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Can Investors Benefit from the Phase Difference Between Countries and Overreaction of the Major World Markets During the Pandemics? Study on the Covid-19 Case

Serkan ÜNAL[1]

ABSTRACT

While the Covid-19 pandemic affected the world economies and investors' behavior, it caused serious volatility in asset prices. Studies on Covid-19 in the literature generally analyzed the relationship between the number of cases, the number of deaths, and the performance of the stock markets. In this study, different from the literature, it has been tested whether investors can benefit from the phase difference between countries and overreaction in stock prices during the pandemic. In the study, which included 48 of the world's leading stock exchanges, countries were classified according to the time the epidemic progressed and the loss of stock market indices. Regardless of the country-based progression of the pandemic, it was observed that the global news flow was more effective in the pricing of different stock markets. On the other hand, it has been observed that the indices of the countries where the epidemic first spread, performed 6% worse than other indices on average, but this difference has closed over time. Another finding of the study is that the indices that lost the most during the period when the pandemic spread were the ones that showed the highest performance in the following period. This finding supports the overreaction hypothesis.

Keywords: COVID-19 and Stock Markets, Pandemics, Overreaction, Statistical Arbitrage.

JEL Classification Codes: G11, G14, G15, H12

INTRODUCTION

The Covid-19 pandemic, which first started in China in December 2019, spread the world in a short period and has seriously affected the countries of the world in public health and economic dimensions (World Health Organization, 2020a). As of August 25, 2020, 23.5 million cases have been identified due to the Covid-19 pandemic, and 810 thousand people have been reported to have died (World Health Organization, 2020b). During the pandemic, many countries slowed down economic activities as a precaution, and this caused a serious slowdown in production and trade worldwide. The pandemic, which affects all countries regardless of the level of economic development, has caused the credit default swap premiums to rise, the world stock markets to perform very poorly and the volatility in markets to increase (El-Khatib and Samet, 2020).

In this study instead of using panel data of daily development of Covid-19 cases and market performances, a different methodology is used. When the development of Covid-19 cases and the reactions of the markets are observed, similar reaction patterns are noted in the markets during the Covid-19 pandemic. After the announcement of the global pandemic by the World Health Organization on March 11, 2020 (World Health Organization, 2020a), although it is a highly probable risk, many countries' markets reacted to the first reported case as a negative and unexpected development. The most important milestone is reaching the number of 100 cases. This milestone means that the cases of Covid-19 have spread widely and the epidemic in the country is likely to reach serious dimensions. Therefore, while the reaction of the investors is very high up to this level, after a certain level, the reaction is decreasing as the market pricing is already formed.

Although many studies in the literature examine the relationship between the daily number of COVID-19 cases and the stock market (El-Khatib and Samet, 2020; Salisu and Vo, 2020; Baig, Butt, Haroon and Rizvi, 2020; Ashraf, 2020; Narayan, Phan and Liu, 2020), there is no comparison of the cross-section of countries have been made to our knowledge.

The Covid-19 pandemic threatens not only investments but also the health of all investors. This threat becomes more evident especially when the epidemic reaches investors' home countries. Therefore, although it was

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known that the pandemic will spread to every country, facing the pandemic in their home country also affected investors psychologically. Although there was no change in the risk posed by the pandemic numerically, there was a change in ordinary investors' perception. This threat also created a situation that can be turned into an advantage for rational investors. In this study, by defining these advantages, investors are tried to gain different perspectives.

Contributions to the literature are as follows. (1) By defining the performance differences between the countries where the pandemic first spread and then spread, it was analyzed whether investors can invest with long and short strategies. (2) The validity of the overreaction hypothesis was tested by comparing the subsequent performance of the lowest-performing and high-performing country indices during the pandemic. (3) The performances of the countries according to the order of the spread of the pandemic were compared. In this way, it is defined which of the country-specific news flow and global news flows were more prominent in different country index movements.

In the ongoing parts of the article, studies on Covid-19 in the literature are presented in section 2, data and methodology in section 3, findings in section 4, and results in section 5.

STUDIES COVERING EFFECTS OF COVID-19 ON STOCK MARKETS

Liu et al. (2020), in their studies examining the price changes caused by the Covid-19 pandemic in 21 leading world exchanges, found that these markets reacted very quickly and sharply with the spread of the epidemic. In the study, in which the date of 20 January 2020 was determined as the date of detection of the epidemic, it was observed that the markets in Asian countries with previous epidemic experiences reacted faster. According to other findings of the study, the negative impact on the markets increased as the number of Covid-19 cases increased, and the interaction in the markets worked negatively as a result of the fear of investors. Another study related to market reactions to health news of the top 20 worst affected countries from the Covid-19 pandemic, showed that there is a statistically significant and negative relation between health news and stock market returns (Salisu and Vo, 2020). Zeren and Hızarcı (2020) analyzed the response of stock markets to the pandemic in their study in countries highly affected by the Covid-19 pandemic. According to their findings, the countries' stock markets negatively reacted to the number of Covid-19 cases and deaths. Narayan, Phan, and Liu (2020) have investigated the policies of the governments and related reactions of stock markets in G7 countries. They found that all governmental policies including a lockdown of country, restriction of movements, and monetary expansion had positive impacts on stock market returns. Al-Awadhi, Al-Saifi, Al-Awadhi, and Alhamadi (2020) analyzed the relationship between the returns of the shares in the Chinese stock market and the Covid-19 outbreak. The daily increase in the number of Covid-19 cases and the increase in the number of deaths data were used as independent variables. According to the findings, the increase in the total number of cases and the number of daily cases reflected negatively on stock returns. Ashraf (2020) analyzed the response of 64 stock markets to the Covid-19 pandemic and found that stock markets quickly responded to the reported Covid-19 cases however the decline in the stock market is lower after the spread of the disease has progressed. On the other hand, the stock market response to reported deaths is lower in comparison with the reported cases. It may be due to the fact that disease detections have been reported and priced before and deaths follow the cases.

Examining the impact of the Covid-19 pandemic on different industries in the United States; Mazur, Dang, and Vega (2020) researched SP1500 shares. In the study where companies in the natural gas, food, health, and technology sectors respond positively; it has been observed that companies in the oil, real estate, entertainment, and hospitality sectors are differentiated quite negatively; and they have been found to experience abnormal price movements. In the same study, it was observed that senior executives resigned from their jobs and wage cuts were experienced, but on the other hand, new bonus payments and salary increases were realized in some companies unexpectedly. Alfaro, Chari, Greenland, and Schott (2020) studied the effects of Covid-19 on companies traded in the United States. According to the research conducted on a stock basis, it was observed that significant changes in estimates about the dimensions of the Covid-19 outbreak had a statistically significant negative effect on stock market pricing. On the other hand, it was determined that the unemployment applications were higher in states with a low rate of decrease in stocks. According to Ramelli and Wagner's (2020) study, between January 2, 2020, when the virus epidemic started, and February 27, 2020, the sectors that experienced the most loss in China were insurance, financial services, energy, banks, and transportation. On the other hand, the sectors that performed the best returns in the same period in the Chinese stock market

are telecom, healthcare, software, and technology. When the stock market in the United States is considered in the same period it is found that energy, transportation, automobiles, and materials sectors are affected at most similar to the Chinese market.

Some studies have examined the relationship between the Covid-19 pandemic and the volatility of stock markets. Lyócsa, Baumöhl, Výrost, and Molnár (2020) shown that Google researches related to the Covid-19 pandemic and the volatility of the market are correlated and it is possible to use Google search trends as an early warning indicator for sharp moves of the market. Baig, Butt, Haroon, and Rizvi (2020) investigated the trade volume and volatility of SP500 companies during the Covid-19 pandemic period and found that the liquidity of the market has been decreased significantly, on the other hand, there is a sharp increase in the volatility. When the last 120 years are examined, the volatility in the capital markets due to the Covid-19 pandemic has been higher than any previous crisis (Baker, et.al., 2020).

Sharif, Aloui, and Yarovaya (2020) have examined the relationship between the Covid -19 pandemic, oil prices, stock market, policy uncertainties, and geopolitical risks. In the study where it was determined that the geopolitical risks caused by the Covid-19 pandemic were much higher than the economic risks, it was reported that the negative effects were likely to continue in the long term. It is thought that the sharp losses in production and the drop in oil prices will seriously affect the oil-producing companies and the energy sector. On the other hand, travel restrictions and the prolongation of the impact of the pandemic pose a long-term risk for the accommodation and transportation sectors. Okorike and Lin (2020) examined the negative effects of the Covid-19 pandemic in their study involving 32 different countries and reached findings that support the fractal market hypothesis. Gormsen and Koijen (2020) investigated the impact of the Covid-19 outbreak on the growth expectations of companies, based on the amount of dividends companies are planning to distribute. At the beginning of the pandemic planned dividend distribution growth in 2020 was 28% in the United States and 25% in the European Union. On the other hand, the GDP growth forecast was 2.6% on the same date for both economies. The decline of the expected dividends was 43% in the United States and 50% in the European Union which cost about 4 to 10 years to catch up with previous GDP volumes. The study also demonstrated that the rapid decline of the stock markets can also be explained by the decrease of the dividend estimates.

DATA AND METHODOLOGY

Data

In this study, the index performance data of the leading markets in the world between February 21, 2020, and August 24, 2020, were used to measure the impact of the Covid-19 outbreak on the stock markets. February 21, 2020 was determined as is the date when world indices started to fall due to the pandemic. The most recent data available during the study are for 24 August 2020. Countries that are members of MSCI developed markets and emerging markets indices were selected to represent the leading stock markets in the world (MSCI, 2020). Daily data of world indices were obtained from investing.com, and the number of daily cases for Covid-19 was obtained from the European Union's https://data.europa.eu/ address. The number of developing countries included in the research is 25 and the number of developed countries is 23. The Chinese and Hongkong stocks markets were not included in the study due to the fact that the epidemic in these countries started long before other countries and because of their divergence from other countries with a 1-month phase difference. The countries included the MSCI index, the date of 1st, 100th and 1000th cases reached in each country, population, the total no of Covid-19 cases, and the max drawdown in the stock markets have been shown in Table 1.

METHOD

Articles in the literature, which studied the effects of Covid-19 on the stock markets, focused on the relation between the number of cases and deaths and stock markets' reactions (El-Khatib and Samet, 2020; Salisu and Vo, 2020; Baig, Butt, Haroon and Rizvi, 2020; Ashraf, 2020).

All the studies have shown that there is a negative relation between Covid-19 cases and stock market performances. This study, unlike other studies, it is tried to answer whether investors can benefit from the pandemics by measuring the response rates of different stock market indices compared to each other.

The spread of the Covid-19 epidemic, the measures which are taken regarding the epidemic, and the economic effects of the epidemic started in different countries on different dates. This situation allowed investors in countries where the epidemic started late, to follow the developments in other countries, and make advance moves. In addition, with the significant increase in world trade and international investment in the 21st century, the countries of the world have become more closely interconnected. On the other hand,

Table 1. The Countries in MSCI Index, Covid-19 Milestone Dates, and Max Drawdown in the Stock Markets

Country	MSCI Index	1st Case	100th Case	1000th Case	Population	Total # of Cases as of 24th Aug 2020	Max Drawdown in Stock Market
China	Emerging	31.12.19	19.01.20	25.01.20	1.433.783.692	89.695	-12,5%
South_Korea	Emerging	20.01.20	21.02.20	26.02.20	51.225.321	17.665	-32,6%
Japan	Developed	15.01.20	22.02.20	21.03.20	126.860.299	61.754	-29,2%
Italy	Developed	31.01.20	24.02.20	01.03.20	60.359.546	259.345	-39,4%
France	Developed	25.01.20	01.03.20	09.03.20	67.012.883	242.899	-37,7%
Germany	Developed	28.01.20	01.03.20	10.03.20	83.019.213	233.575	-37,8%
Singapore	Developed	24.01.20	01.03.20	02.04.20	5.804.343	56.353	-30,3%
Spain	Developed	01.02.20	02.03.20	08.03.20	46.937.060	386.054	-38,2%
USA	Developed	21.01.20	03.03.20	11.03.20	329.064.917	5.702.611	-33,0%
UK	Developed	01.02.20	04.03.20	13.03.20	66.647.112	325.642	-32,6%
Belgium	Developed	04.02.20	05.03.20	13.03.20	11.455.519	81.842	-38,0%
Switzerland	Developed	26.02.20	07.03.20	14.03.20	8.544.527	39.802	-26,6%
Netherlands	Developed	28.02.20	07.03.20	16.03.20	17.282.163	66.490	-34,5%
Norway	Developed	27.02.20	07.03.20	16.03.20	5.328.212	10.197	-33,1%
Sweden	Developed	01.02.20	07.03.20	16.03.20	10.230.185	86.068	-31,2%
Austria	Developed	26.02.20	09.03.20	17.03.20	8.858.775	25.239	-48,2%
Denmark	Developed	27.02.20	10.03.20	18.03.20	5.806.081	16.127	-24,9%
Malaysia	Emerging	25.01.20	10.03.20	21.03.20	31.949.789	9.267	-20,3%
Australia	Developed	25.01.20	10.03.20	22.03.20	25.203.200	24.812	-36,3%
Canada	Developed	26.01.20	12.03.20	22.03.20	37.411.038	124.896	-37,1%
Qatar	Emerging	01.03.20	12.03.20	05.04.20	2.832.071	117.008	-17,1%
Czechia	Emerging	02.03.20	13.03.20	23.03.20	10.649.800	21.923	-33,0%
Finland	Developed	30.01.20	13.03.20	28.03.20	5.517.919	7.871	-35,0%
Greece	Emerging	27.02.20	13.03.20	29.03.20	10.724.599	8.664	-45,8%
Portugal	Developed	03.03.20	14.03.20	21.03.20	10.276.617	55.597	-33,2%
Israel	Developed	22.02.20	14.03.20	23.03.20	8.519.373	103.151	-32,1%
Brazil	Emerging	26.02.20	15.03.20	22.03.20	211.049.519	3.605.783	-44,1%
Ireland	Developed	01.03.20	15.03.20	24.03.20	4.904.240	27.969	-39,7%
Poland	Emerging	04.03.20	15.03.20	26.03.20	37.972.812	61.762	-37,5%
Philippines	Emerging	30.01.20	15.03.20	29.03.20	108.116.622	189.601	-37,3%
Thailand	Emerging	13.01.20	16.03.20	26.03.20	69.625.581	3.397	-31,2%
Saudi Arabia	Emerging	03.03.20	16.03.20	27.03.20	34.268.529	307.479	-25,6%
Indonesia	Emerging	02.03.20	16.03.20	28.03.20	270.625.567	153.535	-33,1%
Egypt	Emerging	15.02.20	16.03.20	06.04.20	100.388.076	97.237	-36,2%
Chile	Emerging	04.03.20	17.03.20	26.03.20	18.952.035	397.665	-36,5%
Pakistan	Emerging	27.02.20	17.03.20	26.03.20	216.565.317	292.765	-32,3%
India	Emerging	30.01.20	17.03.20	30.03.20	1.366.417.756	3.106.348	-36,9%
Russia	Emerging	01.02.20	18.03.20	28.03.20	145.872.260	956.749	-45,4%
Peru	Emerging	07.03.20	18.03.20	01.04.20	32.510.462	594.326	-30,9%
UAE	Emerging	27.01.20	18.03.20	03.04.20	9.770.526	67.007	-36,9%
Turkey	Emerging	12.03.20	19.03.20	23.03.20	82.003.882	258.249	-27,9%
South Africa	Emerging	06.03.20	19.03.20	28.03.20	58.558.267	609.773	-35,4%
Mexico	Emerging	29.02.20	19.03.20	31.03.20	127.575.529	560.164	-26,4%
Colombia	Emerging	07.03.20	19.03.20	02.04.20	50.339.443	541.147	-45,2%
Taiwan	Emerging	21.01.20	19.03.20	N/A	23.773.881	487	-25,7%
Argentina	Emerging	04.03.20	20.03.20	02.04.20	44.780.675	336.789	-42,8%
Hungary	Emerging	05.03.20	21.03.20	10.04.20	9.772.756	5.155	-35,6%
New Zealand	Developed	28.02.20	23.03.20	10.04.20	4.783.062	1.332	-29,8%

Resource: MSCI index, https://data.europa.eu/ and investing.com; prepared by the author

the rapid development in communication channels, especially in social media, has enabled people to access information much faster. In all these opportunities and interrelationship networks, the monetary policy decisions of the FED, the financial packages announced by the governments, and the intense news flow have been important factors affecting the world stock markets. Therefore, looking at the stock prices in daily frequency and forming a relationship with the number of cases may give wrong results. In this study, larger time frames are used to prevent this. There are two stages of the study. The first one determines the relation between the spread of the Covid-19 pandemic and stock market performances. The second one tests the overreaction hypothesis in the Covid-19 pandemic.

In the first part of the first stage of the research, countries are divided into 4 groups with an equal number of countries according to the spread dates of Covid 19. While determining the periods there were two goals. The first was to differentiate the countries where the epidemic progresses rapidly from other countries in terms of the impact of the epidemic on the stock market. The second is to measure the performances over as long as possible while doing this. When the development of the Covid-19 outbreak is monitored in different countries, slow progress is observed in the first weeks. For example, although the first cases were reported on January 25 in France, January 28 in Germany, and February 1 in Russia, the rapid increase in the pandemic started at the end of February. Although progress after the first cases is slow in many countries, it is noteworthy that a geometric increase begins after the number of 100 cases exceeds and control is lost. On the other hand, the number of 100 cases represents a statistically significant size, therefore, it has been determined as an important milestone in many similar studies (Oh et al., 2020; Phan and Narayan, 2020; Binny et al, 2020). In addition, when 100 cases have been observed in a specific country it is a material indicator for investors to be sure about the dimensions that the epidemic may reach in the future. So, the base metric when forming different quartiles of the countries is the report date of the 100th cases. Based on the time elapsed until 100 cases were seen in each of the countries in the relevant country groups, 4 different test periods were created. It has been determined whether the performances of the relevant country indices differ from the average of all countries in the periods by using t-tests. Abnormal returns are calculated by looking at the difference between the average of the group formed from the relevant country indices and the average of all country indices.

In the second part of the first stage, to strengthen the statistical results, the test in the first stage was repeated by forming two groups. The countries are divided where the pandemic first spread and later, and it was tested by t-tests whether the performances of these country groups differed in the relevant periods.

In the third part of the first stage, to understand whether the level of economic development of the countries is effective in the response of stock market indices to the pandemic, countries are divided into developed and developing countries. Later, both groups were divided into two as the countries where the pandemic spread before and the countries where it spread later. The index performances of the countries where the pandemic first spread and the countries where it spread later were compared with the t-tests and it was determined whether there was a performance difference. The hypothesis tested by the first research methodology is presented below.

H1: Pricing was not formed effectively in stock markets in countries where the Covid-19 outbreak has not started. Therefore, there was a relation between the order of countries in terms of starting Covid-19 cases and the stock market performances.

In the second stage of the research, the overreaction of the stock markets to the Covid-19 pandemic was examined. Investors can react sharply to negative news and may want to sell their shares even though prices have already dropped too much. On the other hand, while there is negative news, the desire of other investors to open new positions decreases. This increases the severity of the depreciation in securities as sellers cannot find buyers. De Bondt and Thaler (1985), who theorized this situation, put forward the overreaction hypothesis. De Bondt and Thaler (1985) calculated the performances of companies by determining different periods, especially three years. They formed winners and losers' portfolios based on past performances of the companies and monitored the performances of the two different portfolios in the following periods. They found that losers' portfolios have achieved higher returns than winners in the following periods. In this study, it was tried to determine whether the stock markets of some countries overreacted to the pandemic. For this purpose, the post-pandemic performances of the countries that suffered the most and the least losses due to the pandemic were examined. During the spread of the pandemic, the stock market performances of the countries in the 25% (50%) percentile with the highest loss in the stock market index and the countries in the 25% (50%) percentile with the

Table 2. The Formation of Quartiles in the Study Based on the Date of the 100th Case in Each Country

1st Quartile based on date of 100th case; until March 5, 2020, except China	South Korea, Japan, Italy, France, Germany, Singapore, Spain, USA, United Kingdom, Belgium
2nd Quartile based on date of 100th case; since March 6, until March 13, 2020	Switzerland, Netherlands, Norway, Sweden, Austria, Denmark, Malaysia, Australia, Canada, Qatar, Czechia, Finland, Greece
3rd Quartile based on date of 100th case; since March 14, until March 17, 2020	Portugal, Israel, Brazil, Ireland, Poland, Philippines, Thailand, Saudi Arabia, Indonesia, Egypt, Chile, Pakistan, India
4th Quartile based on date of 100th case; since March 18, until March 23, 2020	Russia, Peru, UAE, Turkey, South Africa, Mexico, Colombia, Taiwan, Argentina, Hungary, New Zealand

Resource: Prepared by the author using the countries listed in MSCI indices and Covid-19 cases reported in https://data.europa.eu/

least loss were compared in the following period, and whether there was a difference was tested. T-tests were used in the study. The hypothesis tested by the second research methodology is presented below.

H2: World stock markets, which experienced the most loss during the Covid-19 epidemic, have achieved the highest return in the following period.

FINDINGS

In the first methodology, countries are divided into 4 quartiles depending on the date of the spread of the Covid-19 outbreak. Accordingly, the time periods were determined as the first period between February 21st and March 5th, the second period between March 6th and March 13th, the third period between March 14th and March 17th, and the fourth period between March 18th and March 23rd. The countries included in the quartiles created are presented in Table 2.

Figure 1 shows the daily performance of country stock market indices based on the quartiles described in Table 2. As stated earlier, the SP500 reached its highest level on February 21, 2020. This figure shows the cumulative returns of country indices starting from this date. As can be seen from the graph, all country quartiles formed according to the spread order of the Covid-19 show similar performances on the same dates. This shows that global news and interaction between countries are much more effective in the performance of stock markets than the number of cases seen in a country. On the other hand, it is observed that the countries in Quartile 1 and Quartile 2, which reached the number of 100 cases before March 13, performed lower than other countries until that date. In the following period, the cumulative performance was equalized in the countries of the different quartiles as the disease spread in other countries.

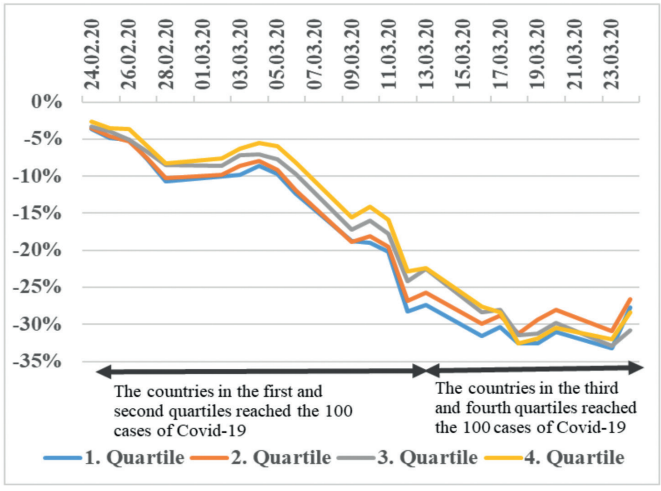


Figure 1. Daily Performances of the Stock Price Indices in Different Quartiles
Source: Prepared by author using research data.

Figure 2 shows the abnormal returns of each quartile in specific periods determined based on the date each quartile reached the number of 100 cases. The abnormal returns of the quartiles were calculated based on the difference between the average returns of all country indices within the scope of the study. In this graph, it is seen that the 1st and 2nd quartiles were negatively differentiated at the beginning compared to the overall average, and the countries in the 3rd and 4th quartiles close the difference when the virus outbreak reaches their own countries.

In Table 3, the average periodic returns of the countries in different quartiles are presented. The periods are determined based on the progress of the Covid-19 in different quartiles. The data in this table show that the country indices generally act together, but there is still a significant divergence in the countries where the epidemic first started and later started.

