 2: Portfolio Contents and Distribution Percentages

Portfolio 1	Portfolio 2	Portfolio 3	Portfolio 4	Portfolio 5
KCHOL 25%	KENT 25%	CCOLA 25%	TUPRS 25%	EREGL 25%
TUPRS 25%	TTKOM 25%	SISE 25%	SISE 25%	SISE 25%
ASELS 25%	EREGL 25%	KCHOL 25%	KOZAL 25%	KENT 25%
ARCLK 25%	TCELL 25%	ARCLK 25%	KCHOL 25%	KAREL 25%
Portfolio 6	Portfolio 7	Portfolio 8	Portfolio 9	Portfolio 10
KCHOL 20%	KENT 20%	CCOLA 20%	TUPRS 20%	KAREL 20%
TUPRS 20%	TTKOM 20%	SISE 20%	SISE 20%	KCHOL 20%
ASELS 20%	EREGL 20%	KCHOL 20%	KOZAL 20%	SISE 20%
ARCLK 20%	TCELL 20%	ARCLK 20%	KCHOL 20%	ETH 20%
BTC 20%	ETH 20%	XRP 20%	BTC 20%	XRP 20%

The data used in the study were made by providing daily data of stocks and cryptocurrencies between January 1, 2019, and December 31, 2020. Since Borsa Istanbul is not traded on holidays, holidays in cryptocurrencies are excluded from the sample. Daily data of cryptocurrencies and stocks are available at investing.com and coinmarketcap.com. Microsoft Excel programs were used in the descriptive statistical analysis. In all analyzes, annual returns calculated from daily data and standard deviations were used.

Analysis

Portfolios from Portfolio 1 to Portfolio 5 are also not included in cryptocurrencies. Portfolios from Portfolio 6 to Portfolio 10 were created by adding cryptocurrencies to the same data. In this way, while comparing the two years that cryptocurrencies were popular, it is also possible to compare the portfolios whether cryptocurrencies are included or not.

Table 3: Descriptive Statistics of Portfolio Returns

	Average Daily Return	Standard Deviation	Annual Return (2019)	Standard Deviation (2019)	Annual Return (2020)	Standard Deviation (2020)
Portfolio 1	0,10%	1,74%	23,44%	1,50%	25,38%	1,93%
Portfolio 2	0,31%	1,88%	53,74%	1,36%	374,52%	2,24%
Portfolio 3	0,13%	1,71%	28,40%	1,55%	38,81%	1,85%
Portfolio 4	0,09%	1,61%	28,57%	1,31%	12,89%	1,83%
Portfolio 5	0,36%	2,03%	89,07%	1,52%	390,58%	2,39%
Portfolio 6	0,18%	1,70%	35,24%	1,38%	83,19%	1,95%
Portfolio 7	0,34%	2,02%	39,71%	1,40%	395,14%	2,45%
Portfolio 8	0,14%	1,94%	13,00%	1,49%	34,37%	2,29%
Portfolio 9	0,17%	1,64%	39,34%	1,28%	73,20%	1,91%
Portfolio 10	0,24%	2,67%	46,43%	1,95%	118,35%	3,19%

Descriptive statistics data for the portfolios included in the study are shown in Table 3. While the portfolio with the highest average daily return is Portfolio 5 with 0.36%, the lowest is Portfolio 4. On the other hand, Portfolio 5 has the highest risk, and Portfolio 4 has the lowest, 1.61%. As can be understood in this case, the highest return corresponds to the highest risk.

In addition, according to the table above, portfolios with cryptocurrencies are higher in terms of both risk and return. While the annual return of Portfolio 7 was 39.71% in 2019, it had the highest annual return of 395.58% in 2020. When we examine Portfolio 2, which is the same portfolio that does not include crypto money, the return for 2019 is 53.74%, and the return for 2020 is 374.52%.