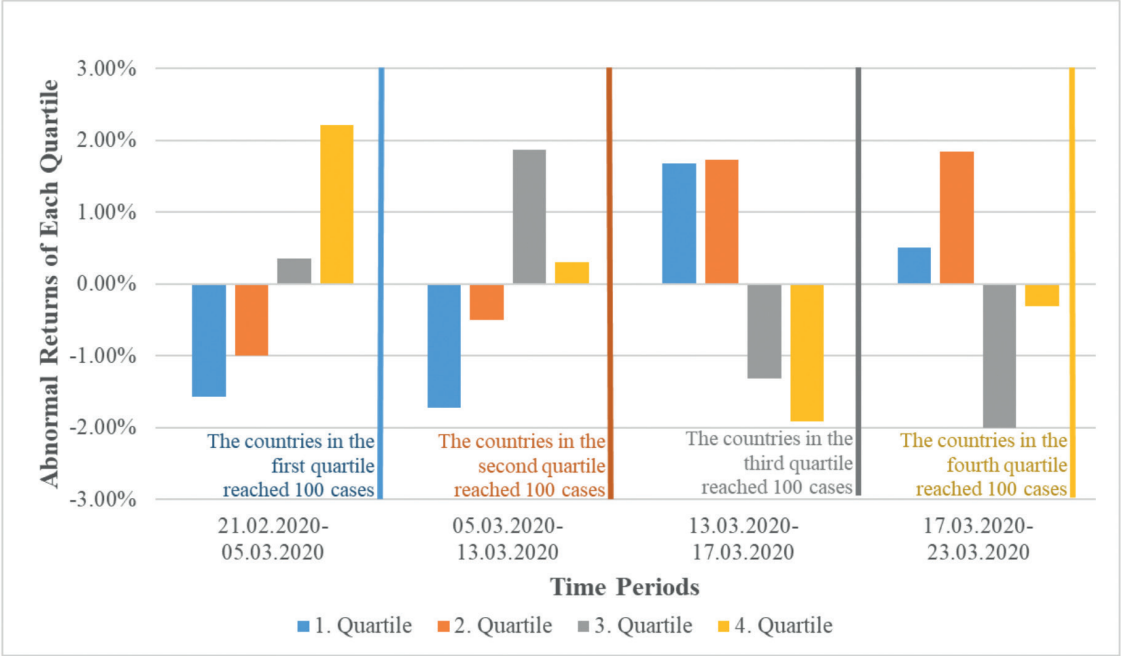


Figure 2. Abnormal Returns of Each Quartile During Different Periods of the Spread of The Covid-19 Pandemic
Source: Prepared by author using research data.

Table 3. The Development of Periodic Return Performance of the Stock Market Indices in Different Quartiles

Quartiles (According to the starting order of the epidemic)	**21.02.2020-05.03.2020**	**05.03.2020-13.03.2020**	**13.03.2020-17.03.2020**	**17.03.2020-23.03.2020**
1 (First)	-9.7%	-19.6%	-4.2%	-4.2%
2	-9.1%	-18.4%	-4.1%	-2.9%
3	-7.8%	-16.1%	-7.1%	-6.9%
4 (Last)	-6.0%	-17.6%	-7.7%	-5.2%

Source: Prepared by author using research data.

To test the statistical significance of the above-mentioned results, the countries in quartile 1 and quartile 2 are combined in group 1 and other quartiles in group 2. Afterward, it was tested whether the performances of the countries in these groups were different from each other.

The results are statistically significant in the first period between February 21 and March 5 and in the third period between March 13 and March 17. On March 11, 2020, the World Health Organization declared the Covid-19 outbreak as a pandemic, and it was clear that all countries in the world would experience the pandemic similarly. However, the results in Table 4 show that stock markets in countries where the epidemic spread late had not priced the epidemic as quickly as other countries.

Many countries in Europe are classified in the MSCI developed countries index. On the other hand, since the stock markets of developed countries are more efficient, it may be possible that they react to the Covid-19 outbreak faster. In this case, there is a bias against the finding of this study that the stock markets are falling faster in the countries where the epidemic first spread. To test this situation, developed and developing countries are separated. Each country group is also divided into two equal subgroups, where the disease is first spread and subsequently spread. Then, by looking at the development of pricing in these different groups, it was tried to find out which criterion was more effective. The results are presented in Table 5. According to the data presented in this table, it is seen that the stock market indices in the countries that experienced the epidemic first in both developed and merging country groups reacted before. The stock markets in the countries which experience the epidemic later show poor performance when the epidemic spreads, closing the gap.

In this study, to test the overreaction hypothesis, portfolios should be created first. SP500, the world's leading stock market indicator, reached its historical peak

Table 4. t-test Showing the Performance Differences Between the Country Indices According to the Spread Date of the Epidemic

According to the starting order of the epidemic		21.02.2020 - 05.03.2020	06.03.2020 - 13.03.2020	14.03.2020 - 17.03.2020	18.03.2020 - 23.03.2020
Average	**First 50%**	-8.9%	-18.4%	-4.1%	-3.5%
	Last 50%	-6.7%	-16.3%	-7.8%	-4.9%
Variance	**First 50%**	0.2%	0.3%	0.1%	0.3%
	Last 50%	0.1%	0.3%	0.3%	0.4%
t stat		-1.85	-1.33	2.53	0.93
Probability		0.04	0.10	0.01	0.18

Source: Prepared by author using research data.

Table 5. The Performance of Countries in Different Indices and in Different Periods

MSCI Index	Groups (According to the starting order of the epidemic)	21.02.2020-05.03.2020	05.03.2020-13.03.2020	13.03.2020-17.03.2020	17.03.2020-23.03.2020
Developed	First 50%	-10.2%	-20.1%	-3.4%	-3.0%
Developed	Last 50%	-8.6%	-18.2%	-3.8%	-6.1%
Emerging	First 50%	-7.0%	-15.5%	-6.3%	-3.6%
Emerging	Last 50%	-5.8%	-16.2%	-8.8%	-6.7%

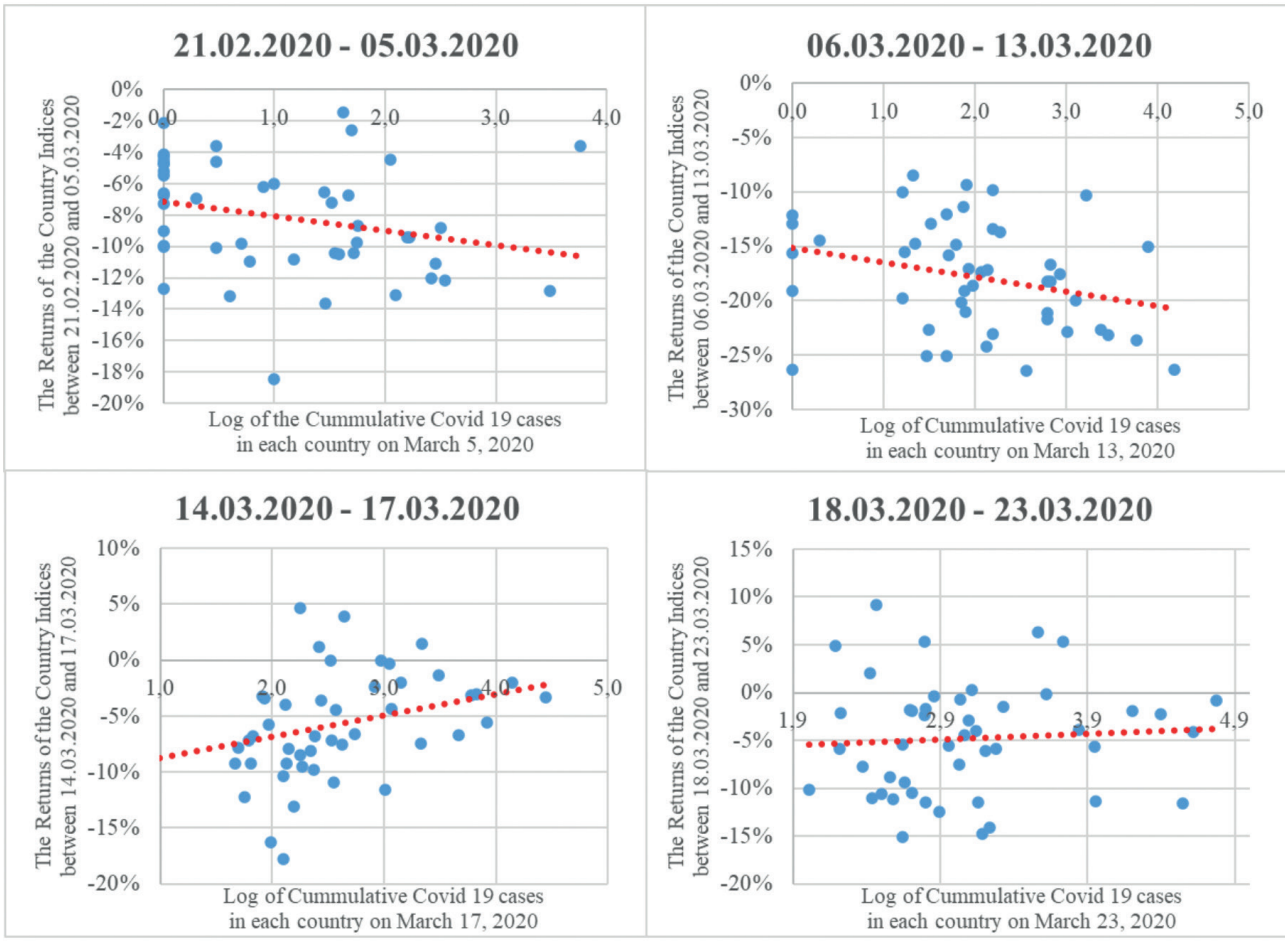
Groups are prepared based on the spread of the covid-19 pandemic. The top 50% of the countries which reached the 100th case of Covid-19 earlier is included in Group 1 and other countries included in Group 2. Developed and emerging countries classified separately.

Source: Prepared by author using research data.

on February 21, 2020, before the Covid-19 pandemic was priced. After this date, declines were observed in all world stock markets with the effect of Covid-19. On March 23, the number of Covid-19 cases exceeded the number of 100 in all leading countries of the world, and the Covid-19 outbreak was largely priced. Therefore, the time frame between February 21, 2020, and March 23, 2020, has been determined for the creation of portfolios. In this period, the 24 companies with the highest performance were used to create the winners' portfolio, and the worst-performing 24 companies were included in the losers' portfolio. Then, the performance differences of the winners and losers' portfolios between March 23, 2020, and August 24, 2020, were measured. 24 August 2020 is the date when the most up-to-date data is available as of the time this study was prepared.

In the tables and graphics presented up to this stage, the returns were calculated based on the date of reaching the 100th case. So, is there a relationship between the number of cumulative cases reached and the performance of stocks until that date? To answer this question, the analysis presented in Figure 3 was conducted. The cumulative Covid-19 cases and stock market performance in 48 countries in MSCI indices have been shown in this figure. Accordingly, between February 21 and March 13, the stock market indices in the countries where the epidemic first started were negatively differentiated. There is a negative relationship between the total number of cases and the stock market index. Later, when the epidemic reached a certain size in other countries, this relationship was disrupted, and the cumulative stock market returns in all countries approached each other. The low stock market performances between March 14 and March 17 in countries where the epidemic later spread is particularly interesting.

Studies examining behavioral finance show that people remain in control of their emotions and cannot



Fiqure 3. The Relation Between Cumulative Covid-19 Cases and Performance of Stock Market Indices in Each Country Listed in MSCI Developed and Emerging Markets

Source: Prepared by author using research data.

act rationally in many situations (Barberis and Thaler, 2003). Pandemics are events that affect large masses, disrupt human psychology, and also have serious negative effects on economies. From this point of view, pandemics may affect investors at the point of making irrational decisions. In this part of the study, the validity of the overreaction hypothesis proposed by De Bondt and Thaler (1985) was tested for the Covid-19 pandemic. For this purpose, the data of the stock market indices of 48 countries listed in the MSCI index were used, and portfolios of winners and losers were created. Before the pandemic, February 21, 2020, which was the peak level of SP500, and March 23, 2020, when the number of cases exceeded 100 in all countries, were determined as milestones. The indices of 24 countries with the highest losses among these dates were included in the losers' portfolio, while other countries were included in the winners' portfolio. The validity of the overreaction hypothesis was tested by comparing the returns of these portfolios between March 23 and August 24. The results of the overreaction hypoesthesia tests are shared in Table 6 and Table 7. According to the findings obtained, it is seen that the indices that performed the worst between February 21 and March 23, 2020, showed a performance of 35.5% in the following period. It is seen that the best performing stock market indices in the top 50% remained at 31% in the following period. However, the difference between the returns of two different portfolios is not statistically significant. Another comparison is made between the worst-performing 25% of the stock market indices and the best performing 25% of the stock market indices. The performance difference in the following period between these two different portfolios is 8.6% in favor of the losers. Besides, the results are statistically significant at the 5% level.

CONCLUSION

In this study, the development of 48 leading world indices, including MSCI developed and emerging market indices, during the Covid-19 pandemic was examined. By comparing the performances of the countries according to the spread order of the pandemic, it has

Table 6. The Performances Used in the Formation of Winners' and Losers' Portfolios and Following Performances

Portfolio	Country	100th Case Date	Minimum Date	Loss since Feb 21, 2020 until Min Date	Loss since Feb 21, 2020 until March 23, 2020	Gain since March 23, 2020 until Aug 24, 2020	Average Gain since March 23, 2020 until Aug 24, 2020
Losers	Brazil	15.03.2020	23.03.2020	-44.1%	-44.1%	60.4%	36.4%
	Colombia	19.03.2020	18.03.2020	-45.2%	-43.4%	30.5%	
	Russia	18.03.2020	18.03.2020	-45.4%	-42.0%	45.0%	
	Greece	13.03.2020	16.03.2020	-45.8%	-41.9%	22.0%	
	Austria	9.03.2020	18.03.2020	-48.2%	-40.3%	19.5%	
	Italy	24.02.2020	16.03.2020	-39.4%	-38.4%	31.8%	
	Ireland	15.03.2020	18.03.2020	-39.7%	-38.2%	44.5%	
	Canada	12.03.2020	23.03.2020	-37.1%	-37.1%	47.9%	
	Spain	2.03.2020	16.03.2020	-38.2%	-37.0%	14.1%	
	India	17.03.2020	23.03.2020	-36.9%	-36.9%	49.3%	
	Australia	10.03.2020	23.03.2020	-36.3%	-36.3%	34.8%	
	Chile	17.03.2020	18.03.2020	-36.5%	-36.1%	36.7%	
	Philippines	15.03.2020	19.03.2020	-37.3%	-35.6%	25.3%	34.6%
	Germany	1.03.2020	18.03.2020	-37.8%	-35.6%	49.5%	
	South Africa	19.03.2020	23.03.2020	-35.4%	-35.4%	45.8%	
	France	1.03.2020	18.03.2020	-37.7%	-35.1%	27.9%	
	Finland	13.03.2020	18.03.2020	-35.0%	-34.9%	47.2%	
	Belgium	5.03.2020	17.03.2020	-38.0%	-34.7%	26.5%	
	UAE	18.03.2020	17.03.2020	-36.9%	-33.8%	30.7%	
	Portugal	14.03.2020	19.03.2020	-33.2%	-33.2%	23.0%	
	USA	3.03.2020	23.03.2020	-33.0%	-33.0%	53.4%	
	Norway	7.03.2020	18.03.2020	-33.1%	-32.9%	38.7%	
	Poland	15.03.2020	12.03.2020	-37.5%	-32.7%	31.0%	
	Hungary	21.03.2020	18.03.2020	-35.6%	-32.6%	16.7%	
Winners	UK	4.03.2020	23.03.2020	-32.6%	-32.6%	22.2%	34.1%
	Indonesia	16.03.2020	25.03.2020	-33.1%	-32.2%	32.3%	
	Israel	14.03.2020	23.03.2020	-32.1%	-32.1%	20.4%	
	Argentina	20.03.2020	18.03.2020	-42.8%	-31.8%	76.6%	
	South Korea	21.02.2020	19.03.2020	-32.6%	-31.5%	57.2%	
	Netherlands	7.03.2020	18.03.2020	-34.5%	-31.4%	32.4%	
	Czechia	13.03.2020	18.03.2020	-33.0%	-31.3%	13.2%	
	Sweden	7.03.2020	23.03.2020	-31.2%	-31.2%	38.4%	
	Thailand	16.03.2020	23.03.2020	-31.2%	-31.2%	21.9%	
	Singapore	1.03.2020	23.03.2020	-30.3%	-30.3%	15.1%	
	New Zealand	23.03.2020	23.03.2020	-29.8%	-29.8%	40.6%	
	Pakistan	17.03.2020	25.03.2020	-32.3%	-29.0%	39.3%	
	Peru	18.03.2020	3.04.2020	-30.9%	-28.3%	30.1%	27.8%
	Turkey	19.03.2020	23.03.2020	-27.9%	-27.9%	31.6%	
	Japan	22.02.2020	20.03.2020	-29.2%	-27.8%	36.1%	
	Egypt	16.03.2020	18.03.2020	-36.2%	-26.8%	13.8%	
	Switzerland	7.03.2020	23.03.2020	-26.6%	-26.6%	26.3%	
	Mexico	19.03.2020	23.03.2020	-26.4%	-26.4%	15.5%	
	Saudi Arabia	16.03.2020	16.03.2020	-25.6%	-25.2%	32.8%	
	Denmark	10.03.2020	23.03.2020	-24.9%	-24.9%	40.8%	
	Taiwan	19.03.2020	19.03.2020	-25.7%	-23.9%	42.3%	
	Malaysia	10.03.2020	19.03.2020	-20.3%	-17.7%	24.5%	
	Qatar	12.03.2020	9.03.2020	-17.1%	-14.6%	12.7%	
	China	19.01.2020	23.03.2020	-12.5%	-12.5%	27.3%	

Source: Prepared by author using research data.

Table 7. t Tests Showing the Comparison of Performances of the Winner and the Loser Portfolios

	Comparison of the Performances (Top 50% and Bottom 50%)		Comparison of the Performances (Top 25% and Bottom 25%)	
	Losers (Bottom 50%)	Winners (Top 50%)	Losers (Bottom 25%)	Winners (Top 25%)
Mean	35.5%	31.0%	36.4%	27.8%
Variance	1.6%	2.2%	1.9%	1.0%
df	23		11	
t Stat	1.036		1.904	
Probability	0.155		0.042	

Losers and winner portfolios formed based on the performance of the stock market indices from Feb 21, 2020 until March 23, 2020. The values in the tables show the performance of the indices between March 23,2020 and August 24, 2020.

Source: Prepared by author using research data.

been tried to understand whether there is an arbitrage opportunity for investors. Besides, due to the pandemic, the performances of the world stock markets were examined, and it was tested if they overreacted. In this way, it was tried to be understood whether cases that affect investors psychologically, such as the Covid-19 pandemic, create an investment opportunity for rational investors.

According to the research results, the main determinant affecting the performance of stock markets during the Covid-19 outbreak was the global progression of the epidemic. Because the stock markets of countries where the epidemic has not yet started or where it is behind reacted with a similar harshness to other countries in the first days. Although many studies in the literature have examined the number of Covid-19 cases and the performance of stocks and found a positive relationship (El-Khatib and Samet, 2020; Salisu and Vo, 2020; Baig, Butt, Haroon and Rizvi, 2020; Ashraf, 2020; Narayan, Phan and Liu, 2020), findings from this study do not confirm them. According to the results obtained from this study, it is seen that market pricing in most countries formed before the epidemic progressed. On the other hand, when the performances of the stock market indices in the countries where the epidemic progressed earlier and spread later have been compared, it was observed that there was a performance difference of approximately 6% between these two groups in the first 3 weeks. This performance difference was closed in the following two weeks after the epidemic spread to all countries. This shows that investors can gain an advantage by closing their positions or opening short positions in countries where the epidemic has not yet spread.

On the other hand, the index performances of the countries were analyzed after the pandemic spread to all countries. It has been tried to understand whether the indices of the lowest-performing countries overreact. For this purpose, indices were divided into groups according to their performances, and portfolios of winners and losers country indices were created. The date when the number of cases reached 100 in all countries has been determined as a milestone. In the following period, it was observed that the portfolio created from the losing country indices overperformed the winning country indices by an average of 8.6% in 5 months.

The results obtained from this study show that investors did not make rational decisions during the Covid-19 pandemic, and they reacted excessively during the beginning of the epidemic. Findings from this study provide investors with information to help them decide on similar events in the future. In future studies on this subject, it can be analyzed whether the overreaction hypothesis is valid on stock-based performances. The efficiency of investors can be measured by comparing the financial performances of the companies with the development in their prices.

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The Effect of Workplace Social Courage on Life Satisfaction: A Scale Adaptation

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ABSTRACT

Although the concept of courage has a long history, it is a latterly popular topic in organizational behavior. It is also an essential attitude or behavior for employees in whistleblowing, voice, unethical pro-organizational behavior. A valid and reliable scale is needed to reveal the effect of courage in different cultures. The study aims to adapt the workplace social courage scale to Turkish and test the validity and reliability of the scale. In three studies, the authors tested the scale's linguistic equivalence first, then its structural validity, and finally its predictive power on life satisfaction. Correlation, internal consistency, and explanatory factor analysis (EFA) were conducted with SPSS 23.0, and confirmatory factor analysis (CFA) and structural model analysis were performed with AMOS 23.0. Study one sample consisted of 48 academicians with sufficient English and Turkish language. Study two sample involved 267 employees from the tourism and finance sector. Study three sample comprised 374 data obtained from industrial and textile manufacturing employees. Back and forth translation and test-retest analysis results show the Turkish form has linguistic equality. EFA results indicate the adapted scale has a one-dimensional factor like the original one. CFA results reveal the adapted form has the one-factor structure in a different sample. The structural model analysis showed workplace social courage has a significant and positive effect on life satisfaction. The adapted Turkish form of workplace social courage scale is valid and reliable.

Keywords: Workplace social courage, Scale adaptation, Life satisfaction, Turkish form of courage.

JEL Classification Codes: I31, J21, M10

INTRODUCTION

Courage is one of the fundamental values that have been talked about from past to present. However, there is no consensus on it as a concept. Authors working in different fields have made different definitions. Especially philosophers defined courage based on the heroism of soldiers on the battlefield. In this view, courage means that people face various dangers on the job, such as soldiers, police officers, firefighters, and doctors, to fulfill their duties against these dangers. However, it may require employees to make brave decisions in today's organizations in situations such as disclosing information, unethical behaviors for the organizations' benefit, and decision-making in ethical dilemmas (Howard et al., 2017).

Individuals' bravery in organizational life has significant effects on both employees and the organization in the long term (Kilmann et al., 2010). Having social courage in the workplace can be defined as voluntarily pursuing a socially worthwhile goal, despite the fear and risk of a challenging event (Detert & Bruno, 2017). To protect the organization's interests or society, the employees must face formal or natural power people. Courage comes into play and can affect employees' behaviors or decisions in these situations (Hannah & Avolio, 2010; Koerner, 2014).

Studies show that workplace social courage has a relationship with various organizational outcomes, and it has positive effects on employee voice, organizational citizenship behavior, and life satisfaction. Employees with high social courage exhibit extra organizational citizenship behavior, share their ideas further and experience more life satisfaction. Also, social courage causes a decrease in stress, depression, and anxiety while also decreasing counterproductive work behaviors (Detert & Bruno, 2017; Howard & Alipour, 2014; Howard & Holmes, 2019; Magnano et al., 2017; Santisi et al., 2020).

Another aspect of courage is a contribution to the development of the organizational culture. The stories told about the courageous behavior of the employees become a part of the corporate culture and inform the employees about the desired or accepted behaviors (Detert & Bruno, 2017). Howard and Cogswell (2019)

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state that social courage antecedent is brave, resilience, initiative, tenacity, a proactive personality, social support, empowering leadership, power distance, and age.

The number of studies on social courage in Turkey is deficient, and these are generally qualitative and conceptual studies (Mert, 2007, 2010, 2021; Mert & Aydemir, 2019). Social courage needs to be accurately measured to understand its concept, increase empirical studies, and guide researchers and practitioners in Turkey. A valid scale is required to determine both predecessors and organizational consequences of social courage and is essential to quantitative studies. Howard et al. (Howard et al., 2017) developed the workplace social courage scale, and researchers conducted it in some studies (Ginevra et al., 2020; Howard, 2021; Howard & Fox, 2020; Howard & Holmes, 2019). The scale successfully measures individuals' perceptions of social courage (Howard et al., 2017).

There is a lack of empirical studies about workplace social courage in Turkish literature. At this point, the authors considered developing a scale for courage or adapting an existing one. Because courage has been a topic discussed in different cultures for centuries and interpreted in common across cultures (Zavaliy & Aristidou, 2014) and advantages of adapting a scale (e.g., fast, cheap, and more reliable), the authors decided to adapt to the workplace social courage scale developed by Howard et al. (2017), whose reliability and validity have been tested in different studies before (e.g., Howard, 2019; Howard & Fox, 2020; Howard & Murry, 2020). One of the biggest obstacles in courage studies is the lack of a valid and reliable scale in Turkish literature. The authors considered that this study is essential in filling this gap. Turkish adaptation of the scale is also critical for comparing the results in international literature and different cultures.

The study aims to adapt to the workplace social courage scale developed by Howard et al. (Howard et al., 2017) to Turkish. For this purpose, the authors conducted three different studies. The first study is for linguistic equivalence, the second is for explanatory factor analysis, and the third is for confirmatory factor analysis. In the third study, we also examined the effect of social courage on life satisfaction to test the predictive power of the translated scale with structural model analysis because studies show that individuals who attribute themselves as courageous see their behaviors positively and have a more positive perspective on their life (Hannah et al., 2007; Koerner, 2014; Magnano et al., 2021; Santisi et al., 2020).

SOCIAL COURAGE

Studies on courage date back 2500 years, and according to Plato, courage is one of the most important virtues, and it is not easy to demonstrate other virtuous behaviors without courage. Philosophers stated that courage is critical for wars and other civil life areas, but courage emerges as an essential issue in an organization. It is a virtue that may also be necessary for today's employees. Some situations may require courage for employees, such as speaking up against powerful people or opposing injustice (Detert & Bruno, 2017; Scarre, 2012). Management researchers also refer to managers should have courage as a trait or behavior for effective leadership (Detert & Burris, 2007; McMillan & Rachman, 1988). It is a guiding virtue in managers' and employees' decisions and whistleblowing, reducing counterproductive work behavior, conflict management, and moral behavior (Detert & Bruno, 2017; Howard, 2019; Kilmann et al., 2010).

There is no consensus on the definition of the concept of courage. Different disciplines define courage differently. Mert (2021) tried to reveal the components of courage in Turkish culture with a qualitative study. He defines courage as "the conscious and decisive use of the power (resources) by taking the fear under control to achieve a moral purpose, generously doing what is necessary, in difficult conditions that contain threats and risks.". The main concepts in the general definition of courage are good for others, and these values can be moral, reaching an important goal or result, taking risks, acting voluntarily (Kilmann et al., 2010; Rate et al., 2007).

Depending on the interaction in the organizational environment, three different courage are essential, moral, physical, and social courage (Howard et al., 2017; Woodard & Pury, 2007). Moral courage is especially evident in the violation of ethical norms. Few studies reveal the nature of moral courage. When evaluated from an organizational perspective, moral courage gains importance in whistleblowing, especially considering today's corporate scandals. Physical courage is a trait or behavior that an individual shows perform to duties that could be physically harmed. These two courage is not our concern in this study. The third courage type is social courage. Social courage can be expressed as behaviors that individuals perform voluntarily for the benefit of the organization by taking risks and gaining respect in the eyes of others (Howard & Holmes, 2019).

Antecedents and consequences of social courage

Researchers have taken courage as an attitude or behavior and examined the factors that cause this attitude or behavior. The personality traits of the individual are a priority of courage. Especially risk-taking and proactive personality has a positive relationship with courage. Apart from personality traits, the social support of individuals, job diversity, job significance, identity, complexity, and skill diversity has a positive relationship with courage. An ethical and empowering leadership style also positively impacts social courage. Demographic variables such as gender, age, and experience may affect courage (Howard, 2021; Howard & Cogswell, 2019; Koerner, 2014; Rate et al., 2007).

Studies show that courage predicts some organizational outcomes such as organizational citizenship behavior, silence, counterproductive work behavior, stress, depression, anxiety, life satisfaction, psychological capital, and career adaptation (Detert & Bruno, 2017; Howard, 2019; Howard & Holmes, 2019).

Social courage and life satisfaction relationship

Life satisfaction is the degree of general satisfaction individuals have with life (Haybron, 2007; Marques et al., 2007, 2013; Pavot & Diener, 1993). The studies conducted between life satisfaction and courage show that individuals who attribute themselves as courageous see their behaviors positively and have a more positive perspective (Hannah et al., 2007). Employees who display brave behavior perceive themselves more constructively, thus gaining a positive view of life (Koerner, 2014). Studies show that courage is positively associated with life satisfaction (Howard, 2019; Magnano et al., 2021; Santisi et al., 2020) Based on this, we hypothesize that:

H1: Workplace social courage has a positive and significant relationship with life satisfaction.

Social courage scales

Empirical studies need a valid scale. There are three commonly known scales used to measure courage. The first is the multidimensional courage scale, with 23 expressions developed by Woodard and Pury (2007). The uncertain dimensions of this scale (Howard & Alipour, 2014; Woodard & Pury, 2007) caused the scale not to be preferred much. The second one is the courage scale developed by Norton and Weiss (Norton & Weiss, 2009). Researchers used Norton and Weiss's courage scale in different studies. However, Norton and Weiss's definition of courage on fear made the factor measured by the expressions in the scale controversial. It has been criticized primarily for shifting towards risk-taking (Howard & Alipour, 2014). The third scale is the social courage scale developed by Howard et al. (Howard et al., 2017). There are 11 statements of the original scale, and it consists of one dimension. Different studies showed the original version of the scale is valid and reliable (Howard, 2019; Howard & Fox, 2020; Howard & Murry, 2020).

METHODS

In the study, the authors conducted three investigations within the scope of adapting the workplace social courage scale into Turkish. Firstly, the authors performed back-and-forth translation and test-retest analysis for linguistic equivalence, factor analysis for construct validity, and confirmatory factor analysis to test the existing structure in different sample groups. They collect the data from three different samples by online surveys between April 2018 and September 2019. SPSS 23.0 and AMOS 23.0 programs were used to analyze the collected data.

Scales

Workplace social courage scale. Howard et al. (Howard et al., 2017) developed the workplace social courage scale. It has one dimension consisting of 11 expressions. Interviewees indicated their level of participation using 7-point Likert (1, strongly disagree and 7, strongly agree). High scores from the scale show that social courage is high in the workplace. Table 1 presents the expressions of the form in Turkish and English.

Life satisfaction scale. The authors measured life satisfaction using the scale developed by Diener et al. (1985) and adapted to Turkish by Bekmezci and Mert (2018). Participants assessed the expressions with 7-point Likert (1, strongly disagree and 7, strongly agree). High scores indicate high satisfaction, and low scores indicate low satisfaction. There are expressions such as "I have a life close to my ideals." and "I am satisfied with my life." in the life satisfaction scale.

Strategy of analysis

The authors followed the Hambleton and Patsula (1999) procedure in adapting the courage scale. First, it should be ensured that structure similarity exists in the language and cultural groups of interest. Second, it should be decided to adapt or develop a scale. The other steps in the procedure were translating the scale using

Table 1: Social Courage Scale Expressions in the Workplace

Sıra	Items (In Turkish)
C1	*"Although it may damage our friendship, I would tell my superior when a coworker is doing something incorrectly."* (Arkadaşlığımızı zedeleyecek olsa bile, çalışma arkadaşım yanlış bir şey yaparsa yöneticime söylerim.)
C2	*"Although my coworker may become offended, I would suggest to him/her better ways to do things."* (Çalışma arkadaşımın kırılacağını bilsem dahi, ona işlerin daha iyi yapılmasına yönelik önerilerde bulunurum.)
C3	*"If I thought a question was dumb, I would still ask it if I didn't understand something at work."* (Aptalca bir soru olarak algılanacağını bilsem dahi, işte anlamadığım bir şeyi sorarım.)
C4	*"Even if my coworkers could think less of me, I'd lead a project with a chance of failure."* (Çalışma arkadaşlarım hakkımda olumsuz düşünse dahi, başarısızlık ihtimali olan bir işi/projeyi yürütürüm.)
C5	*"I would not tolerate when a coworker is rude to someone, even if I make him/her upset."* (Çalışma arkadaşımın bozulacağını bilsem de onun başka birisine kaba davranmasına müsamaha etmem.)
C6	*"Despite my subordinate disliking me, I would tell him/her when they're doing something against company policy."* (Astlarım/çalışma arkadaşlarım hoşlanmasa dahi, şirket/kurum politikasına aykırı bir şey yaparlarsa ikaz ederim.)
C7	*"I would let my coworkers know when I am concerned about something, even if they'd think I am too negative."* (Çok negatif birisi olduğumu düşüneceklerini bilsem dahi, çalışma arkadaşlarımın işle ilgili bir şeyden endişe duyduğumu bilmelerini isterim.)
C8	*"Even if it may damage our relationship, I would confront a subordinate who had been disrupting their workgroup."* (İlişkimizi tamamen zedeleyecek olsa bile, bir astım/çalışma arkadaşım iş arkadaşlarıyla birlikte çalışırken ahengi bozuyorsa, onun üstüne giderim.)
C9	*"Although it makes me look incompetent, I would tell my coworkers when I've made a mistake."* (Beni beceriksiz, yetersiz gösterecek olsa bile, işle ilgili yanlış bir şey yaptığımda çalışma arkadaşlarıma söylerim.)
C10	*"Despite appearing dumb in front of an audience, I would volunteer to give a presentation at work."* (Dinleyicilerin gözünde yetersiz görüneceğimi bilsem dahi, iş yerinde bir sunum yapmak için gönüllü olurum.)
C11	*"Although it may completely ruin our friendship, I would give a coworker an honest performance appraisal."* (Arkadaşlığımızı tamamen zedeleyecek olsa bile, bir çalışma arkadaşıma iş performansı hakkında dürüst bir geri bildirim veririm.)

a forward and back translation method by well-qualified researchers, reviewing the adapted version, conducting a small test of the adapted scale, and performing a validation study as proper.

The authors decided to adapt the scale regarding cross-cultural courage meanings (Zavaliy & Aristidou, 2014) and designed the three different studies for reliability and validity. The first was for linguistic equivalence, the second was for explanatory factor analysis, and the third was for confirmatory factor analysis and causal relationship. These studies intended to show that the courage scale has linguistic equivalence, reliability, and validity.

Linguistic equivalence

The first study aimed to test the linguistic equivalence of the scale.

Sample. The first study population consisted of academicians who were sufficient in both languages and studied management science, especially knowledgeable in courage. Seventy-six academicians fit these criteria in two universities and selected 48 of them as the sample by a convenience sample method. 45.8% of them were men, and 54.2% were women. 64.6% of them were single, and 35.4% were married. 68.8% of the participants were between the ages of 21-30, 20.8% between the ages of 31-40, and 10.4% between 41-50. 27.1% worked for less than one year, 37.5% for 1-3 years, 14.6% for 4-6 years, and 20.8% for six years or more.

The authors used the forward and backward translation method suggested by Hall et al. (2003) for linguistic equivalence. The scale was translated into Turkish by a researcher who has primarily studied courage and is proficient in both languages. Another researcher translated the original version of the scale into English without seeing it. The authors compared this translation with its original form and finalized the scale with the agreed-upon expressions (Table 1).

After the forward and backward translation method, the scale should be examined with a pretest. It could

Table 2: Test of Normality of Courage's Scales

Scale	Kolmogorov-Smirnov		Shapiro-Wilk		Skewness		Kurtosis		Cronbach
	Statistic	p	Statistic	p	Statistic	S.E.	Statistic	S.E.	
Turkish	0,131	0,037	0,963	0,134	-0,358	0,343	-0,498	0,674	0,732
English	0,133	0,033	0,956	0,072	-0,523	0,343	-0,380	0,674	0,759

be conducted one of three different methods for the pretest. The first method is to apply both the original and the translated scale to a sample group who speak both languages. The second method is to use the translated scale to a small group, receive verbal/written feedback, and finally, focus group work (Bayık & Gürbüz, 2016; Hambleton & Patsula, 1999; Van de Vijver & Hambleton, 1996). The authors applied the scale in both languages to 48 academicians proficient in Turkish and English one-week interval and received verbal feedback.

Normality was checked (Table 2) before the test and retest analysis. According to Shapiro-Wilk statistics and skewness and kurtosis values, Table 2 revealed that the courage's data had normality distribution (Sposito et al., 1983). The Cronbach alpha tested the scales' internal reliability and was considered sufficient for comparing the means and correlation (Hair et al., 2014).

Test and retest analysis showed that the original form and adaptation of the Turkish form have a significant and positive relationship. Courage's mean of the Turkish scale was 5,25 (sd=0,71), and the English one was 5,31 (sd=0,79). In both forms, the perception of courage's mean is above the median value of Likert (4). The correlation coefficient between classes was 0,887 (p = 0.000), indicating the scale's linguistic validity.

Reliability and explanatory factor analysis (EFA)

As a pilot study, the second study aims to reveal the factor structure and reliability of the Turkish scale.

Sample. For this purpose, the authors sent a questionnaire by a convenience sampling method from 450 private-sector employees through their human resources office. The institutions where the data were collected operated in the tourism (two hotels and one tour company) and finance sector (two insurance companies and one bank's employees) and had 676 employees working in six different Antalya companies. Participation is voluntary, and information has been provided on the purpose of the study. From 450 questionnaires, 267 of them were returned. The response rate was 59.4%, and the authors considered this rate sufficient for the aim of the second study, which was not a generalization of the results. All returned questionnaires are suitable for EFA. The demographic characteristics of the participants are as follows: 42.7% of the participants work in the tourism sector and 57.3% in the finance sector. 47.9% are men, and 52.1% are women. 39.7% are married, and 60.3% are single. Most of the participants are between the ages of 21-30 (56.6%), followed by 31-40 (28.8%) years old, 41-50 (9.7%) years old, and 51 and over (4.9%), respectively. Many respondents are associate degrees and graduates (78,7%), followed by post-graduate (16,5%) and high school (4.9%) graduates.

Before the reliability and explanatory factor analysis, the authors tested the normality. While the Shapiro-Wilk statistic (0,985, p<0,05) did not confirm the normality, the authors considered the data had normal distribution for the reliability and explanatory factor analysis according to the Kolmogorov-Smirnov statistic (0,050, p>0,05), skewness (-0,312 S.E.=0,149), and kurtosis (-0,261, S.E=0,297) values (Kline, 2011; Sposito et al., 1983).

Reliability analysis

The scale's reliability should be investigated after the pretest in scale adaptation studies. Reliability analysis tests the consistency between scale items. There are different methods for reliability analysis, such as internal consistency, test-retest, parallel forms, and split-half reliability (DeVellis, 2016). The authors performed internal consistency between items with Cronbach alpha, a commonly used method (DeVellis, 2016; Salkind, 2007). Table 3 shows the Cronbach alpha coefficient and the corrected item-total correlations for reliability analysis results. The scale had a good Cronbach coefficient (0,822) for the Likert scale (Hair et al., 2014; Salkind, 2007). Eleven statements gave the best reliability for the scale.

Explanatory factor analysis

First, the authors conducted Kaiser-Meyer-Olkin (KMO) and Barlett sphericity tests to check sampling adequacy (KMO:0.894, p:0.000). Kaiser (1974) proposed that KMO within the 0.80s was meritorious. Measurement sample adequacy values ranged from 0.872 to 0.916 and were above the critical value (0.50). The results show that the data set was sufficient for factor analysis (Kaiser, 1970).

Table 3: Explanatory Factor Analysis Results

			KMO Barlett's Test of Sphericity	0.894
			Chi-square	718,952
			df	55
			p	0,000
			Cronbach	0,822
Expressions	Factor loadings of the adapted scale	Factor loadings of the original scale	Common Factor Variance	Corrected Item-To-tal Correlation
C1	0.482	0.48	0,233	0,383
C2	0.720	0.60	0.519	0,615
C3	0.609	0.52	0,371	0,499
C4	0.544	0.57	0,296	0,442
C5	0,633	0.57	0.401	0,516
C6	0.707	0.66	0.500	0,596
C7	0.516	0.72	0,266	0,400
C8	0.506	0.72	0,256	0,403
C9	0,621	0.58	0.386	0,520
C10	0,642	0.37	0.412	0,527
C11	0.743	0.72	0.552	0,642

They secondly performed an EFA to reveal the factor structure of the Turkish form by the principal component analysis method with varimax rotation for the scale's validity. Table 3 gives EFA results of the adapted and original scales. Results confirmed the Turkish adaptation of workplace social courage also has a one-dimensional structure. There were no factor loadings below the 0.50 point except for the first item. The first item's value was very close to the critical value, and the sample size of the study (n=267) was sufficient for the least (0.48) factor load (Hair et al., 2014) so, the authors did not exclude the item from the scale. It was examined the communalities, and the lowest communalities were 0.233. There is no agreement on the threshold value for the communalities. Hair et al. (2014) stated that it should be above 0.50, while Osborne (2008) indicated that it should be above 0.40. Child (2006) stated that low communalities might occur due to the one-dimensional structure, and the variables below the 0.20 point communalities should be removed. Because of one factorial structure and acceptably factor loadings, the variables with low communalities were not excluded from the scale. As a result, EFA indicates the one-dimensional structure in the original scale is also valid in the Turkish form.

The mean of participants' perception of social courage was 5.16 (sd:0.95). It is higher than the midpoint (4).

Confirmatory factor analysis (CFA) and structural model analysis

The third study aimed to test whether the Turkish form of the workplace social courage scale could measure the latent structure by confirmatory factor analysis and the social courages' predictive power with structural model analysis. The third study has three variables: demographics, workplace social courage, and life satisfaction.

Sample. The third study's population consisted of three companies operating in Ankara. Two of them were in industrial goods manufacturing, and one was in textile. The companies had 482 employees in total. The supervisors and the foremen of the industrial and textile manufacturing company sent the questionnaire link through communication groups to employees. In this way, the authors obtained 394 data. The responding rate was 81.7%. As a result of removing the twenty inappropriate questionnaires, 374 data remained sufficient for the given population. A population consisting of 482 employees requires at least 217 samples (Krejcie & Morgan, 1970). 46.5% of the participants were men, 53.5% were women, 60.4% were single, and 39.6% were married. Many of the participants were aged between 21-30 (56.7%), followed by 31-40 years (28.9%), 41-50 (9.6%), 51 and above (3.7%), 20 and under (1.1%). Most of the employees in the

Table 4: Test of Normality of Courage and Life Satisfaction Scales in Study Three

Scale	Kolmogorov-Smirnov		Shapiro-Wilk		Skewness		Kurtosis	
	Statistic	p	Statistic	P	Statistic	S.E.	Statistic	S.E.
Life Satisfaction	0,043	0,090	0,989	0,006	-0,358	0,126	-0,498	0,252
Courage	0,046	0,053	0,984	0,000	-0,314	0,126	-0,460	0,252

Table 5: Confirmatory Factor Analysis Results

Workplace Social Courage			Life Satisfaction		
Items	Factor Loads		Items	Factor Loads	
C1	0.454	AVE: 0.38	LS1	0,739	AVE: 0.637
C2	0.727	CR: 0.867	LS2	0.798	CR: 0.897
C3	0.581	MSV: 0.05	LS3	0,869	MSV: 0,05
C4	0.524	Cronbach:0,861	LS4	0.795	Cronbach:0,895
C5	0.585		LS5	0.782	
C6	0.731				
C7	0.575				
C8	0.591				
C9	0,632				
C10	0.550				
C11	0.730				

CR: Construct Reliability, AVE: Average Variance Extracted, MSV: Maximum Shared Variance

sample were high school graduates (79.4%), followed by associate (14.4%), secondary (5.9%), and bachelor (0.3%), respectively. 42% of the participants worked in the textile sector, and 58% worked in industrial products.

Before the reliability and CFA analysis, normality was examined. Table 4 shows the normality tests of courage and life satisfaction. According to the Kolmogorov-Smirnov statistic, it could be said that the variables had normality and skewness and kurtosis values were acceptable range (Kline, 2011; Sposito et al., 1983).

The authors performed CFA to determine whether the workplace social courage scale and the life satisfaction scale have the same latent structure in different samples. Table 5 shows the measurement model's factor loadings, average variance extracted (AVE), construct reliability (CR), and maximum shared variance (MSV). The workplace social courage scale has similar factor loadings to the EFA in study two. While the lowest factor loading belongs to the first statement, the highest factor loading belongs to the sixth statement. Except for the first statement, factor loadings are higher than the critical value (0.50). Still, they remain below the desired point (0.70), except for the second, sixth, and eleventh-factor loadings (Hair et al., 2010).

The reliability of the scales was tested internal and construct reliability. The internal reliability of the social courage scale was 0.861, and life satisfaction was 0.895. Courage scales' CR was 0.867, and life satisfaction was 0.897. According to these results, the authors considered the measured variables were reliable and successful in representing the latent construct (Hair et al., 2014).

The courage's AVE score (0.38) was less than the critical value (0.50) but, all items' factor loadings (except item one) were above the point of 0,50, and MSV was so low (0.05). For this reason, the authors considered that the social courage scale could measure successfully and separately. The outcome variable of the study is life satisfaction. The factor loadings of all items are above the point of 0.70, and AVE is 0.63. The life satisfaction scale is also successful in measuring its latent structure.

The CFA results of the measurement model confirm that the scales had acceptable and good fit values (Hu & Bentler, 1999). Table 6 represents CFA model fit values.

Table 6: Fit Values of the Measurement Model

	χ^2	df	χ2/df	RMSEA	CFI	GFI	NFI	SRMR
Measurement Model	212,258	103	2,061	0.053	0.954	0.933	0.915	0.053

Table 7: Descriptive Statistics

Variable	Mean	S.E	1
1-Courage	3.53	0.803	-
2-Life satisfaction	3.34	1.092	0.269*

*p<0.01 (two-tailed)

Table 7 shows descriptive statistics and correlation for variables in study three. Participants' courage perception mean was 3.53 (sd:0.80), and life satisfaction perception was 3.34 (sd:1.09). These values are below the average value of four. There is a positive and significant low-level correlation between these variables (r = 0.269, p <0.0 1).

Structural model analysis results show the effect of employees' workplace social courage perceptions on life satisfaction. According to the results, workplace social courage's perception predicts the life satisfaction of employees in a positive and significant way. Standardized regression coefficient is 0.243 (p<0.01). In other words, courage can explain some changes in life satisfaction. If courage increased one point, life satisfaction would enhance 0.243 points. This result supported Hypothesis 1.

DISCUSSIONS

With conducted three studies, the authors aim to make the validity and reliability of the Turkish form of the workplace social courage scale developed by Howard et al. (2017). We tested linguistic and construct validity and the effect of social courage on life satisfaction with an adapted scale, respectively.

First, the authors translated the scale into Turkish for linguistic validity using the back-forward translation method. The test-retest correlation results showed the Turkish form has linguistic validity by applying the translated and the original document to academicians fluent in both languages at one-week intervals. Second, EFA performed on samples involving 267 data revealed the Turkish form also has a one-dimensional structure. Finally, CFA conducted on the sample consisting of 374 data confirmed the latent structure of courage previously shown by explanatory factor analysis.

As a result of the three studies, we found the observed variables of the courage scale had sufficient power to represent the latent structure but were below the desired level. The first item of the courage scale remained below the critical value in EFA and CFA. The statement is, " Although it may damage our friendship, I would tell my superior when a coworker is doing something incorrectly." The statement means telling the mistake made by his coworker to the upper level. This action is close to the espionage behavior that the group members do not welcome in Turkish collectivist culture. Therefore, the contribution levels of the participants in this statement differed from other expressions. Removing the first item could increase the structural validity of the scale.

The psychometric properties of the adapted scale were similar to the original one. The factor loadings of the Turkish version's scale were akin to the Howard et al. (2017) scale. In their study, Howard et al. (2017) found that the item loadings ranged from 0.37 to 0.72 (Table 3) and retained the minor factor load (0.37) in sample 5 due to the initial samples factor loads. Cronbach's alpha of the original scale ranged from 0.78 to 0.85 in six different studies. Howard (2021) found that workplace social courage was significantly related to personality, and Cronbach was 0.85. Howard and Fox (2020) examined the relationship between social courage, gender, and masculinity-feminity. They found Cronbach 0.83, and there was no significant correlation between courage and gender. Howard and Cogswell (2019) explored the antecedent of social courage and found Cronbach was 0.87, personality and some job characteristics were significantly related to social courage. The Cronbach's alpha of the Turkish version was 0.89.

The structural model also tested the predictive power of the workplace social courages' effect on life satisfaction. Findings show that workplace social courage has a significant and positive impact on life satisfaction. This result is compatible with the other studies' results (Howard and Cogswell, 2019; Santisi et al., 2020; Magnano et al., 2021). The authors considered that the positive feelings and thoughts created by the employees' perception of their brave behaviors positively affect their satisfaction with life.

The Turkish adaptation of the workplace social courage scale successfully measures individuals' perceptions of courage and predicts other variables. The social courages' first item with low factor loads in EFA and CFA could be removed from the scale for cultural reasons. Researchers also might consider removing the items with the low factor loadings from the adapted scale and check the validity and reliability of the short version of the social courage scale because they welcome short scales.

Consequently, workplace social courage is an emerging issue related to organizational variables. Courage is the dedication to achieve individual and organizational aims by voluntarily seeing the risks, logically evaluating the challenging work situations they face, and continuing their mindful behaviors despite danger and fear. Situational and dispositional factors are significant in courage (Kilmann et al., 2010). In fearful and stressful situations, the courage of the individual is decisive on behavior. Thus, studies on courage might contribute to understanding employee attitudes and behaviors in conditions involving stress and fear. The authors scanned the Turkish literature and found conceptual and qualitative studies on courage (Mert, 2007, 2021; Mert & Aydemir, 2019; Mert et al., 2021). Researchers can provide empirical results to practitioners and researchers in future studies by conducting quantitative studies on the predecessors and consequences of courage using the adapted Turkish courage scale.