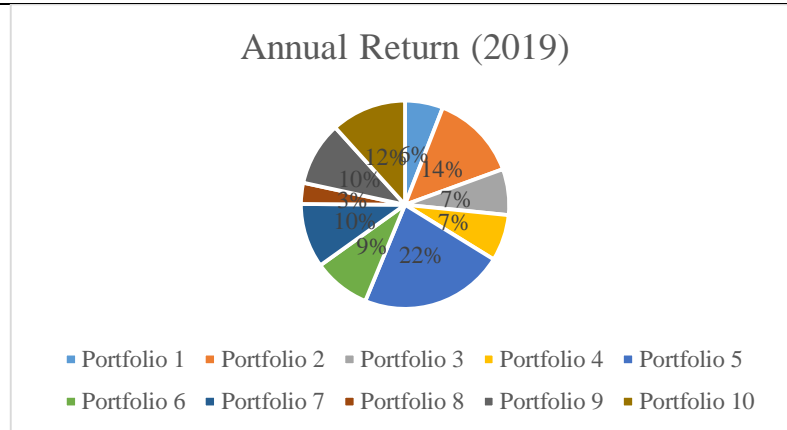


Fig.1. Annual Return of Portfolios (2019)

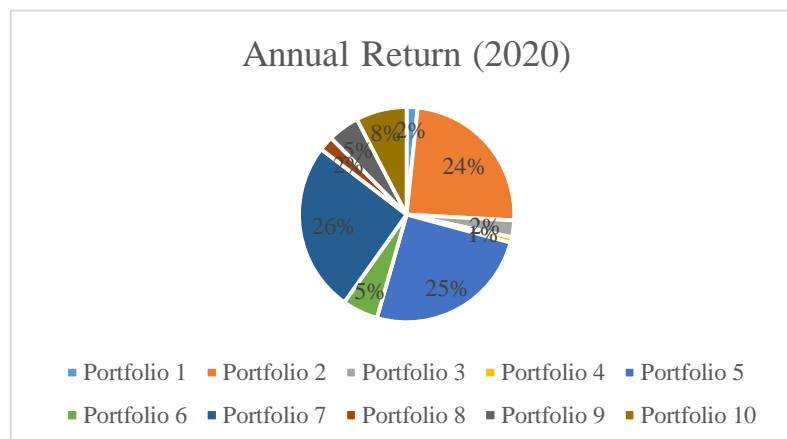


Fig.2. Annual Return of Portfolios (2020)

According to Figure 1, when the annual return analysis of portfolios is examined, Portfolio 5 has the highest return in 2019. The least return is observed in Portfolio 8. At the same time, portfolios with the highest returns according to Figure 6 are Portfolio 7, Portfolio 5 and Portfolio 2. The main reason why the 3 related portfolios have such high returns is the abnormal increase in Kent stock in the portfolio when researched. So much so that the share price increased from 15 TL to 566 TL. When the portfolios are compared considering the addition of cryptocurrencies, according to Portfolio 1 and Portfolio 6 in 2019; Portfolio 4

has lower return rates than Portfolio 9. An increase is observed in portfolio revenues related to the addition of cryptocurrencies.

According to Figure 2, in 2020 according to Portfolio 1, Portfolio 6; According to Portfolio 2, Portfolio 7; Portfolio 4 has higher return rates compared to Portfolio 9 in portfolios where cryptocurrencies are added. When Portfolio 3 and Portfolio 8 are compared, the rates of return remained the same. The fact that 2020 is better than 2019 on the basis of returns may indirectly be an indicator of the increasing awareness of cryptocurrencies day by day.