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Benefits of Flexible Working System During Covid-19 Pandemic: A Field Study in Turkey

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ABSTRACT

The aim of this study is to examine the opinions and attitudes of healthcare professionals (physicians, nurses and other healthcare workers), academicians and civil servants who benefit from flexible working practices during the Covid-19 pandemic period. This is a descriptive study. A questionnaire form was used in the study as a data collection tool which includes statements about the benefits of flexible working practice during the pandemic such as; family work balance, family work conflict, motivation, performance, productivity, quality of life and health. Study results show that; healthcare professionals experienced an increase in their motivation and job satisfaction, their productivity was positively affected, their individual and corporate performances have increased, while academicians experienced a decrease in their motivation and job satisfaction, their productivity was not positively affected, and their concentration has decreased during flexible working period in the pandemic.

Keywords: Flexible Working; Remote Working; Covid-19 Pandemic; Healthcare Professionals, Academicians

JEL Classification Codes: M12, D23, L84

INTRODUCTION

Technological changes have always occurred in human history. Technological change accelerates in a dizzying way, when a slowly accumulating power reaches the explosion point with the effect of a trigger and creates extraordinary effects in a short time. In times of rapid changes in our technology history, most of the triggers have been non-peaceful phenomena such as wars and revolutions. Especially in recent years, the technology that has developed exponentially was waiting for a new trigger. This time, there is a Covid-19 pandemic that acts as a technological trigger in the face of humanity, but also has very high political, economic and social effects. The technological infrastructure and communication systems that have been created in the last two decades in the world are the battlefield in our war against the pandemic, and the innovative technology itself is the main weapon of human beings.

Covid-19 was detected for the first time in Wuhan city, China at the end of 2019 and caused the pandemic, is a very important and urgent public health problem (WHO, 2020). It spread all over the world in such a short time that societies found the solution to quarantine and work at home. At this point, it has been clearly seen that advanced communication technologies are the most important and reliable instrument to stop the spread of the pandemic, prevent infection, quarantine and disease monitoring. Aside from the solution of health concerns, flexible and remote working systems have become widely used in almost all sectors as the only compulsory solution for organizations (Baadel et.al., 2020; Gursoy and Chi, 2020; Khan et.al., 2020; Kumar et.al., 2020; Kyhlstedt et.al., 2020; Prasad et.al., 2020).

The pandemic has forced organizations to rethink the way they do business and develop different working approaches. Remote business technologies, which are already ready to be used, have supported flexible working systems, and the transition to this new way of working has been successfully implemented by many sectors and businesses in a short time thanks to technology. Flexible working systems aim to empower employees and increase their motivation and performance by giving them more flexibility (Griffin and Moorhead, 2013; Anderson et al., 2015). Today, flexible working practices are carried out in the form of remote work, part-time work, job sharing, shift and weekend work, flexible rotational work, home-

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based work and telework practices (Gramm and Schnell, 2001; Houseman, 2001; Meyer et al., 2001; Rothwell et al., 2012).

The Covid-19 pandemic has given us an opportunity and research motivation to examine the widest transition to flexible and remote working system of the health sector and universities in Turkey. This unforeseen and fast transition of the working system has led us to conduct this research to gain answers of these questions; "What are the feelings and thoughts of healthcare professionals, academics and civil servants about the flexible and remote working system? How did it affect them socially, psychologically and economically? What is the impact of flexible and remote working practices on their family and business lives? Is this system sustainable?". Besides, the lack of previous research on this issue prompted us to manage this study to be able to provide beneficial clues to healthcare managers, universities and planners in new potential pandemic periods that may be experienced in the future. At this point, the purpose of this study is to examine the opinions and attitudes of healthcare professionals (physicians, nurses and other healthcare workers), academicians and civil servants who benefit from flexible working practices during the Covid-19 pandemic period.

Individual and Organizational Benefits of Flexible Working System

The flexible working system allows people to work in different hours according to their needs and offers the opportunity to work remotely, unlike the traditional working order, the way and type of work is managed in such a way that they can adapt to the emergency conditions related to the work (Fursman and Zodgekar, 2009). In the flexible working system, it is recommended to establish a working relationship in which the wishes of both the employer and the employees are harmonized, there is no loser, double-sided gain is achieved, shortly in which the "win-win" strategy is dominant (Brummelhuis et al., 2010).

Flexible working practices allow employees to control their daily working hours and places (Fonner and Stache, 2012; Griffin and Moorhead, 2013) and increase the sense of organizational commitment (Cheese, 2008; Kelliher and Anderson, 2008). Studies show that the flexible working system has a positive effect on high job performance, productivity, morale and quality of work. It enables the employees to increase their life satisfaction by establishing a better work-life balance. Thus, there may be many positive consequences for organizations such as less absenteeism, less being late for work and less complaints, more quality problem solving, openness to technological change, increased cost effectiveness, and keeping personnel and organizational knowledge at a high level (Pruchno, 2000; MIT, 2004; Kossek et al., 2005; Kelliher and Anderson, 2008; Rees and French, 2010; Neo, 2013). In addition, flexible working systems have been proven to allow an increase in the mental health and well-being of both employees and their families (Baker et al., 2011; Goodwin and Styron, 2012) and are beneficial for the development of family relationships and gender equality (Bauregard and Henry, 2009; Andringa et al., 2015; Cannito, 2020).

Researches show that flexible working arrangements, in various forms, are increasingly being accepted and included in organizational policy and business patterns (Petts and Knoester, 2018; Geisler and Kreyenfeld, 2019). The rapid and simultaneous transition of tens of millions of people to remote work has led to surprising discoveries in every industry. The data show that employees who work at home during the pandemic period spend their working time more efficiently (Sulaymonov, 2020). Instead of waiting for days or even weeks, meetings that require a joint decision between consumers, suppliers and employees have been made much more practical and effective thanks to online live connections and meetings that take only a few hours to plan and organize (Aydoğan and Sener, 2020).

Surely, it is not easy to embed a flexible working culture within an organization. Flexible working policies need to be reviewed in the context of all employees to ensure that people are effectively managed and goals are achieved. At this point, the role of managers is critical, it will be useful to examine the strategies, barriers and difficulties required for intervention (Golden, 2006; Kelliher and Anderson, 2008). Managers must effectively perform tasks such as identifying unmotivated employees for flexible working, focusing on the suitability of the employee to work flexibly and determining clear duties and expectations, creating a result- oriented performance atmosphere, measuring the advantages gained by flexible working practice, providing feedback to employees after analysing their performance, applying daily management skills that can combine the company's mission with the expectations of the employees (AIM, 2012; Gomez-Mejia et al., 2012).

Flexible Working Practices during the Pandemic in Turkey

Coronavirus spreading rapidly in all countries of the world, has been identified for the first time on March 11, 2020 in Turkey and the number of cases increased rapidly in all cities (MOH, 2020). The rapid increase of cases necessitated the rapid transition to a flexible working system in both the private sector and the public sector.

The circular numbered 22/03/2020-4 was issued by the Presidency of Turkey in order to regulate the working hours of public institutions and organizations during the pandemic. Following this decision, within the scope of the circular numbered 3522 of 23/03/2020 published by the Ministry of Health on the flexible working practice, it was stated that flexible working methods such as remote working and rotational work could be applied even to healthcare workers in order to minimize the spread of the Covid-19 outbreak in the country. In addition to this circular issued by the Ministry of Health, within the scope of the announcement dated 15/05/2020, flexible working practice continued. In the following process, with a letter sent to the Provincial Health Directorates in 81 provinces within the scope of "Normalization and Measures to be Taken in the Scope of Covid-19" on June 02, 2020, it was reported that all personnel working in the central and provincial organizations of the Ministry of Health should start their work full-time. However, with the circular numbered 2020/11 by the Presidency on August 26, 2020, it was reported that employees working in public institutions and organizations could benefit from flexible working methods including remote working and rotational work again (ONT, 2020).

The private sector and public institutions in Turkey have been able to provide a very rapid transition to the flexible working system. However, it can be said that health sector managers were confused about this issue at first. Because, patients who thought that Covid-19 was spreading very quickly in hospitals, did not want to come to the hospital unless there was an emergency, and they wanted to receive medical service remotely. It was decided that healthcare workers, other than the healthcare professionals working in the service and intensive care units serving Covid-19 patients, switch to the flexible working system. The routine appointment system was cancelled in hospitals in units other than Covid-19, and a very limited number of appointments were made. The Ministry of Health and private hospitals have rapidly invested in telemedicine systems where doctors and patients can communicate remotely, and they have begun to provide medical services to non-emergency patients from their homes. Medical data of the patients were monitored remotely, and every possible procedure was performed remotely using communication technologies. If the patient had to come to the hospital, a special appointment was being given. While some of the healthcare professionals were in a very busy working system, some of them worked in a flexible and remote working system and replaced each other periodically. For the first time in the history of Turkey, healthcare professionals switched to a flexible and remote working system due to the pandemic.

Similarly, academicians have switched to the distance education system in all faculties. Lessons were given remotely synchronously or asynchronously. Academicians were free to give their lectures from their homes or their rooms at the university. However, due to the rapid spread of the disease and the high level of uncertainty, the vast majority of academicians worked from their homes and managed their lessons from their homes. Civil servants also switched to a flexible and remote working system. In offices where things could not be handled by working remotely, every day an employee served on duty. All other civil servants worked from home using remote working systems.

Although it was difficult to manage the flexible working system in the health sector at the beginning, Turkey managed the process without major blockages due to the facts such as strong technological infrastructure and hardware (İleri, 2016), more than 62 million people had access to high-speed internet (TSO, 2020), 90.9% of the population was under the age of 65 (TSO, 2020) and could use technology at a basic level and necessary precautions and measures could be taken quickly.

METHOD

Study Design, Study Population and Sampling

This is a descriptive study. The sample of the study consists of physicians, nurses, other healthcare professionals, academicians and civil servants who benefit from flexible working practices in institutions and organizations serving in Konya, Turkey during the Covid-19 pandemic period. Non-proportional quota sampling was used to determine the study participants. Units were selected by convenience sampling method from non-random methods (Esin, 2015). A total of 414 employees benefiting from the flexible working practice were reached. In order to increase the reliability of the study, they have been asked "Did you benefit from the flexible working practice?" and 334 employees who answered "yes" to this question were included in the study.

Konya was selected to be a study location for the study due to being one of the largest and crowded provinces (2.2 million) of Turkey with the highest number of cases during the pandemic period. The city switched to flexible working system at the beginning of the pandemic, it has both qualitatively and quantitatively qualified health infrastructure and health workers, it hosts a large number of public and private universities, its quality electronic communication infrastructure supported working from home / remotely, it geographically takes place in the midst of Turkey, which may help to reach a good sample group with demographic diversity.

Data Collection Tools

A questionnaire was used for data collection in the study. The questionnaire was prepared by the researchers through a literature review (Hildebrandt, 2006; Pichler, 2009; Doğrul and Tekeli, 2010; Giannikis and Mihail, 2011; Doğan et. al., 2015). The final questionnaire was prepared after obtaining expert opinions. In the questionnaire, there are 7 questions related to socio demographic information of the employees, 5 questions containing information about flexible working practice and 28 questions expressing the returns of flexible working practice. The Cronbach Alpha reliability coefficient was found 0.96. In the study, 5-point Likert (1= Strongly Disagree and 5 = Strongly Agree) was used. Statements about the returns of flexible working practice include family work balance, family work conflict, motivation, performance, productivity, quality of life, health, etc. The data were collected via online survey between October and December 2020.

Data Analysis

The SPSS 21.0 program was used in the analysis of the data. Percentage, mean, standard deviation and chi-square tests were performed. Eyes were combined for cells in which the expected value of expressions in chi-square analysis was <5 and the total number of cells exceeded 20%. The rows/columns were combined for cells with the expected value of expressions <5 and the total cell number exceeding 20%. In the study, 1.00-1.79 is evaluated as strongly disagree, 1.80-2.59 disagree, 2.60-3.39 undecided, 3.40-4.19 agree, and 4.20-5.00 is evaluated as strongly agree.

Ethic

Ethical approval was obtained from the Ethics Committee for Pharmaceuticals and Non- Medical Device Researches. Written permission was obtained from the Scientific Research Studies Commission on Covid-19 of the Ministry of Health and another written permission was obtained from Konya Governorship. Informed written consent was also obtained from the participants.

RESULTS

Sociodemographic characteristics of the participants are presented in Table 1. More than half (65%) of the participants of the study (15.27% physician, 15.87% nurse, 34.13% other healthcare worker) are healthcare workers, 18.26% are academicians and 16.47% are civil servants. 65.56% of the participants are women, 73.06% are married, and 52.09% are in the 34-45 age group. 43.71% of the employees are postgraduates and 56% of them have more than 10 years of experience.

Table 1 is here

Study findings show that the flexible working program which does not have a specific start and end time and the working hours are determined by the head of the institution and the employees together was benefited by the participants mostly (55%). This is followed by programs that provide some flexibility in the workplace (18%), followed by flexible programs of which start and end times are determined by only the employee (15%), and programs of which the employees work remotely for a certain period of time with (12%). Benefiting different types of flexible working, only 36% of the participants think flexible working practice was fair.

Examining the results of satisfaction and applicability; the average and standard deviation of those who stated that they were satisfied with the flexible working practice was 3.74 ± 1.29 while 34.4% of the participants "strongly agree" and 33.5% "agree". The average and standard deviation of the statement "In this period, I have seen the applicability of flexible working policies and laws in business life" was 3.82±1.05 while 50.3% of the participants "agree" and 25.1% "strongly agree". The average and standard deviation of those who think that flexible working practice should be applied in jobs and tasks requiring less responsibility was 3.23±1.31 while 36.5% of the participants were "agree" and 19.2% "undecided".

In the Covid-19 period, the expressions of flexible working practice were grouped as family work balance, family work conflict, work-related benefits, and benefits related to the individual's own life, and the findings are presented in Tables 2, 3 and 4.

When the positive statements about the benefits of flexible working are examined in Tables 2, 3 and 4, the

Table 1. Descriptive Variables of Participants

Gender	n	%
Female	219	65.56
Male	115	34.44
Marital Status		
Single	90	26.94
Married	244	73.06
Age		
Between 22-33	109	32.63
Between 34-45	174	52.09
Between 46-56	51	15.28
Educational Status		
High School	15	4.50
Diploma	39	11.68
Bachelor Degree	134	40.11
Postgraduate	146	43.71
Profession		
Physician	51	15.27
Nurse	53	15.87
Other Healthcare Profess.	114	34.13
Academician	61	18.26
Civil Servant	55	16.47
Experiency		
0-5 years	65	19.47
6-10 years	82	24.55
11-15 years	64	19.16
16-20 years	57	17.07
21 +	66	19.75
n: 334		

first three statements with the highest average are listed as follows: (1) 78.7% of the participants (3.87±1.06) stated that they agreed that "their coordination regarding their job or work place was good during flexible working period" (Table 3). (2) 78.1% of the participants (3.87±1.13) agreed that "they did not have any problems in communication about their job or work place during flexible working periods" (Table 3). (3) 77.8% of the participants (3.93±1.21) agreed that "they were able to spare more time for their family thanks to the flexible working practice" (Table 2).

When the negative statements about the results of flexible working are examined the first three statements with the highest average are as follows: (1) 39.5% (2.89 ± 1.29) of the participants agreed that "their technology addiction has increased during flexible working period" as shown in Table 4. (2) 30.6% of the participants (2.65 ± 1.24) agreed that "their multiple roles at home (status at work, mother, spouse, etc.) during the flexible working period overstrained them" as given in Table 2. (3) 26.1% (2.40 ± 1.27) of the employees disagreed that "their concentration decreased due to flexible working practice" as seen in Table 4.

According to Table 2, there was no significant relationship (p= 0.15; p> 0.05) between the professions of the participants and the statement "I have fulfilled my responsibilities in the family more easily due to flexible working practice". This statement is mostly supported by physicians (86.3%) and academics (78.7%). Similarly, it is seen that there is a significant relationship (p = 0.02; p< 0.05) between the participants' professions and the statement "I was able to spare more time for my family due to flexible working practice". This statement is mostly supported by civil servants (87.3%) and physicians (86.3%).

As seen in Table 2, there was no significant relationship between the professions of the participants and the statement "my multiple roles at home (status at work, mother, spouse, etc.) overstrained me during the flexible working practice" and the statement "I had more conflicts with my family members during the flexible working practice" (respectively p= 0.61, p= 0.08; p> 0.05). Mostly, academicians (36.1%) and physicians (33.3%) stated that they had difficulty in multiple roles. Other healthcare professionals (20.2%) and academicians (18%) stated that they had conflicts with family members. A significant correlation (p= 0.00; p< 0.05) was found between the participants' professions and the statement "the time I spent on family responsibilities generally negatively affected my job responsibilities". Again, mostly academicians (27.9%) and other healthcare professionals (10.5%) agreed with this statement.

According to Table 3, a significant relationship was found between the professions of the participants and the statements "my job motivation has increased", "my job satisfaction has increased", "my productivity in my work life is positively affected", "corporate performance has increased" and "coordination with my job or work place was good" during flexible working period (p= 0.02, p= 0.00, p= 0.01, p= 0.00, p= 0.04; p< 0.05, respectively).

Academicians (34.4%, 32.8%, 41%, respectively) and civil servants (47.3%, 43.6%, 50.9%, respectively) were the least participating in terms of increase in motivation, job satisfaction and productivity. While 45.8% of the total participants think that institutional performance increased, the least participating group was academicians (23%). All professional groups stated that they had good workplace coordination over 67%.

According to study results; there was no significant relationship between professions of the participants and the statements "my individual performance increased", "my career is positively affected", "I had the opportunity to make plans for my career", "I had no problem communicating about my job or workplace", "my continuity to work has been positively affected" during flexible working period (p= 0.14, p= 0.51, p= 0.17, p= 0.26, p= 0.05; p> 0.05, respectively). The groups that least expressed an increase in individual performance were academicians (50.8%) and civil servants (50.9%). Besides, less than 41% of the participants think that their careers were positively affected.

51% of physicians, 34% of nurses and 52.5% of academicians think that they had the opportunity to make a career plan. Participants stated that they did not have a problem in communication about their job or workplace (72%). While 65.9% of the total participants supported the statement regarding continuity to work, the least participating group was academicians (54.1%) and civil servants (58.2%).

As seen in Table 4, there was no significant relationship between professions of the participants and the statements "my quality of life has improved", "I can spare more time for myself", "I rested", "I managed time better", "I started to pay more attention to my health (sports, nutrition, etc.)" and "my life (clothing, use of transportation resources, etc.) has become easier" during flexible working period (p= 0.46, p= 0.77, p= 0.71, p= 0.12,

Table 2. Responses to the Statements Related to Family Work Balance and Family Work Conflict due to Flexible Working during the Covid 19 Pandemic Period, Distribution of Average Scores and Comparison of Expressions According to Profession Group

		Physician		Nurse		Other Healthcare Professions		Academic		Civil Servant		Overall		
		n	%	n	%	n	%	n	%	n	%	n	%	
I fulfilled my family responsibilities more easily. (3.81±1.27)***	A	7	13.7	16	30.2	34	29.8	13	21.3	17	30.9	87	26	X^2=6.72* p= 0.15**
	B	44	86.3	37	69.8	80	70.2	48	78.7	38	69.1	247	74	
I was able to spend more time with my family. (3.93±1.21)***	A	7	13.7	15	28.3	35	30.7	10	16.4	7	12.7	74	22.2	X^2=12.0* p= 0.02**
	B	44	86.3	38	71.7	79	69.3	51	83.6	48	87.3	260	77.8	
My multiple roles at home (status at work, parent, spouse, etc.) overstrained me. (2.65±1.24)***	A	34	66.7	41	77.4	79	69.3	39	63.9	39	70.9	232	69.5	X^2=2.68* p= 0.61**
	B	17	33.3	12	22.6	35	30.7	22	36.1	16	29.1	102	30.5	
I had more conflicts with my family members. (2.14±1.07)***	A	48	94.1	48	90.6	91	79.8	50	82	49	89.1	286	85.6	X^2=8.36*p= 0.08**
	B	3	5.9	5	9.4	23	20.2	11	18	6	10.9	48	14.4	
The time I spent on family responsibilities often negatively affected my job responsibilities. (2.06±1.03)***	A	47	92.2	48	90.6	102	89.5	44	72.1	50	90.9	291	87.1	X^2=15.2* p= 0.00**
	B	4	7.8	5	9.4	12	10.5	17	27.9	5	9.1	43	12.9	

* Pearson Chi-Square (X^2) ** p <0.05, *** Mean and standard deviation of each statement A = Strongly disagree / Disagree / Undecided, B = Agree / Strongly agree

p= 0.07, p= 0.94; p> 0.05, respectively). In total, 62.3% of employees stated that their quality of life increased, while academics (57.4%) and civil servants (54.5%) participated below this rate. Besides, 72.8% of the participants stated that they spent more time for themselves and rested and 66.5% of the employees could manage their time better. Academicians (52.5%) were below this rate. Regarding the statement of paying attention to health in the flexible working period, academicians (45.9%) and civil servants (54.5%) participated less than the other groups. 72.2% of the total participants stated that their lives became easier during the flexible working period.

There was a statistically significant relationship between professions of the participants and the statements "my physical health was positively affected", "my psychological health was positively affected", "my expenses (financially) decreased", "my technology addiction has increased",

Table 3. Responses for Work Related Benefits Including Distribution of Average Scores and Comparison of Expressions According to Profession Group

		Physician		Nurse		Other Health-care Professions		Academic		Civil Servant		Overall		
		n	%	n	%	n	%	n	%	n	%	n	%	
My job motivation has increased. (3.34±1.33)***	A	21	41.2	23	43.4	46	40.4	40	65.6	29	52.7	159	47.6	X^2=12.10* p= 0.02**
	B	30	58.8	30	56.6	68	59.6	21	34.4	26	47.3	175	52.4	
My job satisfaction has increased. (3.40±1.33)***	A	19	37.3	23	43.4	39	34.2	41	67.2	31	56.4	153	45.8	X^2=21.53* p= 0.00**
	B	32	62.7	30	56.6	75	65.8	20	32.8	24	43.6	181	54.2	
It positively affected my productivity in my work life. (3.46±1.33)***	A	18	35.3	17	32.1	40	35.1	36	59	27	49.1	138	41.3	X^2=13.71* p= 0.01**
	B	33	64.7	36	67.9	74	64.9	25	41	28	50.9	196	58.7	
My individual performance has increased. (3.50±1.28)***	A	16	31.4	20	37.7	40	35.1	30	49.2	27	49.1	133	39.8	X^2=6.88* p= 0.14**
	B	35	68.6	33	62.3	74	64.9	31	50.8	28	50.9	201	60.2	
I think corporate performance has increased. (3.17±1.31)***	A	29	56.9	23	43.4	51	44.7	47	77	31	56.4	181	54.2	X^2=19.68* p= 0.00**
	B	22	43.1	30	56.6	63	55.3	14	23	24	43.6	153	45.8	
It positively affected my career. (2.97±1.24)***	A	34	66.7	38	71.7	67	58.8	41	67.2	37	67.3	217	65	X^2=3.31* p= 0.51**
	B	17	33.3	15	28.3	47	41.2	20	32.8	18	32.7	117	35	
I had the opportunity to make plans for my career. (3.20±1.24)***	A	25	49	35	66	61	53.5	29	47.5	24	43.6	174	52.1	X^2=6.50* p= 0.17**
	B	26	51	18	34	53	46.5	32	52.5	31	56.4	160	47.9	
I had no problem communicating about my job or workplace. (3.87±1.13)***	A	9	17.6	12	22.6	31	27.2	8	13.1	13	23.6	73	21.9	X^2=5.28* p= 0.26**
	B	42	82.4	41	77.4	83	72.8	53	86.9	42	76.4	261	78.1	
Coordination with my job or work place was good. (3.87±1.06)***	A	6	11.8	12	22.6	27	23.7	8	13.1	18	32.7	71	21.3	X^2=9.95* p= 0.04**
	B	45	88.2	41	77.4	87	76.3	53	86.9	37	67.3	263	78.7	
My continuity to work has been positively affected. (3.62±1.19)***	A	14	27.5	12	22.6	37	32.5	28	45.9	23	41.8	114	34.1	X^2=9.47* p= 0.05**
	B	37	72.5	41	77.4	77	67.5	33	54.1	32	58.2	220	65.9	

* Pearson Chi-Square (X^2), **p<0.05, *** Mean and Standard Deviation, B=Strongly Agree/Agree

A= Strongly disagree / Disagree / Undecided

Table 4. Responses Related to Individual's Own Life Benefits Including Distribution of Average Scores and Comparison of Expressions According to Profession Group

		Physician		Nurse		Other Healthcare Professions		Academic		Civil Servant		Overall		
		n	%	n	%	n	%	n	%	n	%	n	%	
My quality of life has improved. (3.60±1.22)***	A	16	31.4	17	32.1	42	36.8	26	42.6	25	45.5	126	37.7	X^2=3.66*
	B	35	68.6	36	67.9	72	63.2	35	57.4	30	54.5	208	62.3	p= 0.46**
I was able to spare more time for myself. (3.78±1.19)***	A	11	21.6	16	30.2	29	25.4	19	31.1	16	29.1	91	27.2	X^2=1.81*
	B	40	78.4	37	69.8	85	74.6	42	68.9	39	70.9	243	72.8	p= 0.77**
I had the opportunity to rest. (3.78±1.24)***	A	12	23.5	14	26.4	29	25.4	21	34.4	15	27.3	91	27.2	X^2=2.15*
	B	39	76.5	39	73.6	85	74.6	40	65.6	40	72.7	243	72.8	p= 0.71**
I managed time better. (3.66±1.14)***	A	16	31.4	15	28.3	33	28.9	29	47.5	19	34.5	112	33.5	X^2=7.23*
	B	35	68.6	38	71.7	81	71.1	32	52.5	36	65.5	222	66.5	p= 0.12**
It positively affected my physical health. (3.62±1.29)***	A	22	43.1	15	28.3	29	25.4	30	49.2	18	32.7	114	34.1	X^2=12.6*
	B	29	56.9	38	71.7	85	74.6	31	50.8	37	67.3	220	65.9	p= 0.01**
It positively affected my psychological health. (3.59±1.32)***	A	14	27.5	16	30.2	36	31.6	37	60.7	23	41.8	126	37.7	X^2=19.4*
	B	37	72.5	37	69.8	78	68.4	24	39.3	32	58.2	208	62.3	p=0.00**
I started to pay more attention to my health (sports, nutrition, etc.) (3.50±1.24)***	A	20	39.2	19	35.8	37	32.5	33	54.1	25	45.5	134	40.1	X^2=8.82
	B	31	60.8	34	64.2	77	67.5	28	45.9	30	54.5	200	59.9	p= 0.07
My life (clothing, transportation, resource use, etc.) has become easier.	A	16	31.4	14	26.4	33	28.9	15	24.6	15	27.3	93	27.8	X^2=0.77*
	B	35	68.6	39	73.6	81	71.1	46	75.4	40	72.7	241	72.2	p= 0.94**
(3.78±1.17)***														
My expenses (financially) decreased. (3.47±1.29)***	A	25	49	24	45.3	43	37.7	13	21.3	22	40	127	38	X^2=11.1*
	B	26	51	29	54.7	71	62.3	48	78.7	33	60	207	62	p= 0.03**
My technology addiction has increased. (2.89±1.29)***	A	29	56.9	42	79.2	74	64.9	30	49.2	27	49.1	202	60.5	X^2=15.2*
	B	22	43.1	11	20.8	40	35.1	31	50.8	28	50.9	132	39.5	p= 0.00**
It negatively affected my financial gain. (2.44±1.26)***	A	29	56.9	40	75.5	91	79.8	57	93.4	38	69.1	255	76.3	X^2=22.9*
	B	22	43.1	13	24.5	23	20.2	4	6.6	17	30.9	79	23.7	p= 0.00**
Inertia occurred. (2.38±1.27)***	A	37	72.5	45	84.9	95	83.3	38	62.3	36	65.5	251	75.1	X^2=15.1*
	B	14	27.5	8	15.1	19	16.7	23	37.7	19	34.5	83	24.9	p= 0.00**
My concentration has decreased. (2.40±1.27)***	A	43	84.3	45	84.9	92	80.7	34	55.7	33	60	247	74	X^2=24.9*
	B	8	15.7	8	15.1	22	19.3	27	44.3	22	40	87	26	p= 0.00**

* Pearson Chi-Square (X^2), ** p <0.05, *** Mean and standard deviation of each statement A = Strongly disagree / Disagree / Undecided, B = Agree / Strongly agree

"my concentration has decreased", "my financial gain was negatively affected" and "inertia occurred" during flexible working period (p= 0.01, p= 0.00, p= 0.03, p= 0.00, p= 0.00, p= 0.00, p= 0.00; p< 0.05, respectively). While 65.9% of the employees think that their physical health was positively affected, only academicians (50.8%) and physicians (56.9%) were below this rate. In parallel with this result, 39.3% of the academicians think that their psychological health was positively affected which is lower than the other groups. 62% of the participants stated that their financial expenses decreased. Academicians (50.8%), civil servants (50.9%) and physicians (43.1%) participated in the statement about technology addiction. Finally, flexible working negatively affected financial gains of physicians (43.1%) at most and academicians (6.6%) at least. 26% of the participants stated that their concentration decreased, this rate was the highest for academicians (44.3%) and civil servants (40%). Likewise, it was determined that inertia occurred mostly in academicians (37.7%) and civil servants (34.5%) compared to other groups.

DISCUSSION

In the study, it was aimed to examine the opinions of healthcare professionals (physicians, nurses and other healthcare workers), academics and civil servants who benefited from flexible working practices during the Covid-19 pandemic period. It is seen that most of the participants (55%) have benefited from the flexible and remote working program, where their working periods do not have a specific start and end time, and the working hours are determined by the head of the institution and the employee together. 64% of the participants think that flexible working practice is not fair. Surely, all employees do not benefit from flexible working at the same level. While pregnant, breastfeeding, chronically ill, 65+ years old individuals and managers definitely benefited from flexible working practice, the workload of other employees increased in Turkey. However, employees are generally satisfied with the flexible working practice (3.74±1.29) and think that flexible working practice is applicable (75.4%) in working life (3.82±1.05). However, the participants were "undecided" (3.23±1.31) in terms of applying flexible working practice to jobs with little responsibility.

In terms of family work balance, most of the employees stated that they fulfill their responsibilities within the family more easily (3.81±1.27) and they can allocate more time to their family (3.93±1.21) thanks to the flexible working practice. It is observed that the rate of physicians, who benefit from flexible working practice, is higher than the other groups in terms of fulfilling their responsibilities within the family and sparing more time to their families (86.3%). It is also detected that physicians, who had an intense work tempo in the pre-pandemic period, were able to establish their family work balance better during flexible working practice and the balance was positively affected. Similarly, other studies stated that employees can spare more time for their family, environment and themselves thanks to working from home (Tuna and Türkmendağ, 2020).

From the perspective of family-work conflict, the participants were "undecided" whether multiple roles at home (status at work, mother, spouse, etc.) were challenging or not (2.65±1.24). They do not advocate the opinion that they experience more conflicts with family members during the flexible working period (2.14±1.07) and that the time they spend on family responsibilities negatively affects their job responsibilities (2.06±1.03). During the flexible working period, situations such as "having multiple roles at home (36.1%)", "having conflicts with family members (18%)" and "time spent on family responsibilities negatively impacting job responsibilities (27.9%)" were mostly seen in academics. According to Eaton and Bailyn (2000), when organizational flexible working policies are inconsistently implemented and discouraged from participating in these programs, employees perceive more interventions in balancing their work and personal/family responsibilities. Therefore, employees who do not feel free to use the flexible working programs provided by the organization with the fear of damaging career prospects may not benefit from the intended benefits of these initiatives, such as work/life balance. On the other hand, there are studies showing that working from home, which is one of the flexible working types, is associated with higher levels of work pressure and work-life conflict. There is also evidence that working from home may be associated with increased work pressure and work-life conflict in some cases. Further research on working from home reveals that this is associated with working longer hours, as well as causing work to interfere in family time more and regarded as more workload (Russell et al, 2009). Work-family conflict is a source of stress that many individuals experience. Work-family conflict has been defined as a type of inter-role conflict in which role pressures from work and family areas are mutually incompatible (Carlson et al., 2000). Surely, work-family conflict can negatively affect both productivity and family life. Besides, it is shown that work-family conflicts have a potentially detrimental effect on productivity, personal activity, marital relationships, child-parent relationships, and even child development (Gornick and Meyers, 2003).

Expressions of the participants' about work-related benefits reveal that the participants are generally "undecided" (52.4%) whether their job motivation has increased or not (3.34 ± 1.33). Besides, physicians (58%), nurses (56.8%) and other healthcare professionals (59.6%) stated that their job motivation increased. For academicians, this rate was only 34.4%. This finding may support their statements that they experienced family-work conflict while working from home and shows that academics are more motivated when teaching face-to-face with students. Although the main purposes of implementing flexible working programs are to adapt organizations to changing environment, competition and technological and communicational developments, and to increase the morale and motivation of employees by increasing the time they can spare for their family and private lives (Doğan et al., 2015: 376), this study results show that it is not possible to say that all employees have a positive attitude and view about flexible working practices. Tuna and Türkmendağ (2020) stated that the absence of an efficient working environment at home, increased workload, and deterioration of the working environment are negative effects of remote working on motivation. In addition, they stated that remote working increases the need for qualified information technology infrastructure, obligates all stakeholders to be prepared to work remotely, the working time stretches and gets longer, some difficulties arise to hold meetings in homes with children, the workload increases, and workplace discipline deteriorates.

In terms of job satisfaction, the participants agree (54.2%) that they got more job satisfaction (3.40 ± 1.33) in the flexible working period. It was determined that the group with the highest satisfaction was other healthcare workers (65.8%) and the group with the least satisfaction was academicians (32.8%). The results reveal that academicians' continuing all of their courses as distance education dramatically reduces their job satisfaction. For an academician, it is important to know that they are understood and to teach in a discussion environment. However, in the distance education system, the participation of students in the course is naturally less, the interaction is limited, it is often not possible to teach in a discussion environment and to determine whether the students understand the course or not, which probably decreases academicians' job satisfaction. On the other hand, Baydar (2012) reports that the "taste for freedom" is an important reason for employees to prefer working from home. This concept is associated with reluctance to take orders, doing your own job freely and flexibility in the use of time.

In terms of performance, productivity, and efficiency, participants believed that flexible working practices increased productivity (3.46 ± 1.33) and individual performance (3.50 ± 1.28) in working life (58.7%, 60.2%, respectively), but they are "undecided" whether it increased corporate performance (3.17±1.31). While 66% of healthcare workers agreed that the flexible working system increased productivity, only 41% of the academicians participated. Similarly, 62% of healthcare professionals think that flexible working increases individual performance, while this rate is 51% for academics. Besides, 43.1% of physicians, 23% of academics and 43.6% of civil servants agree that flexible working increases corporate performance. Özçelik (2021) stated that employees who worked at home during and after Covid-19 pandemic were more successful in terms of job performance and quality of their work. Forbes et.al. (2020) expressed that, since lockdown during the pandemic, the majority (54.7%) of managers report that over 80% of their employees have been working from home, besides, organisations are providing more support for employees working from home to ensure productivity levels are maintained.

Participants are "undecided" whether flexible working practices positively affected their careers (2.97±1.24) and there were opportunities to make career plans (3.20±1.24). In total, 52.1% of the employees did not have the opportunity to make plans about their careers. Results show that the uncertainty environment created by the pandemic is an important factor in the instability of career development.

In terms of communication and coordination, employees stated that they did not experience any problems in communication related to their job or workplace during the flexible working period (3.87±1.13) and their job or workplace coordination was good (3.87±1.06) in this period. 78% of the employees believe that communication and coordination related to the job was good. The group with the highest rate having this opinion was academicians (86.9%), which may be due to the fact that universities have relatively high quality and well planned systems, academicians already use digital environments effectively, and the hierarchical structure in the academy world is flexible. However, according to studies, one of the possible disadvantages of flexible working practices is that communication problems in the workplace increase and may lead to coordination problems (Giannikis and Mihail, 2011). It is known that such business practices may cause some problems for organizations due to problems such as reducing face-

to-face communication and needing more coordination (Rao, 2004). It is understandable that many flexible workers fear being less in the office or not being able to establish face-to-face relationships with their boss. In addition, 65.9% of the participants believe that flexible working practice positively affects the continuity to work (3.62±1.19). In this manner, Baydar (2012) emphasised the importance of communication technologies (including fast and convenient internet connection) to be able to continue work from home.

According to participants' expressions of "benefits related to their own life", employees agree that "their quality of life has increased" (3.60±1.22), "could spare more time for themselves" (3.78±1.19), and "have rested" (3.78±1.24) thanks to the flexible working practice. On average, 72.8% of the participants stated that they gave more time to themselves and rested during the flexible working period, but the rate of those who stated that their quality of life increased is 62.3%. The relatively low increase in the quality of life can be considered as a reflection of the negative psychological and sociological effects of the pandemic period. In this respect, Tuna and Türkmendağ (2020) stated that working from home with flexible working hours provide advantages for employees including a comfortable working environment, freedom of dress, and a life and lifestyle away from intense stress.

Participants agreed (66.5%) that they managed time better (3.66±1.14) thanks to flexible working practice but the rate was low for academicians (52.5%). It is an expected result because almost half of the academicians think that their motivation and job satisfaction have decreased in the flexible/remote working system and it is a fact that effectiveness in time management is directly related to motivation and job satisfaction (Mackenzie and Nickerson, 2009). On the other hand, Baydar (2012) used in-depth interview techniques in his research on flexible workers and mentioned two groups which evaluated time flexibility positively and negatively. He expressed this situation as "the blurring of the distinction between work and leisure tim

According to the findings, employees think that flexible working practice positively affects their "physical health" (3.62±1.29) and "psychological health" (3.59±1.32). The ratio of those who think that they have started to pay more attention to their health (sports, nutrition, etc.) (3.50±1.24) thanks to flexible working practice is over 60%. The group with the lowest rate in this field is again academics (45.9%). It is seen that healthcare professionals (physicians, nurses, other healthcare workers) could pay more importance to their health during this period and flexible working practices have positively contributed to their physical / psychological health. In addition, 72.2% of the participants think that their life was easier (3.78±1.17) in terms of factors such as clothing and transportation, and 62% of them stated that their financial expenditures have decreased (3.47±1.19).

Participants were "undecided" at the point that their technology addiction increased (2.89±1.29) with flexible working practice. Only 39.5% of the participants stated that technology addiction has increased. The group with the highest rate was academicians (50.8%). It is known that academicians already use digital platforms in most of their routine work before the pandemic. However, the significant increase in the number of distant lives during the pandemic period can be seen as a factor in increasing technology addiction. According to the Turkish Statistical Institute statistics; during the Covid-19 period in Turkey, 90.7% of households had internet access from home, 79% of individuals' used the internet everyday, and 36.5% ordered or purchased products, increasing over the years (TÜİK, 2020).

Participants do not agree that their financial earnings were negatively affected (2.44±1.26) during the flexible working practice period. Only 23.7% of the participants stated that their financial earnings decreased. The rate was the highest among physicians (43.1%). The most important reason for this is thought to be the performance-based payment system in Turkey. In this system, in addition to a fixed salary, doctors receive a certain amount of the predetermined fee for each health service they provide as an additional payment. However, during the pandemic period, it is an expected result that there will be a decrease in the income of doctors due to reasons such as the partial postponement of the health services other than Covid-19, the decrease in the number of patients who are given appointments, and the additional payment rules not determined in the remote patient care regulations.

Finally, 75.1% of the participants disagree (2.38±1.27) that inertia occurred with flexible working practice. However, 37.7% of the academics stated they had inertia. Similarly, 74% of the participants stated that they do not agree that their concentration decreased (2.40±1.27) during the flexible working period, while this rate is over 80% for healthcare professionals, it is 55.7% for academicians. Akyildiz and Durna (2021) found that a majority of the academics (71%) did not conduct academic research after the outbreak of the Covid-19 pandemic and academic research was largely negatively affected (67.2%).

CONCLUSION AND SUGGESTIONS

Although flexible and remote working practices have been in place for many years, they have never been implemented as widely as they were in the Covid-19 pandemic period. The transition of almost all sectors to flexible working practice has led to important discussions about whether societies are ready for this change in psychological, sociological and administrative aspects. Unprecedented in its history, the flexible and remote working of a part of the healthcare sector and academics has created the opportunity to examine the impact of this situation on employees and institutions for the first time.

When the results of the study are summarized in terms of academicians, during the flexible/remote working practice; they allocated more time to their families and themselves and rested, fulfilled their responsibilities more easily, their quality of life has increased, their income has not decreased, but their expenses have decreased, and they have not had any communication problems with their jobs or institutions. On the other hand, they think that they experienced a decrease in their motivation and job satisfaction, their productivity was not positively affected, they could not manage their time well, their personal and corporate performances did not increase, their careers were not positively affected, their technological dependence has increased and their concentration has decreased.

When the study findings are summarized in terms of healthcare professionals, during the flexible / remote working practice, they allocated more time to their families and themselves and rested, fulfilled their responsibilities more easily, their quality of life has increased, their physical and psychological health was positively affected, there has been a decrease in their income, but also a decrease in expenses, they did not have any communication problems with their business or institution and their technological addiction did not increase. In addition, they think that they experienced an increase in their motivation and job satisfaction, their productivity was positively affected, they could manage their time better, their individual and corporate performances have increased, but their careers were not positively affected.

Flexible and remote working systems can be expected to have different effects on different occupational groups. However, as shown in the results of the study, it creates significant differences in terms of healthcare professionals and academicians. The basis of this difference may be due to the fact that healthcare professionals worked very hard before the pandemic, were under constant pressure, and often did not allocate sufficient time to their families and themselves. Flexible and remote working has provided healthcare professionals with the opportunity to get rid of this pressure and spend time at home with their families, even for a while. Although the workload of healthcare professionals varies with factors such as the structure of the health system among countries, the status of the health system in terms of quality and quantity, and economic conditions, it has been emphasized in many studies that healthcare workers generally complain about workload and stress, even in developed countries. In this respect, although the study findings reflect the results in a country, it can be concluded that the attitude of healthcare workers towards flexible / remote working practice can be generalized and supposed to be positive.

It can be concluded that academicians, who had to teach all their courses remotely for months and could not find the opportunity to communicate face-to-face with their colleagues and students, are generally not satisfied with this situation. It is seen that factors such as motivation, concentration, job satisfaction, productivity and effective time management, which are the most fundamental factors in an academician's success, are all negatively affected.

The results of the study show that the advantages and disadvantages of the flexible and remote working system differ according to the sectors and professions. As a conclusion, it would not be correct to generalize that working flexibly and remotely will be beneficial for all organizations and employees. So, it will be beneficial for managers to adopt flexible working practices, taking into account the corporate structure, organizational culture and employees' wishes and expectations, except for mandatory periods such as pandemics. In addition, organizations should develop the necessary policies to define which profession groups better work remotely and which tasks require employee availability. In conclusion, healthcare professionals benefit from flexible / remote working systems much more than academicians in many perspectives. So, it can be also concluded that; if organizations can use flexible working methods in a planned and effective manner, they may allow their employees to better balance work-family, reduce conflicts and stress, and increase motivation and organizational commitment.

All over the world, the flexible and remote working scheme has been implemented in periods that can be expressed in months for now. However, it is likely

that more and more organizations and employees will want to benefit from flexible working systems after the pandemic, and this option will continue to gain popularity. Nevertheless, the transition to fully flexible and remote working systems in organizations may create new and complex problems that were previously unknown, unexpected. The prolongation of this period may create a sense of isolation in employees and cause a lack of motivation. At this point, it will be among the important duties of managers to apply special approaches to human management, to find flexible solutions that can prevent difficulties that may disturb both employers and employees, and to develop effective and innovative policies to keep employees' motivation and performance high.

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Work-Life Conflict Experienced by Turkish Women Managers During the Covid-19 Pandemic: A Qualitative Research

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ABSTRACT

The changes in business life during the Covid 19 Pandemic had a significant effect on work-life balance of individuals, especially women as their roles at home and work have increased and the conflict between these roles has become more pronounced. Considering this fact, this research aimed to determine the conflicts and changes on the work-life balance of female managers during the Covid-19 pandemic. In this context, the research was carried out within the framework of workplace responsibilities, private life responsibilities, work-private life conflict, and the effects of the Covid-19 pandemic. This research was carried out in educational institutions of Turkey, through interviews with 16 married women employees who have children. The obtained data were classified following the main purpose of the research and content analysis, then coded and analyzed using the MAXQDA. The findings showed that the dominant factor in the pandemic period was Work-Life conflict and job responsibilities restricted private life responsibilities more. The fact that working at home decreases productivity, low productivity extends working hours, and the negative effects of technology increasing the workload have caused female managers, who are aware of their job responsibilities, to work more.

Keywords: Covid-19 Pandemic, Women Managers, Work-Life Conflict, Social Roles, Family Responsibilities, Work Responsibilities.

JEL Classification Codes: D23, M10

INTRODUCTION

The Covid-19 pandemic process has disrupted social-economic life all over the world. It has caused important changes in the fields of economy, education, social life, and health. This change in organizational processes also led to a sudden and significant change in the work and family roles of employees (Vaziri et al., 2020). While pre-pandemic studies have shown that work-private life conflict causes stress (Bellavia & Frone, 2005; Schieman & Narisada, 2021); during the pandemic, many employees were either unemployed or had to manage their business from home. Studies have shown that employees experience distributional injustice and unfair decline in wages, although they give priority to job requirements in comparison to family needs. (Narisada, 2020; Schieman & Narisada, 2021). In addition, during this process, employees experienced various health-related anxiety, fear, etc. Working from home and flexible working hours led to an increase in working hours including weekends, as well. The use of technology has also become a must to complete tasks. Despite the increase in the qualifications of the employees, promotion opportunities and wages have decreased (Thomason & Williams, 2020).

While these radical changes in the workforce and private life necessarily change the interaction dimensions of both living spaces, it further increases the importance of establishing a work-private life balance. Recently, one of the most important problems of the business world is the increasing permeability between the business and private life of the individuals. The workload negatively affects their family life, decreasing happiness and peace and increasing the risk of burnout. On the contrary, problems may arise in the workplace due to family-related problems, great interest, and a large amount of time spent for the family. In both cases, while one domain is positively affected, the other domain is negatively affected. If the balance cannot be achieved with this conflict, the efficiency, and productivity of both the employee and the organization decreases, while the peace and welfare of the society, of which

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the organization is a stakeholder, is negatively affected. For this reason, human resources management and organizational behavior disciplines emphasize the subject (Erdirençelebi, 2021). While the issue has not yet been resolved, the Covid-19 pandemic process has been faced and the necessity of reconsidering the issue has emerged.

The main purpose of this study is to identify the conflicts experienced by Turkish female employees in the education sector regarding work-private life imbalance due to the Covid-19 outbreak.

THEORETICAL BACKGROUND

Social Roles of the Individual

According to the social role theory, which tries to explain social roles, women and men assume different roles in their daily lives. In Turkey, as in many countries, a patriarchal structure of society prevails. The patriarchal social structure, as the social role theory defends, expects men and women to display different attitudes and behaviors. In this social structure, while the man is expected to be in working life, it is the woman who should be at home (Oruç & Demirkol, 2015). While the woman has the roles of wife, mother, cousin, niece, aunt, sibling in family life, in business life she assumes the roles of boss, manager, employee, whose duties and responsibilities are different. In patriarchal societies, women should primarily fulfill the responsibilities expected from them in the private life sphere and display attitudes and behaviors depending on this. Even if she is involved in business life, she should put the responsibilities of business life in second place.

Social structure has changed a lot throughout history. Concepts such as "spouses with double careers" have come to the fore especially with the higher number of qualified female employees as career holders in business life (Harvey et al., 2010). Despite the increase in the number of female employees, until the 1980s, the rate of being qualified personnel and taking part in senior management levels remained very limited, even if included in developed countries. Unfortunately, male domination in business life still continues, making women either ignored or underrepresented (Baykal et al., 2020). Indeed, according to the results of the household labor force survey held in Turkey in 2020; the rate of the employed aged 15 and over is 45.7%, 28.7% for women, and 63.1% for men. Studies pointed out the importance of social roles related to women's ineffectiveness in business life, in particular, concepts such as glass ceiling syndrome and learned helplessness have revealed that their social roles are obstacles to the promotion and wage of female employees (Erdirençelebi & Karakuş, 2018).

The Basics of Conflict (Imbalance) in Roles in Work and Private Life

To meet the expectations of both basic domains of life, employees sometimes have conflicts about which role to prioritize and which requirements to fulfill. In this context, as a result of the superiority of one life domain over another, the other is possibly neglected. Increasing negligence also increases conflicts among these domains and consequently decreases life satisfaction (Kossek & Ozeki, 1998). Greenhaus and Beutell (1985) argue that the imbalance/conflicts in the work-private life domains occur in three forms (Erdirençelebi, 2021):

Time-based conflict: arises when the realization of one role prevents the fulfillment of the requirements of other roles in terms of time (Greenhaus & Beutell, 1985). Individuals with different roles are obliged to fulfill all the requirements simultaneously within a certain day. However, when individuals have a new role taking too much time, it tends to take time out of other roles. In this case, the individual also experiences a time-based conflict (Cardenas & Major, 2005).