Table 4: Monthly Returns and Descriptive Statistics of Portfolios in 2019

	P.1	P.2	P.3	P.4	P.5	P.6	P.7	P.8	P.9	P.10
January	0,1860	0,2100	0,1920	0,1860	0,1990	0,1240	0,1060	0,1190	0,1240	0,0520
February	0,0470	0,0470	0,0530	0,0040	0,1060	0,0610	0,0930	0,0460	0,0260	0,1340
March	(0,1270)	(0,1130)	(0,1450)	(0,1160)	(0,0560)	(0,0890)	(0,0820)	(0,1200)	(0,0800)	(0,0530)
April	0,0170	0,0320	0,0520	0,0200	0,0380	0,0740	0,0530	0,0420	0,0770	0,0430
May	(0,0230)	(0,0200)	(0,0670)	0,0160	(0,0960)	0,1020	0,1150	0,0300	0,1330	0,1580
June	0,0160	0,0570	0,0730	0,0170	0,0390	0,1020	0,0780	0,0530	0,1030	0,0630
July	0,0590	0,0110	0,0070	0,0780	0,0040	0,0090	(0,0510)	(0,0440)	0,0250	(0,0810)
August	(0,0560)	(0,0660)	(0,0430)	(0,0210)	(0,0420)	(0,0560)	(0,0980)	(0,0740)	(0,0280)	(0,0840)
September	0,1100	0,0640	0,0630	0,0640	0,0940	0,0620	0,0640	0,0490	0,0250	0,0720
October	(0,0750)	(0,0250)	(0,0550)	(0,0340)	0,0180	(0,0380)	(0,0150)	(0,0120)	(0,0050)	0,0620
November	0,0540	0,1350	0,1150	0,0640	0,1880	0,0120	0,0770	0,0470	0,0200	0,0280
December	0,0500	0,1600	0,0560	0,0260	0,1340	0,0250	0,0950	0,0130	0,0060	(0,0610)
Annual return (2019)	0,2340	0,5370	0,2840	0,2860	0,8910	0,3520	0,3970	0,1300	0,3930	0,4640
Standard Deviation (2019)	0,0150	0,0136	0,0155	0,0131	0,0152	0,0138	0,0140	0,0149	0,0128	0,0195
Variance	0,0002	0,0002	0,0002	0,0002	0,0002	0,0002	0,0002	0,0002	0,0002	0,0004
Coefficient of Change	0,0638	0,0253	0,0545	0,0459	0,0170	0,0392	0,0352	0,1146	0,0325	0,0420
Sharpe Ratio	7,6488	30,7506	10,6011	12,6334	50,7830	16,8138	19,8227	0,6714	21,3841	17,6620

* 1-week repo auction interest rate, 12% for the end of 2019

Table 5: Monthly Returns and Descriptive Statistics of Portfolios in 2020

	P. 1	P. 2	P. 3	P. 4	P. 5	P. 6	P. 7	P. 8	P. 9	P. 10
January	(0,0210)	0,0360	0,0480	(0,0180)	0,0790	0,0510	0,1120	0,0930	0,0540	0,1730
February	(0,0400)	(0,0150)	(0,1000)	(0,1060)	(0,0880)	(0,0460)	0,0270	(0,0950)	(0,0980)	(0,0740)
March	(0,2300)	(0,1270)	(0,2210)	(0,2060)	(0,1290)	(0,2390)	(0,1860)	(0,2310)	(0,2190)	(0,2330)
April	0,1950	0,2180	0,1490	0,1760	0,2620	0,2140	0,2850	0,1630	0,2100	0,2680
May	0,0480	0,3060	0,1110	0,0780	0,2760	0,1160	0,2810	0,0750	0,0810	0,0700
June	0,0330	0,0670	0,0810	0,0490	0,0670	0,0150	0,0420	0,0380	0,0280	(0,0120)
July	0,0260	0,4840	0,0230	(0,0120)	0,5710	0,0550	0,5350	0,1610	0,0450	0,3150
August	(0,0370)	0,3240	(0,0230)	(0,0440)	0,3230	(0,0300)	0,2760	(0,0330)	(0,0360)	(0,0360)
September	0,0700	(0,0520)	0,0940	0,0350	0,0070	0,0360	(0,0910)	0,0390	0,0080	(0,0240)
October	(0,0360)	(0,0590)	(0,0280)	(0,0780)	(0,0960)	0,0230	(0,0340)	(0,0250)	(0,0110)	(0,0530)
November	0,1270	0,2590	0,1540	0,1460	0,2400	0,1920	0,3290	0,4790	0,2070	0,5540
December	0,1020	0,0500	0,1020	0,1600	0,1020	0,1900	0,0910	(0,0470)	0,2370	0,0260
Annual return (2020)	0,2540	3,7450	0,3880	0,1290	3,9060	0,8320	3,9510	0,3440	0,7320	1,1840
Standard Deviation (2020)	0,0193	0,0224	0,0185	0,0183	0,0239	0,0195	0,0245	0,0229	0,0191	0,0319
Variance	0,0004	0,0005	0,0003	0,0003	0,0006	0,0004	0,0006	0,0005	0,0004	0,0010
Coefficient of Change	0,0761	0,0060	0,0477	0,1420	0,0061	0,0234	0,0062	0,0665	0,0261	0,0270
Sharpe Ratio	4,3389	159,3069	11,7937	(2,2460)	156,1068	34,0271	154,6501	7,5987	29,3833	31,7812

* 1-week repo auction interest rate, 17% for the end of 2020

It has been observed that cryptocurrencies have been added to the created portfolios and how the portfolio returns, risks, and Sharpe ratios have changed. Accordingly, Table 4 and Table 5 show the results of the study. Table 4 shows the results for 2019.