Tension-based conflict: It is the situation in which psychological symptoms such as stress, fatigue, and irritability caused by exposure to stress in one of the role areas affect the performance of the individual in another role (Greenhaus & Beutell, 1985; Kinnunen & Mauno, 1998). As a result of the negative psychological effects, the individual cannot fulfill the other role.

Behavior-based conflict: The behavior patterns required by the roles of living space are incompatible with the behavioral patterns in other roles (Greenhaus & Beutell, 1985; Kinnunen & Mauno, 1998). The individual has to exhibit the behaviors required by their roles. Problems and conflicts are likely to occur if they behave in the family environment as in the workplace and in the workplace as in the family environment.

Dimensions of Conflict Between Business and Private Life Domains

Conflict in business and private life occurs in two sub-dimensions (Wayne et al., 2004; Hill, 2005; Voydanoff, 2007): "work-family conflict" that shifts from work to family and "family-work conflict" shifting from family to work (Erdirençelebi, 2021).

Work-family conflict: It is the reflection of work-related negative moods to the family domain and potential threats to welfare and social relations in the family domain (Burley, 1995; Grenhaus & Beutell, 1985). Netemeyer et al.(1996) define work-family conflict as work activities suppressing family responsibilities.

Family-work conflict: It occurs when the family role requirements conflict with job responsibilities (Netemeyer et al., 1996), and it is the disruptive effect of the individual's family role on his/her job role (Wayne et. Al., 2004). In particular, different aspects of family life such as being married, single or widowed, the number of children, the age and health problems of children (visually impaired, down syndrome, autistic, etc.) are very effective in experiencing family-work conflict (Özdevecioğlu & Doruk, 2009).

Studies show that work is the dominant aspect in work-family life conflict (Pedersen & Minnotte, 2012; Premeaux et al., 2007; Netemeyer, et al., 1996). Similarly, Kinnunen and Mauno (1998) argue that as family boundaries are more permeable than work boundaries, the rate of experiencing work-family conflict is higher than family-work conflict. It's because employees think that when they reflect their home and family problems to their jobs, it will not be welcomed by the business community, and they may even face various sanctions (Yüksel, 2005), on the other hand, it is assumed that when they reflect their work-related problems to their families, their families will be flexible and try to help (Qui & Fan, 2015). Studies in the literature also show that female employees experience more work-family conflict than male employees (Starmer, et al., 2019; Demirel & Erdirençelebi, 2019; Özkul & Cömert, 2019; Calvo-Salguero et al., 2011).

Covid-19 Pandemic and Compulsory Change in Business Processes

Facing the Covid-19 pandemic, all countries have switched to crisis management. Extraordinary applications are exhibited in many areas, especially in health, economy, and social life. While some countries have severe restrictions and prohibitions on daily life, some countries have more flexible attitudes. Turkey has taken several measures in the context of combating the pandemic in this process. Quarantine practices, the emergence of the social distance rule, the curfew at regular intervals, travel restrictions, the complete closure of some workplaces, and some restrictions on working schedules can be given as examples of the measures (Erdirençelebi & Ertürk, 2020).

Teleworking has been another measure taken in Turkey's public and private sectors. It is remote working in any place apart from the workplace where individuals meet organizational objectives through high technology, managing their own time under less direct supervision (Contreras, et al., 2020). This practice started on March 22, 2020, in the public sector and ended on June 1, 2020. However, with the increase in the number of cases in November-2020, to prevent the spread of the epidemic, remote working and teleworking have come to the fore again (Serinikli, 2021). With the implementation, it has been observed that individuals can spare more time for their family members, they can make better use of their dead time in traffic and at work, they can spend more time on distance education of their children, and meet the needs of their elders (Akca & Küçükoğlu Tepe, 2020). In addition, this model has brought about digital transformation. People worked from home and conducted their meetings and interviews over digital applications. In addition, through these practices, lectures were given, exams were held, concerts were given, museums and libraries were visited (Dockery & Bawa, 2020). In addition to these benefits, it has been observed that individuals experience problems such as not being able to meet face-to-face with their colleagues, lack of experience in working from home, decreased social contact, inability to focus, ergonomic problems at home, and inadequate technology and equipment (Rubin et al., 2020).

While gender, marital status, age, and having children were counted as individual factors affecting work-life balance in many previous studies, staying healthy without getting sick in this period has currently come to the fore as one of the most important factors. Many employees have already experienced exhaustion due to the more intertwined work and family during the Covid-19. They've faced stress and difficulty focusing on work worrying about the health of the relatives and themselves. Moreover, the problems related to lack of technological knowledge, redefined responsibilities, and ways of doing business increase the stress levels of individuals who are more dependent on work habits and comfort, and negatively affect the work processes and family life balance (Öge & Çetin, 2020).

It seems clear that nothing will be the same again when the pandemic is over. In this sense, it is important to learn crisis management and be able to transfer it to organizational memory. In this context, managers will get the most responsibility, as usual. During the Covid-19, besides restrictions, practices and sanctions to be faced to protect the health of internal and external

stakeholders, mandatory updates according to the course of the epidemic for organizational processes create great pressure and stress on organizational management. It was also stated that in this process, managers have doubts about the fact that teleworking / flexible working / rotational working models may lead to escape from given responsibilities and there will be difficulties in performance evaluation and coordination (Bhumika, 2020). As a result, the Covid-19 process increased the workload of all employees, especially female-parent employees, and caused an imbalance in work-private life (McLaren et al., 2020).

METHODOLOGY

Purpose of the Research and Data Collection Method

Recent research from the UK, Canada, Australia, Italy, Ireland, and the United States suggests that parents have been under more time pressure in recent months, and owing to gender-based discrimination, mothers spend less time on their work and more time on household responsibilities compared to fathers during the pandemic. Although the number of double-income families is increasing, women still take the responsibility of raising children and domestic labor (Schieman et al., 2021). Therefore, it is a fact that women are more affected by the closure of schools due to the pandemic than men (Hjálmsdóttir & Bjarnadóttir, 2020). Particularly, mothers with babies and young children tend to have increased responsibilities in this process compared to mothers with children at older ages, and mothers with children aged 6-12 can give up their jobs more easily than fathers (Qian & Fuller, 2020). During this period, there has also been an increase in the roles of female employees who have sick relatives and the work-private life conflict of women employees (Boca, et al., 2020). Palumbo (2020) emphasizes that remote working can create a disadvantage in the development of employees' skills, that the boundaries between job duties and special duties related to the family can be mixed, which nurtures role ambiguity, thus, work-family conflict may increase. In their research on academics in the UK, Crabtree et al.(2020) revealed that women experienced more work-private life imbalances than men during the Covid-19 process. Actually, most of the participants who reported a deterioration in work-life balance due to childcare, homeschooling, and other care responsibilities were women.

Through semi-structured interviews with female employees in England, Adisa et al. (2020) found out that increased responsibilities of women at home as a result of starting to work remotely during the Covid-19 led to a role conflict. However, they also found that this restriction period created an opportunity to rediscover family values and intimacy with the family.

According to the data collected from male and female employees in South Korea, Lim, et al. (2020) revealed that female employees during the Covid-19 process experienced role conflicts and were unhappy with no reduction in their home responsibilities during the remote work process.

In their study conducted in different sectors of Turkey on white-collars, Tuna Akbaş and Türkmendağ (2020) revealed that changes in business environment, teleworking, the deterioration of workplace discipline, the increased workload, troubles with attendance decreased motivation levels of employees.

Reviewing the literature, the main purpose of the study was to identify the conflicts and changes occurring in the work-life balance of Turkish female managers during the Covid-19 pandemic. In this context, the research was carried out within the framework of workplace responsibilities, private life responsibilities, work-private life conflict, and the effects of the Covid-19 pandemic. Although there are few studies in the literature regarding the work-private life conflict of female employees during the pandemic period, no research has been found on female managers. Therefore, it is predicted that the research will contribute to the literature.

The interview method, one of the qualitative data collection methods, was used to collect data in the study. For this research, interview questions previously present in the literature were used. However, during the interview process, flexibility was provided and additional questions were asked for better comprehension. For this reason, semi-formal interview technique was used in the research. In this way, what kind of conflicts women managers experience in the work-life balance and what kind of changes these conflicts lead to are analyzed.

Research Universe and Sample

Most qualitative studies and qualitative content analyses employ non-probability or purposive samples. Purposive sampling is employed to raise awareness, provide new perspectives, or provide descriptions of events, beliefs,

Table 1. Information About Participants

Participants	Age	Training	Duration of Work Experience (Years)	Administrative Duty	Experince in Current Position	Number of Children
K1	41	University	15	Manager	3 years	2
K2	30	University	4	Vice Manager	1,5 years	1
K3	33	University	9	Vice Manager	2 years	1
K4	37	Graduate School	8	Manager	3 years	1
K5	30	University	6	Manager	2 years	1
K6	50	University	30	Manager	5 years	2
K7	54	University	34	Manager	6 years	3
K8	36	Graduate School	14	Manager	4 years	1
K9	36	University	12	Vice Manager	2 years	2
K10	31	University	5	Vice Manager	1 year	2
K11	40	Graduate School	17	School Principal	3 years	1
K12	48	Ph.D	28	Head of Department	6 years	2
K13	41	University	19	Manager	2,5 years	3
K14	59	Ph.D	34	Head of Department	5 years	2
K15	53	Ph.D	24	Head of Department	7 years	2
K16	46	Ph.D	23	Dean	3 years	2

and actions (Drisko & Maschi, 2016). The research was conducted through interviews with 16 female managers married with children, working in educational institutions. The most important factors in determining the female managers working in the education sector as a sample are the radical changes experienced in the education sector during the pandemic and therefore the increase in the responsibilities of women. Moreover, the participants' being married with children has been determined as another criterion, with the prediction that it will increase their private life responsibilities. Considering women might experience work-private life conflicts, it is thought that married women with children and administrative duties in the education sector will constitute a good data source for the study. Within the scope of the research, 16 female managers, who volunteered, were interviewed face-to-face and through online platforms. During the interview, the participants were asked to respond by taking their experiences in the first wave of the epidemic into account. In the study, the names of the participants and the institution names they work for were not shared to protect their personal rights. Information about the participants is shown in Table 1. All procedures involving the participants are in compliance with the ethical standards of the [NEU Social and Humanities Scientific Research Ethics Committee, dated 19.02.2021, decision number 2021/88] and the 1964 Declaration of Helsinki and subsequent amendments or comparable ethical standards.

Data Collection/ Limitations of the Study

The semi-standardized interview involves the application of a predetermined set of questions and specific topics. Each participant is systematically asked questions, but the participant is left free to answer (Berg & Lune, 2019). During the interview process, questions were prepared in line with the purpose of the study and semi-structured interview technique. Later, the necessary approvals were obtained from the participants and an interview schedule was created with the options of face-to-face/online due to pandemic. Interviews were held

between February-March, 2021. Interviews were audio-recorded, and detailed notes were taken. Each interview lasted for about 30-50 minutes.

As with any other study, there are some limitations in this research such as the selection of participants from a unique sector, constantly changing internal dynamics of this sector owing to the pandemic, and limitations regarding time and financial concerns.

Data Analysis

The research employed "content analysis" defined by Drisko and Maschi (2017) as "a family of research techniques for making systematic, credible, or valid and replicable inferences from texts and other forms of communication". In this context, first of all, audio-recordings were transcribed and research data were created with the notes taken. Then, the data were classified following the main purpose of the research and content analysis. Later, the data were coded using the MAXQDA 18 and analyzed.

Reliability of Qualitative Research

Krippendorff (1980) mentioned three different reliability tests: stability, reproducibility, and accuracy. The codings in this study were re-performed after a certain period of time, and no difference was found, thus stability-reliability test was successfully achieved. Then, two different experts made the coding to examine coding agreement. The coding similarity rate was 88% and the reproducibility of the study was provided. Accuracy is the degree of compliance of the obtained data with a standard (Krippendorff, 1980). Since the research covers the pandemic period, there is no generally accepted standard in the literature. However, in the study, reference was made to previous studies on the subject. As already stated in Krippendorff (1980), "accuracy is not always attainable due to the ability of experts to set a standard, reproducibility is the strongest realistic method by default". In this context, it was determined that the reliability of the study was acceptable.

Research Findings

The data were analyzed through the Hierarchical Code-Sub-Code Model, and it was tried to find out the conflicts and changes in the work-private life balance of female managers working in educational institutions during the pandemic. The data included factors as Special Life Responsibilities (family responsibilities: spouse role, mother role, sibling role, child role, and daughter-in-law role, personal life responsibilities, socialization, habits, hobbies, and self-development), Workplace Responsibilities (planning, organizing, commanding, coordinating and supervising), Work-Private Life Conflict (work-private life conflict and private life-work conflict) and the Effects of the Covid-19 Pandemic (positive, negative and neutral effect). In addition, it has been observed that technology, productivity, family ties, and solidarity factors have an effect on this process and are therefore included in the study to explain the changes in the work-life balance. Hierarchical Code-Subcode Model is shown in Figure 1.

Figure 1 shows how work-private life responsibilities and related sub-elements are rated according to the negative, neutral and positive effects of the Covid-19 pandemic period. The rating was created according to the intensity of the Covid-19 effects (positive, negative, and neutral) of all elements and the number of codes. In other words, the effects of all elements on Covid-19 and their relationships with each other were evaluated, averaged, and ranked according to their degree of impact. Within the framework of the research, although these answers were used by asking separate questions to the participants to determine the work-life conflict, the answers that these elements are related to that of work and private life elements were coded together, and how the balance changed was explained. Then, a Hierarchical Code-Subcode map was created using MAXQDA 18 on which the line width for different frequencies was used.

Work-Life conflict was the biggest sub-factor negatively affected by the Covid-19 pandemic in the context of work responsibilities, private life responsibilities, and work-life conflict. Then, it was determined that the sub-factors of control, planning, coordinating, and controlling, which are job responsibilities, were again negatively affected. In this period, it is seen that technology, child, and sibling roles are approaching the balance due to both negative and positive effects. However, this does not mean that these elements are neutral or not affected by the pandemic. On the contrary, it states that it has different effects both negatively and positively. It was determined that family ties, family solidarity, the role of the daughter-in-law, and self-development, respectively, were positively affected by the Covid-19 period.

Findings and participant responses regarding the research analysis are as follows:

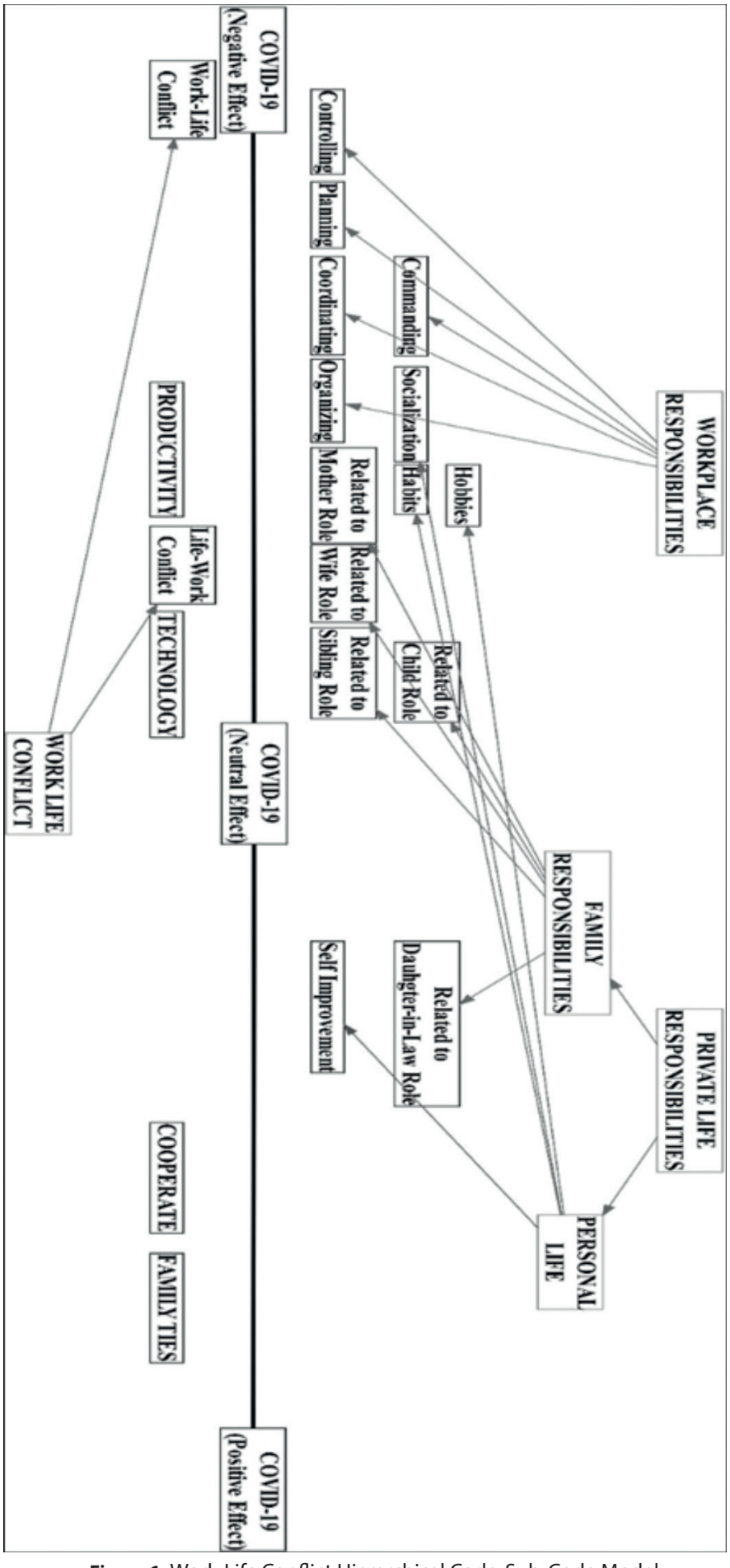

Figure 1. Work-Life Conflict Hierarchical Code-Sub-Code Model

Workplace Responsibilities

According to the degree of impact, controlling, planning, command, coordination and organization were adversely affected by the pandemic period. It has been determined that the decrease in the hierarchical effect of managers on the employees working from home is effective in the fact that controlling responsibility is in the first place compared to other types of work responsibility.

"…of course there are differences between working face-to-face and working at home in supervision. The attitude and feedback of an employee working at home may differ from that of the ones given face to face at the workplace. Because you send your directive by phone or mail while working at home during which you may not be able to use your hierarchical influence on your subordinates effectively. I think the comfort of being at home or different factors can make employees more flexible about their responsibilities of the work.."

Although there is a ranking among them, it has been determined that the degree of negative impact of all job responsibilities from the process is very close to each other in terms of impact intensities. In this process, almost all of the participants stated that even though the workload is the same, the working time has increased significantly.

"In other words, we don't do more than we normally do, but we have to report, plan, schedule, and convert many activities carried out in daily life into meetings."

"…the work, which was previously between certain hours, can now extend until 24 hours. We work at the weekend and we work in the evenings. So the limits are gone."

It has been observed that two different factors come to the fore in the prolongation of working hours and negative effects of job responsibilities in this process. The first of these factors is efficiency. According to the participants, although working from home seems comfortable compared to working in the workplace, it decreases efficiency considerably in terms of concentration and focusing on problems. In addition, it was determined that the woman at home could not work efficiently because her responsibilities in the house were constantly interrupting her work and as a result, her working hours were extended.

"…working from home is not something a married woman can do. Because at my workplace, I can concentrate on only my work during working hours. Whatever I have to do, I concentrate and work without losing my concentration, within my own planning. All in all, I am getting the result I should have gotten."

"Jobs that would finish quickly face to face were done from afar longer. At home, I can hardly do some of the things I was doing very comfortably at work."

Another factor that negatively affects work responsibilities is technology. In this process, the participants stated that documenting and reporting most of the routine work done in a natural process in the workplace utilizing technology during the home working process extends the business process a lot. In this process, technology has made things workable regardless of time and place, eliminating the working hours and home-work distinctions. Thus, there is a perception that all work can be done anytime, anywhere. In addition, the fact that the technological infrastructure in the participants' homes and the technological infrastructure in the workplace are not equivalent has led to negative consequences. In addition, it has been stated that there is a large increase in the number of transactions made, especially for educational institutions, due to the transfer of most manual work to technological environments.

"…our work was disrupted due to the inability to work efficiently during the home working period. Of course, working periods started to increase to complete these tasks given. Then, I can say that this continued as a habit. Now we have left the working-from-home model. However, when we come home at the end of the shift or at the weekend, a job instruction is received and we are expected to deal with it immediately without delays."

"During the pandemic process, doing everything and every process in a digital environment has increased my work. It exhausted me. Each lesson, exam document, similarity report, etc. took me a long time to upload to the system. Normally, I was more flexible and comfortable."

"Disconnections while working from home lead to stress. Our technological infrastructure in the business environment is much better than home. There were some difficulties with this. "

During the pandemic, along with the negative effects, technology has also provided positive outcomes, as well. It was stated that thanks to technological infrastructure, many tasks could easily be completed in comparatively shorter times than normal.

"…If you ask me whether I want to hold a face-to-face or online meeting, I'd definitely prefer online platforms because it is much more practical and easy. You can arrange the meeting wherever and whenever you want. Everyone can participate comfortably as they wish. In this process, technological equipment and remote work had great advantages. We can do many tasks in a shorter time"

Private Life Responsibilities

Private life responsibilities are examined under two headings. These; family life responsibilities and personal life. From family life responsibilities, the roles of mother, wife, child, and sibling were negatively affected by the pandemic process, and the role of the daughter-in-law was positively affected. The closure of schools and the distance students were determinant in taking *the role of the mother* in the first place. Most of the participants mentioned the difficulties of mentoring the training of their child as a parent. However, the age of the child appears to be a very important factor here. It was determined that the participants whose children were in primary and secondary education were very worn out during this process, and those with older children were not affected by this process.

"…On the first term, schools were closed and their parents mentored the training of their children. This process was very weary because I was involuntarily involved in many processes, such as mentoring my child's lessons and homework, and communication with the teacher. This situation has already become a major responsibility…"

"During the period we stayed at home, all my responsibilities inevitably increased as the time we stayed at home increased. As a working individual, I was getting service from outside for housework such as cleaning and ironing. However, during this period, I couldn't get this. Therefore, I had to do all these things. In addition, all family members were at home during this period. Therefore, the number of meals eaten at home also increased. While we were having breakfast and dinner first, we started to have lunch. Of course, all these tasks required time and effort. Sometimes it caused conflict."

"…I made a lot of effort early on, especially on hygiene. I was cleaning the whole place over and over again because there was uncertainty about how the epidemic spread, and I felt like it was my primary responsibility to clean everywhere to protect my family. I noticed that I was behaving obsessively…"

The findings revealed that some factors were positively affected in the pandemic period other than family responsibilities. The first of these elements is family bonds. In this process, the fact that all family members were at home spending more time with each other has had a positive effect on family ties. However, workload emerges as a very important factor in this process. It has also been stated that as the workload gets heavier, the family bond is negatively affected, and even in some cases, conflicts are experienced due to work stress. In other words, the respect and support of the family for the work of women has gained great importance in this process.

"…we started spending more time with my husband and children. We had breakfast with them in the mornings, prepared meals together, organized domestic activities. They were very happy. Actually, we got a little connected."

"…when we started working from home, my work and my husband's business did not go on the same period. In other words, my wife was not working when I was busy, and I was not working when he was busy. The kids wouldn't be ready if we were both idle. For example, we became unable to even have dinners together. Because when I was going to eat, he was attending an emergency meeting. I was writing a report when he wanted a meal. As our workload increased, conflicts started and I felt that family unity was broken. In this process, I realized how important your family respected your work and supported you."

Another factor positively affected by the pandemic process is domestic solidarity. In this process, husbands and children showed great cooperation in the first place and helped with household chores. However, as in the family bond factor, it was observed that the rate of assistance gradually decreased when the workload started to increase.

"My husband and children started helping with housework more than usual. There were hours we both had to work at a desk. We both got by each other for housework. This was the positive side of the process."

"…after a while, my husband's workload increased too much and he could not give the support he used to, thus my responsibilities increased considerably in the following term …"

Child and sibling responsibility has also been negatively affected by the pandemic. Participants stated that not being able to meet face to face with their mother, father and siblings negatively affected them.

"…I could not see my mother, father, siblings during this period. There was a routine that we were used to. But during this period, I could not visit them worrying about whether I would infect them. You know that as a nation, visiting elders on holidays is a tradition, but we could only communicate with them over the phone on the last holiday. This incident made me very sad."

Unlike other types of family responsibilities, the daughter-in-law role has been positively affected by the pandemic. Participants stated that the decrease in home visits of their spouse's parents, siblings, relatives during this process alleviated their workload and improved their communication.

"…we couldn't get in touch with my mother-in-law, husband's siblings, relatives, which made this period seem like a holiday to me. I used to have too many guests and much effort to entertain them. It decreased my workload. Having space also positively affected the relationship between my mother-in-law and me…"

Socialization, habits, and hobbies from personal life responsibilities were negatively affected by the pandemic period, while self-development was positively affected. Participants stated that being unable to meet face to face with their relatives and friends during this process was one of their biggest problems.

"My relationship with the social environment is really weak. I neither see my friends nor my relatives. We do not visit anyone's house as much as possible, and vice versa, so of course we have reduced our relations with the social environment."

Habits have been adversely affected by the pandemic period. As participants not being able to leave the house during the pandemic, they mentioned that their habits of shopping, personal care, clothing, etc. also changed.

"…my shopping frequency has decreased very seriously. I learned to check my clothes. My style became more sporty and casual. I could go to the hairdresser rarely, and I had to dye my hair myself. I learned manicure and pedicure. I did not wear makeup during the pandemic. I don't use my jewelry for fear of germs sticking."

Hobbies from private life responsibilities are the last factor negatively affected by the pandemic period. Participants stated that not being able to do their activities outside home during this process negatively affected their psychological states.

"…during the pandemic period, not being able to leave the house, not going to the theatre/cinema, staying away from people, etc. affected my psychology negatively. For example, we used to go on vacation every summer, we couldn't do that either…"

Self-development responsibility is the only personal life factor positively affected by the pandemic. During the pandemic, spending time at home continuously, having training opportunities for courses online from many institutions gave people the chance of personal development.

"…I attended many training activities online that I would not normally be able to attend face to face during this period, which was very advantageous for me in this respect. I reached places easily during this period, such as museums, palaces, libraries, etc. through online access by institutions."

Work-Life Conflict

Work-life conflict has been evaluated through two sub-dimensions as in the literature: work-family conflict and family-work conflict, both of which were found to be negatively affected during the pandemic. The findings showed that work responsibilities mostly limited private life responsibilities, and took priority. In this process, it was observed that the responsibilities and embarrassment of the participants towards their superiors and subordinates in the workplace prevailed, and in most processes, they left their private life responsibilities behind.

"You can have your meal an hour later or you can clean the house later. I earn money from this job and I have responsibilities, there are people I will be accountable and embarrassed when I don't. Therefore, I think job responsibilities are very important."

"After all, my family is very important to me, but I couldn't put my job behind in this process."

However, it should be clearly stated that this does not mean that private life responsibilities never restrict their job responsibilities. There were also times where the participants gave priority to their private life responsibilities.

"I felt that I was lagging behind in this process. The rush to complete housework made me spend less time on my work. Frankly, this situation bothered me a lot."

"…doing housework and running your business from home is incredibly difficult because too many responsibilities

overlap and you can easily fall apart. You can only focus on your work in your workplace. While working at home, while doing your job, eat, clean, etc. you may need to be directed to many things. This decreases your productivity a lot."

The findings showed that the most important effects of the pandemic period were the increase of Work-Life conflict and the more restriction of job responsibilities to private-life responsibilities. Working from home reduced productivity, low productivity extended working hours, and the negative effects of technology increasing the workload caused female managers who were aware of their job responsibilities to work more. In this process, it was determined that female managers who did not fulfill both types of responsibilities exerted too much effort, compromised themselves, and were psychologically worn out.

"Previously, we could leave the job outside your door and spend time in our home, in this special area, without thinking about it. At the moment, we are living at home with inefficient work, with our permanent job and the stress it brings. This was a very tiring and psychologically exhausting process. I have had moments when I was clearly neglecting my home and family. When I realized this, I made a more intense effort not to neglect them. This time I was very weary and realized that I was neglecting myself. I felt drained…"

DISCUSSION

Some negative consequences that can be drawn from this research and similar studies in the literature are as follows: The necessity of using technology more effectively has brought some new processes with it. Problems that can be solved immediately with cooperation in the workplace have become unsolvable. There were problems with focus on work at home, supervision and working time, and there was a limitation of movement. It has been observed that business processes take longer time and there are problems in technological adaptation (Tuna Akbaş ve Türkmendağ, 2020). On the other hand, due to prohibitions, lack of support (from social and family elders) regarding cleaning, childcare, food, etc., increased tendency to eat meals at home, children switching to distance education and so on. led to an increase in the responsibilities required by the roles within the family (Schieman et al., 2021; Hjálmsdóttir & Bjarnadóttir, 2020; Qian & Fuller, 2020; Boca et al., 2020; McLaren et al., 2020; Palumbo, 2020; Crabtree et al., 2020; Lim, et. al., 2020). Sometimes it led to conflicts between spouses. In addition, he longed to be unable to meet with his extended family members and social environment (Uysal & Yılmaz, 2020). It has been stated that not being able to go on vacation, to the cinema or to the theater reduces motivation (Bhumika, 2020). Especially Ramadan and Sacrifice Feasts, which have an important place in Turkish culture, could not be celebrated with enthusiasm as before. Considering that the addition of health anxiety and fear of death caused by the Covid-19 pandemic brought psychological negativities to this situation (Öge & Çetin, 2020), burnout is in question (Kara Keskinkılıç et al., 2021). It triggered some obsessive behaviors at the point of hygiene. In addition, it was observed that the age ranges of the children of the female managers interviewed were effective in supporting housework.

In addition to the disadvantages of teleworking during the pandemic process, there were also some positive benefits. Saving from transportation time (Akca & Küçükoğlu Tepe, 2020), reducing the risk of getting viruses, freedom of clothing, spending more time with family members (Adisa et al., 2020), decreasing conflicts with the role of daughter-in law and mother-in-law, gaining excellence at kitchen, etc. are among the individual advantages of teleworking. In addition, it was observed that domestic solidarity increased, communication and dialogue with family members improved, and as a result of the change in purchasing habits, more financial savings were made. It has been observed that individuals have contributed to their personal development and career planning by participating in various trainings thanks to distance education.

CONCLUSION AND RECOMMENDATIONS

The Covid-19 pandemic process has affected the whole world. Since it has become dangerous, states have tried to protect the public by exhibiting different practices against this virus. Employees could not go to their workplaces for a long time, as the most effective practices were curfew and social isolation. In addition, businesses have demonstrated practices such as giving unpaid leave, firing or working remotely for their employees because they are aware of the danger or because of economic necessities. The method of working remotely or teleworking has gained importance during the Covid-19 pandemic in terms of both public health and mitigating the negative effects of this process on the economy. Thus, one of the prominent issues during the pandemic period for white collar workers who can perform their work independently of the workplace has been teleworking. However, in our country, which has a patriarchal social structure, this situation has increased

the work-life conflict women managers experience. This research proves this. The conflict between the work-life spheres has led to a decrease in efficiency and increased stress among female managers, and therefore conflicts with family members at times. Cases and death news triggered more anxiety and stress. Considering this situation, it may be beneficial for organizations to organize webinars on stress management, effective use of technology, and work-life balance. In addition, managers can be trained on digital leadership. Reminder trainings can also be offered on the correct use of water from natural sources in providing hygiene.

As a result, it is a matter of curiosity how some changes that started with the pandemic will continue after the pandemic. The human resources management process needs to be reconsidered. It will be beneficial to carry out studies on the subject in a wider area and in cooperation with different disciplines.

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Utilization of Strategic Marketing in Nonprofit Sector - Evidence from Turkish Nonprofit Organizations

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ABSTRACT

Marketing has always been an important research topic for researchers and practitioners where it often focuses on the private sector and commercial businesses, marketing of non-profit organizations is gaining more importance recently. The reason is non-profit organizations are competing with each other in order to attract new volunteers, allure financial donors and build up their reputation. To achieve these aforementioned objectives, strategic marketing is an invaluable concept that can be utilized by non-profit organizations to differentiate themselves from their competitors. Within this context, aim of this paper is analyze how non-profit organizations in Aegean Region in Turkey incorporate strategic marketing aspects into their organization's marketing plans. To achieve this aim, semi-structured in-depth interviews were conducted with the chair boards, managers and marketing managers of non-profit organizations located in Aegean Region in Turkey. Overall, 6 in-depth interviews were conducted. Result of the study revealed that non-profit organizations in this study are aware of the strategic marketing concept and utilize some of its aspects in their marketing activities albeit not deliberately. Findings also indicate that internal situational analyses are widely used while planning marketing activities, but not external ones. Numerous suggestions and managerial implications are provided for better utilizations of strategic marketing concept. Limitations and future recommendations are mentioned.

Keywords: Strategic Marketing, Strategic Marketing Management, Non-Profit Organization, Turkish Non-profit Organizations.

JEL Classification Codes: M31

INTRODUCTION

Marketing has always been an intriguing field for both researchers and practitioners alike. First effective, operational marketing campaigns were developed by practitioners and commercial advertisement consultants (Sargeant et. al, 2002). Being a vast field consists of many sub-topics, marketing has attracted interest of many sectors, primarily the private sector such as commercial businesses or corporates. Thus, most of the literature and relevant research on the marketing field is conducted towards the for-profit organizations and enterprises. There are however, other sectors whose actors play equally important roles: public and non-profit sector. Public sector consists of the administrative bodies, municipalities, governmental institutions, ministries and other public institutional bodies whose main goal is to serve their country and nation. Although public sector is an important part of an economic environment in their countries, Throughout the 20th century, marketing of the public sector has always been left in the shadows in the literature by private sector. Similar to public sector, marketing activities of non-profit sector are also widely overlooked in the literature.

Often abbreviated as NPO's, non-profit organizations are complex and hierarchical organizations whose main goal is to distribute services. These provided services can be given to both members of the organizations or society in general. Most NPO's are not striving for the monetary rewards except for the required financial capital for conducting their activities. In other words, non-governmental organizations are not aiming for profits. (MacMillan, 2021).

As more and more non-governmental organizations established on all around the world, differentiation between NGO's has started to be equally important. Since 2010, intense competition between non-profit organizations sprung up. Main reason of competition between NGO's is to attract better funds, grab bigger market shares and allure already-small volunteer base. This forced NGO's to specialize their activities and employ "specific techniques". Among many other, strategic marketing is one of the best comprehensive tools that non-profit organizations can utilize to survive in a competitive environment.

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Since the beginning of 21st century, executives at non-profit organizations have started to realize the importance of strategic marketing for their organizations. Most non-governmental organizations do not product any tangible outcome or product; rather, main asset of an NPO (non-profit organization) is its vision, provided services and presented programs. Therefore, marketing a non-profit organization is wildly different than marketing a commercial organization. Thus, analyzing how NPO's utilize strategic marketing may provide valuable information.

Purpose

As it was stated previously, concept of marketing and strategic marketing in non-profit organizations is quite different than their commercial counterparts. Moreover, as Dolnicar and Lazarevski (2009) point out, concept of strategic marketing is barely acknowledged by non-profit organizations. Although commercial strategic marketing topic is saturated thoroughly in the literature, strategic marketing applications in non-profit organizations can still be considered as a niche area.

Within this context, main aim of this study is to analyze how NPO's in Aegean Region in Turkey incorporate strategic marketing aspects into their organization's marketing plans. Considering that Aegean Region is one of the richest areas of Turkey regarding the active number of NPO's within it, understanding to what extent they utilize strategic marketing in their overall marketing practices and promotional activities holds significant importance which may help understand the overall framework of NPO marketing.

Literature Review

Usually abbreviated as NPO's, non-profit organizations are defined as the entities established by various individuals with an aim of providing various services to its members and others. As stated by Golensky and Hager (2020), definition of nonprofit organizations varies quite a lot. Non-profit organizations are not operating for profits and largely independent of governments as their name suggests (MacMillan, no date). Being one of the most important aspect of our contemporary society, non-governmental organizations may direct their efforts towards various issues such as awareness, human rights, sustainable development goals, smoking-free life, basic availabilities. Within this context, Parthasarathy (2013) remarks that non-profit organizations in Western countries are more mature than their counterparts in Asia and Africa, therefore they engage in usually larger issues such as environmental sustainability, global warming, awareness of cancer, development goals, humans rights issues whereas non-governmental organizations in developing or under-developed countries are still struggling with basic issues such as availability of clean water and food for everyone, accessible education, awareness of AIDS and population planning.

Research on the various aspects of non-governmental organizations can be found dotted around the literature. As stated by Ayyıldız & Akmermer (2017), "sectors" in the developed countries can be divided into three groups: private sector, public sector and non-governmental/ nonprofit sector. Especially after the 2004-2005 aid campaigns in Indonesia and Sri Lanka, NGO's fostered and strengthened their position among other sectors (Lewis, 2010). Although the standpoint is balanced on these three dimensions, there are significantly fewer research on the topic of non-governmental organizations.

Although the literature clearly separates the for-profit organizations and non-profit organizations, establishing, running and expanding an NPO is quite similar to its for-profit counterparts (Pope et al., 2009; Yoga & Bumi, 2020). Furthermore, one would assume that because non-governmental organizations are not striving for profits; competitiveness in the environmental will not be a problem. However, as Blery et al. (2010) suggests, non-governmental organizations still compete with each other in an overly-saturated environment. Competition between non-governmental organizations is usually based on the limited financing options, investments and small volunteer pool. To strive in this saturated, competitive environment, NGO's rely on marketing concepts and campaigns (Pope et al. 2009; Yoga & Bumi, 2020).

First examples of marketing campaigns for non-profit organizations has been experienced in 1960's and 1970's (Kotler & Andreasen, 1991). As the time goes by, marketing approach of non-governmental organizations has changed fundamentally. First and foremost, NPO's do not usually produce products and only provide services with no expectation to get anything back. Therefore, some researchers falsely assume that marketing of NGO's are an impossible endeavor (Yoga & Bumi, 2020). However, this is not completely true. Credit should be given when its due; yes, non-governmental organizations cannot be marketed with conventional methods due to lack of tangible products; nevertheless, one should not forget that most non-governmental organization actually sell their mission and vision (Yoga and Bumi, 2020). Within this context, it can be stated that marketing concept for non-governmental organizations differ significantly than other two sectors. Fundraising activities, communications, volunteer attraction, goal reaching, consistent target messaging are some of the functions of marketing for non-governmental organizations (Nicolau, 2016; Nageswarakurukkal et al., 2020).

Many studies can be found dotted around the literature which explores the marketing activities of various NGO's. In their study, Blery et. al. (2010) examined the marketing practices of WWF in Greece. Findings of their study revealed that World Wide Fund for Nature, which aims to protect near-extinction animal, effectively promote its message on various different channels such as newspaper, internet and even direct mails. Similarly, Yoga and Bumi (2020) analyzed the marketing activities of the Bali WISE program, which empowers local communities and females through educational programs. Focusing mostly on the content shared on the social media of the aforementioned program, authors mention that number of posts shared on the social media platform is crucial for the success of the marketing endeavor. In other words, for marketing campaign to be successful, sufficient number of posts should be shared. In another study, Kwak (2015) examines the 4C aspect that can be applied to non-profit organizations. Findings of her study mention that communication with different recipients holds crucial importance for non-governmental organizations. Moreover, study proposes a 4C formula for non-governmental organizations: customer value, cost to the customer, convenience, communication. These elements make up the marketing mix of non-governmental organizations. In their study, Wenham, Stephens and Hardy (2003) analyzed websites of 32 different NGO's. Authors mention that web use between for-profit and NGO's differ quite a lot, but web use practices in different types of NGO's require further research. Authors compare the marketing practices of these NGO's with a "best practice". This best practice involves six key elements dubbed as 6C: capture, content, community, commerce, customer orientation and credibility. Results showed that most environmental NGO's in United Kingdom lack the previously mentioned six elements. However, findings reveal that most websites are easy to use; contain simple texts but no personalized content or multimedia. Credibility-wise most NGO's are in a good position but lack various content that is important for online marketing. Use of online marketing by NPO's are widely studied in the literature. Nageswarakurukkal et al. (2020) remarks that up until 1990's, televised advertisements or telemarketing practice are the main communication channel for non-profit organizations. Nowadays websites, e-mails and even texts are utilized.

At this point, it is prudent to delineate strategic marketing. As it was stated by Meydan (1999), strategic marketing can be considered as a guideline which determines the organizations direction in customer relations. Moreover, strategic marketing aspects in an organization may also include the potential suggestions for dealing with competitors. Overall, as Chernev and Kotler (2012) remarks that strategic marketing provides a thoroughgoing framework for the strategic planning of marketing activities in an organization. Strategic marketing plan helps companies generate a structured game plan for analyzing, identifying and solving various different marketing problems. Within this context, Meydan (1999) mentions that strategic marketing generated by organizations must be in accordance with customer's perception, attitude, needs, wants and beliefs.

For the non-profit organizations, marketing has only just started to be important. Marketing campaign and promotional activities are utilized by non-profit organizations to entice new volunteers or attract new funding options. Although traditional marketing activities prove useful to the non-profit organizations, a more comprehensive, all-inclusive endeavor is employed by many non-profit organizations, otherwise known as strategic marketing. Even though some studies shine light on the topic, field is still in its infancy stage. In one of those studies, Čačija (2013) examines the fundraising activities within the context of non-profit strategic marketing. Study revealed that long term relationships are crucial and effective marketing practices can help with the awareness problems of NPO's.

Within the context of strategic marketing utilization in non-profit organizations, Kotler and Andreasen (2003) put together a formulation for strategic marketing for non-profit organizations. As Dolnicar and Lazarevski (2009) points out successfully, these specific guidelines provided by Kotler and Andreasen puts conventional and traditional marketing activities on its foundation. Rather than providing new and unique marketing options, pathways suggested in the study are meant to be utilized in new and challenging scenarios. In their study, Andreasen and Kotler (2003) highlight that for non-profit organizations to successfully adapt strategic marketing in their operations, it is imperative to adopt a customer-centered perception, rather than organization-centered mindset. Customer-centered approach entails focusing on the perceptions, attitudes, needs and wants of customers in oppose to organization centered approach. Within this context, importance of market research is also mentioned. In another study which examines the Kotler's previously mentioned guidelines in the context of strategic marketing aspects throughout non-profit organizations, Dolnicar and Lazarevski (2009) remark that importance and effectiveness of marketing are not yet acknowledged by non-governmental organizations. Thus, proving the point that most non-profit organizations still have organization-centered approach.

RESEARCH METHOD

Research Settings

As it was stated previously, main goal of the study is to understand how nonprofit organizations located in Aegean Region of Turkey employ and embrace strategic marketing practices throughout their marketing practices. To achieve the objective of this study, qualitative research methods are utilized. Qualitative research methods are deemed to be the most appropriate for this research setting due to the fact that literature hold virtually no information regarding the strategic marketing practices of nonprofit organizations located in Western Turkey. Although comprehensive theoretical studies exist in the field, few studies which focuses on the Turkish NGO's are few and quite scattered. Within this context, lack of the studies with previously mentioned features on the topic and the lack of researches with concrete and uniform findings effectively justify the use of qualitative research methods.

Throughout this research, non-profit organizations located in the Aegean Region of Turkey are chosen as the main research population. As of 2021, there are almost 16000 active nonprofit organizations and association located in Aegean Region (Ministry of Interior, 2021) and data shows that this number is increasing at a drastic rate.

As for the data collection, semi-structured in-depth interviews were chosen as the primary data collection method. Semi-structured interviews thought to be more suitable since it also allows to divert into other valuable topics without losing the focus too much. Overall, 6 interviews were conducted with the managers, board of chairs and marketing directors of various nonprofit organizations. Participants are chosen from 5 nonprofit organizations located in İzmir, Aydın, Kütahya, Manisa and Denizli. These nonprofit organizations are chosen based on their primary working fields. These fields include include but not limited to: climate change, life with disabilities, sustainable development goals, humanitarian aid and providing education to disadvantaged segments of Turkish society. By choosing such a diverse sample of non-profit organizations, authors aimed to explore different segments of nonprofit organization environment.

Semi-Structured In-Depth Interviews

Interviews were held with 6 individuals who hold various positions in 5 different nonprofit organizations. These positions include board of chairs, marketing managers and people who are responsible in charge of marketing. Each of the interviews took between 45 minutes to 1 hour. Questions of the interview generated based on the previous works in the literature and based on the initiative of the author. Questions are designed to be semi-open-ended so that interviewers had the flexibility to follow-up any question they deemed important. Interviews started with warm-up questions. Before asking essential questions, throwaway questions are also asked.

Prior to interviews, an interview guide is created to follow a line of questioning without losing focus. After the first interview, interview guide is renewed and updated. Throughout the in-depth interviews, 10 to 12 questions are asked, excluding the probe questions. Throughout the interviews, probe questions were utilized liberally. Before asking the questions about the use of strategic marketing, questions about the overall marketing practices of organizations were asked to understand to what extent do the organization engage in marketing activities.

All the interviews were recorded with audio tape, with the permission of participants. Participants were ensured that no personal information or organizational information will be revealed in the study except for the city names. To ensure the privacy of the participants, they are named as Respondent 1 to 6. In order to maintain anonymity, no organizational information is given whatsoever. Recorded interviews then transcribed and those transcriptions are analyzed. Data analysis of the interviews is initiated by the analysis of each interview transcription. Through an iterative process, common answers are gathered and important points are recorded. Analysis process was iterative and exhaustive as to not left any important aspect of the interview.

FINDINGS

As the result of the interviews, many insightful points were revealed about the marketing practices of nonprofit organizations and the incorporation of strategic marketing aspects in their operations. During the initial questions of interviews, marketing activities of respondent's organizations were asked. Their answers revealed that all of the organizations in this study engage in various different marketing practices. When asked about the marketing practices of their organizations and main communication channels that they utilize, respondents answered as such:

"Marketing is considered one of the most important departments in our organization. (…) A special team consisting of executive board members and volunteers who has a knack for marketing is running our department. For the last 4 years, our marketing activities are being conducted online, mainly social media."

Respondent 1

"… we try to market our organization on social media as much as possible. (…) However, in some cases, especially when dealing with financial donors, face-to-face marketing is required. We also make ourselves known to society by partaking in expositions and events relevant to our organizational mission."

Respondent 2

"Our marketing often relies on the social media usage. We have different accounts on most of the social media platforms. Our sharing and posts mostly consist of the activities we conduct and projects we realize, but due to our primary working field (climate change) we also share some informational posts on important dates and events."

Respondent 5

While talking about the overall marketing activities and efforts of the organizations, it has been revealed that social media is the main communication channel that organizations in this study make use of. Even though initial questions did not include any "strategic marketing" concept, responses of the participants divulged that some semblance of strategic marketing can be found in their marketing activities, which can be found in the respondent 2's and 5's answers above.

Participants are also asked about their expectations from engaging in marketing activities. Question of "Why do you engage in marketing activities in your organization? What are your main expectations?" is asked to shine light on the topic. Responses are generally found to be in line with the literature:

"… volunteers were always hard to come by for our organization and other associations in our city as far as I know. We usually depend on the word-of-mouth to entice new volunteers to our organizations (…) but we realized that online marketing is more effective to attract new volunteers."

Respondent 2

"… to attract new volunteers of course. (…) However, to gain to attention of public administrations such as municipalities and other institutions that can provide funding for us, marketing is also useful."

Respondent 6

Almost all the respondents mentioned that attracting new volunteers is quite hard to achieve and marketing is a valuable tool for them to allure new people into their organization. Some respondents also mentioned that in order to make themselves known to financial donors and public institutions, they use different marketing techniques. Interestingly, one respondent remarked that main reason of utilizing marketing in their organizations is to build reputation on the eyes of public:

"There are of course other organizations in our environment. (…) We compete with each other, not openly but clandestinely. In our field, we compete with other organizations who are working in similar areas to us (SDG's). Thus, building up our reputation in our society is important to us."

Respondent 4

When asked about the utilization of strategic marketing concept in their organization with the question of "Does your organization utilize strategic marketing?", it has been revealed that all of the respondents know of strategic marketing concept and 5 of the respondents mentioned that they utilize in their day-to-day operations. However, it was obvious that they engage in strategic marketing without even knowing that they are embracing strategic marketing concept. Furthermore, while probing the question to get a bit more detail on the topic, it has been revealed that there is no written guidelines or already-established instructions for directing the marketing efforts of respondent's organizations.

In order to gain better insight about the strategic marketing process of organizations, question of "How did your organization develop its strategic marketing framework?" is asked to the respondents. While some participants did not know the answer clearly, responses to the question ranged from utilizing knowledgeable volunteers to outsourcing.

"Some of our volunteers were aware of the strategic marketing concept from their courses in university. We had to come up with many things (…) such as our mission and vision; things we didn't need before. We already knew our target segment (students) but many other things were decided on the spot. Finalized marketing plan was a bit crude but it helped immensely"

Respondent 3

"We realized that however much we spend on the ads, it wasn't tangibly contributing our organization. (…) Then, we turned to outsourcing option."

Respondent 6

As stated in the literature by Andreasen and Kotler (2003), strategic marketing consists of different practices and steps which, comprehensively guides the marketing activities of organizations. Thus, in order to understand the incorporation process of strategic marketing principles into their day to day operations and main

strategic marketing principles that they use, questions of "Which aspects of strategic marketing do you mostly use?" and "How do you implement strategic marketing aspects in your day to day marketing activities?" are asked to the participants.