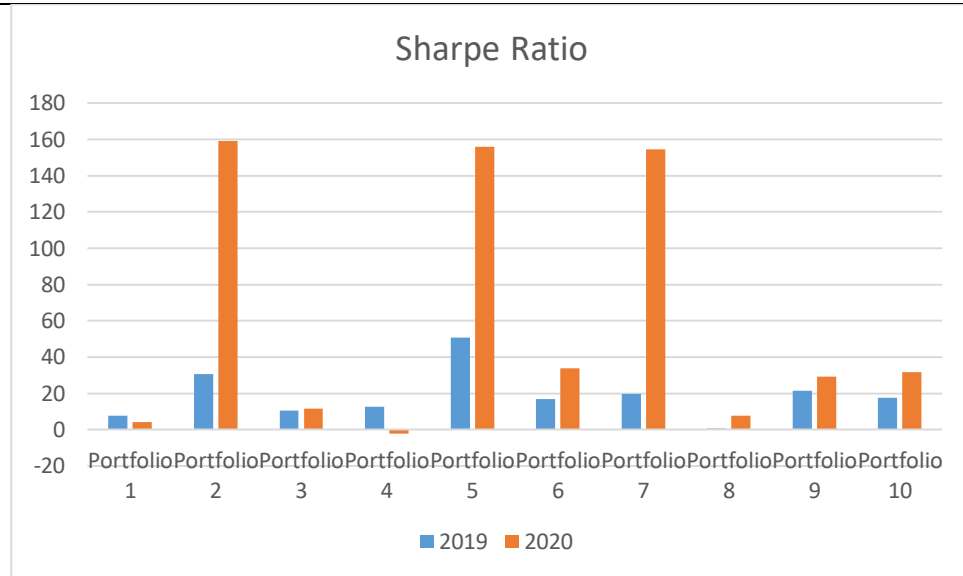


Fig.3. Portfolio Sharpe Ratio between 2019-2020

According to Figure 3, when the Sharpe ratios of the portfolios between 2019-2020 are examined, it is seen that the ratios for 2020 are higher. A higher Sharpe ratio indicates a better investment decision. It is seen that the crypto money added to the portfolio in 2020 increased the Sharpe ratio. The fact that the ratio is negative in Portfolio 4 and the sharpe ratio turns positive with the addition of crypto money to the relevant portfolio shows that a better investment decision is made. In 2019, there was no Sharpe ratio that went into the negative section. The highest rate belongs to Portfolio 2 in 2020.

Table 6: Correlation Matrix

	Kent	Ccola	Asels	Karel	Tcell	Ttkom	Eregl	Kozal	Kchol	Tuprs	Sise	Arcik
Kent	1,000	0,776	0,811	0,634	0,595	0,465	0,699	0,543	(0,165)	(0,581)	0,708	0,762
Ccola	0,776	1,000	0,842	0,844	0,802	0,805	0,892	0,770	0,222	(0,476)	0,641	0,818
Asels	0,811	0,842	1,000	0,756	0,825	0,677	0,709	0,674	(0,162)	(0,713)	0,727	0,648
Karel	0,634	0,844	0,756	1,000	0,686	0,930	0,733	0,905	0,144	(0,599)	0,405	0,589
Tcell	0,595	0,802	0,825	0,686	1,000	0,727	0,684	0,702	0,250	(0,369)	0,732	0,721
Ttkom	0,465	0,805	0,677	0,930	0,727	1,000	0,673	0,905	0,331	(0,472)	0,315	0,505

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Eregl	0,699	0,892	0,709	0,733	0,684	0,673	1,000	0,581	0,282	(0,325)	0,703	0,838
Kozal	0,543	0,770	0,674	0,905	0,702	0,905	0,581	1,000	0,269	(0,472)	0,292	0,530
Kchol	(0,165)	0,222	(0,162)	0,144	0,250	0,331	0,282	0,269	1,000	0,620	0,076	0,352
Tuprs	(0,581)	(0,476)	(0,713)	(0,599)	(0,369)	(0,472)	(0,325)	(0,472)	0,620	1,000	(0,220)	(0,153)
Sise	0,708	0,641	0,727	0,405	0,732	0,315	0,703	0,292	0,076	(0,220)	1,000	0,806
Arclk	0,762	0,818	0,648	0,589	0,721	0,505	0,838	0,530	0,352	(0,153)	0,806	1,000

According to Table 4, the risk of two portfolios decreased while the risk of three portfolios increased due to comparing the five portfolios created with and without crypto money. In direct proportion to this, an increase is observed in the returns of the three portfolios whose risk increases. As a result of comparing Portfolio 1 with Portfolio 6, to which crypto money was added, the Sharpe ratio increased from 7.65 to 16.81. This case shows that the investment performance has a good performance on the risk-based return basis.

When we examine the Sharpe Ratio within the scope of 2019 data, it is seen that Portfolio 2, Portfolio 3, and Portfolio 5 have decreased. That is, portfolios with crypto money added have an unsuccessful performance.

When we examine Table 5, we see the monthly returns, annual returns, standard deviations, and Sharpe Ratios of the portfolios for 2020. The annual return of Portfolio 1 was from 0.254 to 0.832; the standard deviation increased from 1.93% to 1.95%. When we pay attention to the Sharpe ratio, it increases from 4.34 to 34.03. The portfolio performance of the crypto money added to Portfolio 1 affects the portfolio performance well, and the risk remains at a very reasonable level compared to the return. The only negative value is the Sharpe ratio of Portfolio 4 (2.25), which increased the ratio of the portfolio with crypto money to 29.38, showing that it had a significant positive effect on the portfolio performance.

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When we examine the Sharpe ratio of Portfolio 2, it is seen that the performance of the portfolio to which crypto money is added at 159.31 is not as good as Portfolio 1. The same is true for Portfolio 3 and Portfolio 5, with a decrease in Sharpe Ratios. Added cryptocurrencies harmed portfolio performances.

When comparing 2019 and 2020, we should consider experiencing the most critical epidemic in the whole world. The Covid 19 pandemic is a virus outbreak that emerged on December 1, 2019, in Wuhan, the capital of the Hubei region of China. With the spread of the epidemic all over the world in 2020, the stock markets were affected. The primary source of sudden decreases in the Turkish stock market in April 2020 is the Covid 19 epidemic. In this context, when 2019 and 2020 are compared, an increase is observed in the return rates of Portfolio 2, Portfolio 5, and Portfolio 7. However, we see an increase in the risks of the related portfolios. It had the Sharpe ratio of Portfolio 2, which increased the most in two years.

Conclusion

Cryptocurrencies, including Bitcoin, which has entered our lives since 2008, are receiving intense interest every day. The establishment of social media and the increasing number of crypto money exchanges make the public more aware and investable. The transaction volume of cryptocurrencies, which receive support day by day, is increasing worldwide. Although cryptocurrencies have high volatility, high return, and high risk, it is an investment tool for some, although it misses some investors. Although much research has been done on Bitcoin, there is relatively little research on its investability using a portfolio. The primary purpose of this study is to reveal the usability of cryptocurrencies in portfolio management and how they can benefit portfolio returns. In the study, daily data from 1 January 2019 to 31 December 2020 were used. The returns, risks, and Sharpe ratios of portfolios created with stocks and new portfolios created by

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adding crypto money to related portfolios are calculated. According to the study, portfolios that include cryptocurrencies have both higher risk rates and higher returns. In 2019, it was concluded that Sharpe ratios were better than 2020. However, in 2020, it caused decreases in the stock market due to the Covid 19 epidemic. In addition, Tesla, one of the most substantial companies in the world, has caused sudden withdrawals in crypto money exchanges after announcing that it will sell cryptocurrencies. For these reasons, it is seen that there are sudden increases or sudden decreases in the Sharpe ratios of the portfolios in 2020. As a result of other researches, it is thought that it may be beneficial that cryptocurrencies can be used in portfolio diversification, albeit a little. Healthy investments can be made by using it in portfolio diversification instead of undertaking high risks by investing only with cryptocurrencies.

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