"We worked things out by trial and error. (…) After realizing that Google ads were not providing sufficient visibility, we devoted our efforts to creating customized ads on social media by targeting specific groups of people that may show interest in our organization and out projects …"

Respondent 1

"We generate our message based on out strong points such as the projects we undertake and our mission, which is to protect the environment. Thus, we realized that if we reach out to people who shares similar mindset to us, our chances to allure them is higher. Implementation process is mostly happened on social media; we shared paid ads to specific groups of people who might be interested in our organization."

Respondent 5

"Analyzing ourselves and our competitors may have given us an edge (…). For example, after realizing that volunteer exchange programs and Erasmus + projects are quite popular in our environment, we have started to include more and more of these projects in our posts on social media."

Respondent 2

"Throughout our first years, after establishing the organization, we promoted ourselves as a fun, entertaining organization which also tinker with serious projects. (…) By doing this, we hoped to attract young volunteers whose main expectation is entertainment and friendship from organizations such as ourselves. (…) However, after realizing that by positioning our organization as such, we were constantly turned away by serious financial donors. So, we changed our image and repositioned ourselves"

Respondent 3

Responses provided quite invaluable insights about the use of strategic marketing, whether intentionally or unintentionally. First and foremost, responded revealed that the use of "customized messages" are quite common especially on social media. Different strategies are undertaken by organizations, some utilize Google ads or make use of specialized advertisement options whereas others utilize search engine optimization feature. These customized messages are targeted towards the groups of people that are deemed important to the organization, such as the students, financially wealthy people or youth.

Moreover, it is apparent that organizations in this study engage in situational analyses. Internal and external analyses are conducted by organizations to assess their strengths, their value propositions and services as well as the competitors' strengths and weaknesses. Competitive analysis is also utilized, albeit not thoroughly.

One of the prominent steps of strategic marketing, positioning is also given importance as it can be seen from the quotes above. It is apparent that organizations in this study actively aim to position themselves on the eyes of the would-be volunteers and potential investment options based on their value propositions, mission and vision. Furthermore, as it can be seen on the Respondent 3's answer above, even repositioning is experienced in some cases. Responses reveal that act of positioning is made in accordance with the medium and long term needs of the organization. Nevertheless, mission and vision of the organization also play an important role.

CONCLUSION

In their daily operations, marketing is given a secondary importance by nonprofit organizations most of the time. As Ayyıldız and Akmermer (2017) remarks, sectors in a country is divided into 3 sectors: private sector, public sector and nonprofit sector. Throughout the 20th century, marketing of the nonprofit sector has always been left in the shadows in the literature by private sector. However, since 1990's, marketing applications of NPO's are also started to be given importance. Moreover, as Lewis (2010) mentions, nonprofit sector started to gain recognition and given importance especially after the disasters that struck Indonesia and Sri Lanka in 2004, which indirectly fostered the number of marketing studies of NPO's. However, literature still lacks marketing studies that focuses on various different dimensions of nonprofit organizations. One of these dimensions is the application of strategic marketing concept into NPO's marketing practices.

Throughout this study, strategic marketing applications of nonprofit organizations located in Aegean Region of Turkey is analyzed. Their incorporation of strategic marketing concept into daily operations and day-to-day marketing activities are examined.

Results of the study showed that all of the nonprofit organizations in this study is aware of the strategic marketing concept, and some of them are deliberately utilizing in their operations. Findings showed that NPO's actively market themselves to specific target segments that are deemed most appropriate considering their vision and mission. Results also remarks that customized

ads and customized messages are utilized to liberally to attract new volunteer or financial donors. This phenomenon is found to be in line with the previous works in the literature (Yoga and Bumi, 2020; Blery et al., 2010). All of the NPO's in the study have mission and vision statements, albeit not written.

Yet another strategic marketing step, situational analysis, is found to be used by NPO's in the study. Most organizations are aware of their strengths and weaknesses and generate their marketing messages accordingly. It is revealed that NPO's in this study know their strengths, opportunities, threats and weaknesses even though they do not call it a "situational analysis" or SWOT. However, only one respondent mentioned that they also conduct external analysis, which would yield invaluable knowledge in a competitive environment such as theirs.

While implementing their strategic marketing plan, organizations in this study utilized diverse range of tools. Communication channel is found to be similar across all organizations (Social Media), and customized messages, specialized advertisements, paid advertisements or promotional messages. Overall, it is safe to say that nonprofit organizations in this study which are located in Aegean Region in Turkey are utilizing some aspects of strategic marketing aspects in their day-to-day operations and marketing practices. However, it has been revealed that no organization is embracing strategic marketing completely. Moreover, it is found that organizations in the study do not have a rigid, written marketing plan which be used in different situations. In light of this information, some suggestions are provided for organizations that wish to incorporate strategic marketing concept in their operations:

Nonprofit organizations should analyze their environment by using different situational analysis tools such as SWOT, PESTLE and Porter's Five Forces framework. Although they are aware of their own strengths and weaknesses, external analysis aspects are lacking.

Although organizations are aware of the strategic marketing concept and utilize some of its aspects, they are found to be lacking a written, predetermined strategic marketing plan. Therefore, a comprehensive, overall marketing plan should be generated by organizations.

Knowledge-sharing or cooperation can be helpful especially when identifying different target segment. Within this context, concept of coopetition can be beneficial.

Most organizations utilize social media as their main communication channel. However, establishing networks by traditional, face-to-face marketing practices can be advantageous, especially when dealing with financial donors.

Getting feedback and monitoring is found to be lacking in all of the organizations. Thus, in their future endeavors, organizations should apply monitoring principles to understand which practices effectively contribute to their operations.

Study aimed to explore the incorporation of strategic marketing concept into the marketing practices of nonprofit organizations. There are however, some limitations that should be mentioned. First and foremost, due to time restrictions and lack of willing respondents, only 6 interviews were conducted. Moreover, only the nonprofit organizations located in Aegean Region of Turkey is taken into consideration. It was not easy to reach NPO's from other regions of Turkey. Thus, in future studies, researchers may integrate additional organizations from different regions of Turkey which can be helpful for developing a comprehensive framework. Furthermore, increasing the number of interviews may yield valuable insight in future studies.

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Appendix 1

Interview Questions

1) Can you explain your organization and your role within it?

2) To what extent does you organization carry out its marketing?

3) Can you explain the marketing practices of your organization?

4) What are the main communication channels you utilize?

5) Why does your organization engage in marketing?

6) What are your organizations' main expectation from marketing activities?

7) Is your organization aware of the strategic marketing concept?

8) How did your organization's strategic marketing framework was developed?

9) Which elements of strategic marketing do you mostly use?

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Tracing Trajectories of Regime Support in Turkey

Murat İNAN[1]

ABSTRACT

According to the legitimacy approach of political culture research, public's approval of a particular regime as the best form of government and rejection of its alternatives provides public support for that particular regime. This research attempted to trace temporal trajectories of approval of democratic political system as well as it's three alternative forms of government among the electorates of recent three major political parties in Turkey, the Justice and Development Party (AKP), the Republican People's Party (CHP) and the Nationalist Movement Party (MHP). It also revealed the extent these parties' manifesto documents praise democratic political system across the successive eighteen general elections in the modern Turkish political history. It revealed the changes in both public and party support for four alternative regimes across years in modern Turkish history. This research analyzed the World Values Survey and the Manifesto Project data using quantitative research methods. It has achieved four main findings. First, voters are more stable than their parties across time in terms of pro-democracy. Second, democracy clearly emerges as the strongest alternative among the four alternative regimes for all the three electorates. Third, supporting democracy and rejecting its three alternatives occupy different places in the minds of the three party electorates. Fourth, changes in the three political parties' pro-democracy as identified in their manifesto documents are not always parallel with changes in those of their voters.

Keywords: Political regime, political culture, legitimacy approach, democracy, party politics.

JEL Classification Codes: D72.

INTRODUCTION

Political culture research has been instrumental to understand how particular cultural assets aid flourishing of particular political regimes. Students of this line of research aim to explain bottom-up mechanisms operating from societal culture to institutional structure. The main argument of the advocates of this line of research is that are compatible with the principles of a regime, the more entrenched that regime. Three approaches within the political culture research aim to explain this accord from different perspectives. They are; the legitimacy approach, the communitarian approach and the human development approach. These approaches suggest different sets of societal values and orientations that are thought to be important for entrenchment of a regime. The advocates of the legitimacy approach suggest that the public's overt legitimization of a particular regime and delegitimization of its alternatives support its establishment, entrenchment and survival. Expectedly, the application of this approach to the democratic political system is guided by the parameters that explain values intrinsic to democracy. Expectedly, it is suggested by the advocates of the legitimacy approach that the greater public's overt approval of democracy as the best way of governing the country the greater the changes that democracy will survive (Weber 2002 [1904], Almond and Verba 1963, Easton 1965, 1975, Dowling and Pfeffer 1975, Przeworski 1991, Putnam, Leonardi and Nanetti 1994, Evans and Whitefield 1995, Mishler and Rose 1996, Klingemann 1999, Evans and Rose 2012, Bratton and Mattes 2001, Inglehart and Welzel, 2005).

The application of the legitimacy approach to democracy is not free of criticism though. These criticisms are mostly based on problems related to people's identification of democracy. Similarly, misidentification of the term may also be the case for institutions such as political parties. The most popular criticism is about the popularity of the term democracy. The critics argue that the public's overt approval of democracy as the best regime is not a good way of measuring its democracy level owing to the fact that democracy, by far, the most popular regime among its alternatives all over the world. Although the world societies' tendency to name democracy as the best way of governing their country is evident in almost all the countries of the world, the picture is absolutely different when it comes to their level of intrinsic democratic values.

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Another reason why the public's approval of democracy as the best regime is not a good way of measuring it's genuine democratic level is that as democratic countries are mostly the economically developed ones, democracy as a term, most of the time, is used as synonymous to economic development instead of its authentic meaning (Inglehart and Welzel, 2005). Despite these criticisms targeting this approach's power to predict the public's genuine democracy level, understanding the level of the public's affirmation of democracy is still important. Understanding what different segments of the society — people of different generations, of different age groups, people supporting different political parties — may give us power to predict how much democratic ideals will be supported by the members of future generations or the electorates of future governments.

Departing from this perspective, the empirical aim of this research is thought to be threefold. The first aim is to follow three recently most popular political party electorates' trajectories of support for democracy across the time. The electorates of the three recent most popular political parties in Turkey, the AKP, the CHP and the MHP will be analyzed over the elections, that their parties took part in, in terms of their level of endorsement of democracy as the best administrative form of governing the country. The selection of these three parties first based on their vote shares and effect in Turkish politics. The AKP is governing party since 2002. It's executives tend to define themselves as a centrist, conservative, pro-democratic political party but it largely claimed to be a pro-Islamist one in academic circles. The CHP is the founder party of the modern Turkish Republic. It is a left-wing, modernist, pro-Western, pro-democratic political party which is frequently criticized by its opponents for being elitist. The MHP is a right wing political party which show great sensitivity to cultural degeneration and issues related to national security and high politics.

It is suggested both empirically and theoretically that the most effective way of analysing popular democratic support is to analyse it together with popular support for its alternative regimes (Klingemann 1999, Bratton and Mattes 2001). For this reason, this research will inquire three major political party electorates' countenance of democracy together with their endorsement of strong leader, expert rule and army rule as the most popular three alternatives of democracy of which there exist available empirical data. Owing to the global popularity of the term democracy, my first hypothesize is that Turkish society endorses democracy highly across the generations and across the electorates of the three political parties. Having mapped the historical course of the three party electorates' endorsement of democracy and its alternatives as the best way of governing Turkey, the following question may spring to the mind: Is it possible for a person or an overall political party electorate, owing to individual or party specific historical reasons, may be, to support at the same time both democracy and a regime which is suggested to be it's alternative? This question naturally brings us to the second aim of the research, which will be to empirically explore whether these three allegedly alternative forms of democracy are genuinely alternatives of democracy in the minds of the three party electorates. Owing to a century long democratic experience in Turkey, my hypothesis is that democracy and its three alternatives emerge in distinct places in the minds of all the three electorates. People know and understand the differences between the four regime types and perhaps owing to Turkish greater experience with military coups, locate army rule to the furthest point to democracy. Following this, the research will move on with its third aim, which is to go beyond the scope of a descriptive show and arrive to a point where the legitimacy approach meets with party-voter congruence. As discussed above, the traditional interpretation of the legitimacy approach argues that the public's endorsement of a particular regime is important for that regime's survival. Yet, we know from the recent wave of protests for democracy from the Arab World to the Caucasia and to the Far East that the large gap between the public's desire for establishing a democratic political regime and that of the political parties governing the country may, on the contrary, end up with situations to the detriment of democracy. Keeping this in mind, it is plausible to argue that not only party bases' level of support for democracy, but also electorate-party accord on the desirability of a democratic regime is important for democratic progression. So far, only a few studies have investigated ideological accord between political parties and their supporters in Turkey in a systematic way (İnan 2020). Thereof, as the third aim, this research will explore the congruence between the three major political parties and their supporters by looking at the formers' pro-democratic pledges in their manifesto documents and the latters' pro-democratic inclinations. Matching party-level Manifesto Project data with party-level aggregated individual-level World Values Survey data in a causal fashion, this research will show us the extent of the party-electorate accord on the desirability of democracy and its three alternatives. This sort of a causal analysis will show whether Turkish political parties follow the trajectories of the public's approval of democracy and of its alternatives as the best regime while determining their pro-democratic stance. My expectation of this final analysis is to find results supporting the elitist theory of democracy. More frankly, I hypothesize that the political parties' pro-democracy levels are not necessarily determined by those of their supporters. The final set of findings is assumed to be useful to understand the representativeness of the democratic political parties in Turkey, which also, by extension, bespeaks to their political legitimacy.

Turkey constitutes an important case study to investigate democratic support because a research on Turkey will contribute to the discussions revolving around the question whether Islam is compatible with democracy. It will reveal whether voters and their parties in a country populated heavily by Muslims are compatible with democratic principles by showing important political parties' commitment to the democratic political system as well as their supporters' inclination towards democracy.

In order to accomplish the above-mentioned aims, this paper has been divided into five sections. The second section lays out the theoretical dimensions of the research. The third section introduces the data, the construction of the variables and the research strategy and methodology. The fourth section presents empirical findings. The final section discusses the empirical findings of the research in a broader theoretical perspective.

POLITICAL CULTURE RESEARCH AND THE LEGITIMACY APPROACH

All political regimes require public endorsement. It provides them legitimacy and power to govern. However, public endorsement is perhaps the most required for democratic regimes. This is simply because a democratic regime, different than all its alternatives, no ways can rely on brutal force to maintain its rule but on mere public support. Types of public support that a democratic regime can enjoy are diverse. People's interest in politics, their high participation level or their interest in taking part in voluntary organizations are known to be bolstering democratic political regimes. Beyond these, when looked from the political culture research's point of view, cultural, behavioral and attitudinal orientations, which are compatible with democratic norms and values, also provide support for a democratic political system. So far, a number of scholarly works following this line of research have provided a useful account of how cultural values and orientations such as popular support, trust and tolerance determine the destiny of democratic governments (Dowling and Pfeffer 1975, Weber 2002 [1904], Almond and Verba 1963, Putnam, Leonardi and Nanetti 1994). In this causal picture drawn by the political culture researchers, the idea is that the more prevalent cultural assets compatible with democracy in a society, the more likely that a democratic regime will take root. At least three basic approaches have emerged within the political culture research, which suggest different types of values, and orientations that help entrenchment of a democratic regime. The first one is the human development approach, which suggests values such as tolerance and self-expression as the most important determinants of destiny of a democratic government. The second approach is the communitarian approach, which promotes the view that some orientations such as participating in politics and voluntary organizations and trusting fellow citizens are important for entrenchment of a democratic system. The third approach, the legitimacy approach, is different from the first two in that it does not focus on societal values but interests in overt popular support for, in other words assessment, in the eyes of the public, of democracy as the best way of governing the country. Inglehart and Welzel's empirical findings suggest that the orientations associated with all the three approaches are distinct and correspond to different facets of democratic support (Inglehart and Welzel 2005, İnan 2016).

DATA AND METHODS

Data

The final data were drawn from two separate datasets. They are the Manifesto Project and the World Values Survey. These two datasets are unprecedented to maintain the objectives of the research strategy adopted here. The party-level data was culled from the Manifesto Project, which codes the Turkish political parties' policy positions referring to their manifesto documents over elections. The individual-level data, on the other hand, which was then aggregated to the party level, was achieved from all the four legs of the Turkish Values Survey between 1996 and 2012.

The four variables were constructed using four items of the same battery-type question of the Turkish Values Survey. The question reads: I'm going to describe various types of political systems and ask what you think about each as a way of governing this country. For each one, would you say it is a very good, fairly good, fairly bad or very bad way of governing this country?

Following the question the following regime types are described as in the following.

a. Having a strong leader who does not have to bother with parliament and elections.

b. Having experts, not government, make decisions according to what they think is best for the country.

c. Having the army rule.

d. Having a democratic political system.

Finally, four answer categories were provided for each statement: I) Very good, II) Fairly good, III) Fairly bad, IV) Very bad.

The variable was coded with whole numbers ranging from 1 to 4 and greater scores show greater support for the regime in question.

There are some matters with the individual level data that should be mentioned at this point. One matter is the under-representation problem of the older electorates and over-representation of the younger ones. The Turkish Values Surveys were conducted between the years 1990 and 2012. For that reason, the number of surviving electors of older elections is fewer than the number of surviving electors of newer elections which creates a bias against the representativeness of the older electors. Another problem,

which emerges owing to the time interval between the election time and the survey time, is related to electoral volatility. It is known that even in established democracies voter behaviors and preferences may change even in short time periods. In developing democracies, the voting volatility is even greater. When the length of the interval is considered the change in voting preferences is expected to be even larger.

The party-level democracy score was achieved from Manifesto data. The variable is a continuous one and greater numbers show greater level of pro-democratic notion in the manifesto document in the related party-election year dyad.

MEASURING PARTY-VOTER CONGRUENCE

In democracies, responsive political parties take their supporters' views into consideration while determining their policy positions. Thus, in democratic regimes, it is expected that a significant accord occur between the views of the parties and their supporters. This accord is called congruence. Congruence can simply be defined as the correspondence on opinions, values, orientations of the represented and the representative (Powell 2008). It is now a well established view that the greater the congruence between the public and its representatives the greater the level of democracy. Ideological congruence between parties and voters (Huber and Powell, 1994), between legislators and voters (Miller and Stokes 1963, Barnes and Farah 1972) or between governments and voters have been subject to considerable academic attention. In these studies finding the most representative point of the representatives and the represented constitutes the most important step of the research. Different researchers have applied different procedures in this regard. In general, while voter positions are estimated by using mass survey of the voters, party positions are estimated by either elite survey of the party executives, or voting positions of party legislators, or content analysis of the party manifestos. Benoit and Laver compared the left-right positions of the party electorates achieved from mass surveys with estimates of the same parties' left-right positions achieved from the content analysis of their manifestos on four policy dimensions (Benoit and Laver 2007). Castles and Mair (1984) used the results of the questionnaires asking experts, academics and journalists in different countries about parties' ideological positions on a 0-10 scale. Kim and Fording (1998) used party manifesto data compiled by Budge, Robertson, Heari, Klingemann and and Volkens, which was then updated by Volkens (1992). After this step, the most common procedure for measuring the level of party-voter congruence is simply to calculate the absolute distance between the policy positions of the representatives and the represented.

While finding the most representative ideological point of the representatives and the represented a researcher is to decide whether to take mean or median. Kim and Fording (1998) estimated the median voter position as the best representative point of voter ideology. Some other previous studies have selected mean as the most representative position. The use of both procedures has weak and strong points. Using the mean as the most representative position of an electorate is appropriate while working with large-N data. However, mean gives greater weight to those voters whose substantial political positions are at the margins. Giving greater weight to any voter's influence creates a problem that a researcher studying democracy would not like to have since one of the principles of the democratic theory is that each voter's influence to the configuration of the political outcome is supposed to be equal. The median can be a good alternative to mean in equating each voter's influence, yet, it is not as effective as mean for finding the most representative point, since it provides numbers in integers only which in most cases causes loss of information. Nevertheless, for the large number of the cases and the small range of the variable that was introduced above, in this research mean was preferred to median (İnan 2020).

METHODS

Having introduced the data, now I can turn to introducing methods. To assess the relationships between independent and dependent variables a series of Multiple Linear Regression were used. To distinguish between different dimensions of pro-democratic support Explanatory Factor Analysis were used. Factor Loadings were used for the illustration of different dimensions on two-dimensional panel. Loading Plot and Bar Charts were used for the visualization of regime support (Field 2013).

FINDINGS

This section starts with providing descriptive statistics of the final dataset. Having the main features of the data presented then it turns to provide findings of the statistical analyses conducted. First, to develop a better understanding of our final dataset, let us take a close look at descriptive statistics for each variable.

Table 1 shows the three party electorates' aggregated legitimization level of four types of regime over all the elections their parties have joined since their foundation. For each battery item, the answer categories rank from 1 to 4, where 1 corresponds to "Very bad", 2 to "Fairly Bad", 3 to "Fairly Good" and 4 to "Very good" way of governing the country. On the right-most column the parties' democracy score for the election year is presented.

It is seen that from their foundation over the years the three party electorates' endorsement of these four alternative regimes have not changed considerably. Yet, this is not true for their parties' democracy score as shown on the right-most column of the table. The individual level trend is much easily seen in the Figure 1.

Table 2 reports the percentages of the answers given by the party electorates to the question inquiring their level of endorsement of four alternative regimes.

Table 1. Mean values for the three party electorates' endorsement of democracy and its alternative forms of government with parties' democracy scores by election years

Party Abbr.	Election year	Strong leader	Expert rule	Army rule	Democracy	Party democracy score
CHP	1950	2.35	2.39	2.10	3.46	0.80
CHP	1954	2.47	2.52	2.16	3.44	6.00
CHP	1957	2.39	2.45	2.01	3.47	5.40
CHP	1961	2.42	2.53	2.10	3.42	0.80
CHP	1965	2.52	2.54	2.00	3.44	0.20
CHP	1969	2.58	2.62	1.98	3.51	0.50
CHP	1973	2.56	2.61	1.93	3.51	4.80
CHP	1977	2.51	2.61	1.88	3.47	8.29
CHP	1983	2.50	2.62	1.90	3.49	-
CHP	1987	2.56	2.69	1.94	3.47	-
CHP	1991	2.58	2.73	1.96	3.48	-
CHP	1995	2.57	2.70	1.98	3.47	4.25
CHP	1999	2.59	2.75	2.05	3.47	2.58
CHP	2002	2.61	2.75	2.06	3.47	2.02
CHP	2007	2.59	2.75	2.09	3.45	0.74
CHP	2011	2.60	2.73	2.10	3.45	3.99
CHP	2015 (June)	2.60	2.73	2.11	3.44	9.60
CHP	2015 (Nov.)	2.60	2.73	2.11	3.44	11.07
CHP	2018	2.60	2.73	2.11	3.44	8.19
MHP	1961	2.71	2.46	2.17	3.71	13.82
MHP	1965	2.71	2.55	2.15	3.65	2.91
MHP	1969	2.58	2.58	2.09	3.52	4.31
MHP	1973	2.70	2.62	2.10	3.44	1.10
MHP	1977	2.78	2.67	2.17	3.38	1.10
MHP	1983	2.76	2.77	2.13	3.40	-
MHP	1987	2.75	2.77	2.10	3.38	-
MHP	1991	2.75	2.79	2.09	3.34	-
MHP	1995	2.79	2.78	2.09	3.34	10.48
MHP	1999	2.80	2.77	2.13	3.34	2.34
MHP	2002	2.80	2.79	2.13	3.32	10.13
MHP	2007	2.79	2.79	2.14	3.32	0.97
MHP	2011	2.79	2.79	2.14	3.32	2.60
MHP	2015 (June)	2.80	2.79	2.15	3.33	8.09
MHP	2015 (Nov.)	2.80	2.79	2.15	3.33	8.22
MHP	2018	2.80	2.79	2.15	3.33	15.14
AKP	2002	2.56	2.65	2.04	3.40	3.03
AKP	2007	2.58	2.64	2.05	3.41	1.60
AKP	2011	2.60	2.65	2.05	3.40	2.41
AKP	2015 (June)	2.60	2.65	2.05	3.39	6.19
AKP	2015 (Nov.)	2.60	2.65	2.05	3.39	6.16
AKP	2018	2.60	2.65	2.05	3.39	2.12

Data: World Values Survey, rounds: 1996/2001/2007/2012, Manifesto Project 1950-2018.
Number of Obs: 2.278 (WVS), 35 (Manifesto Project).

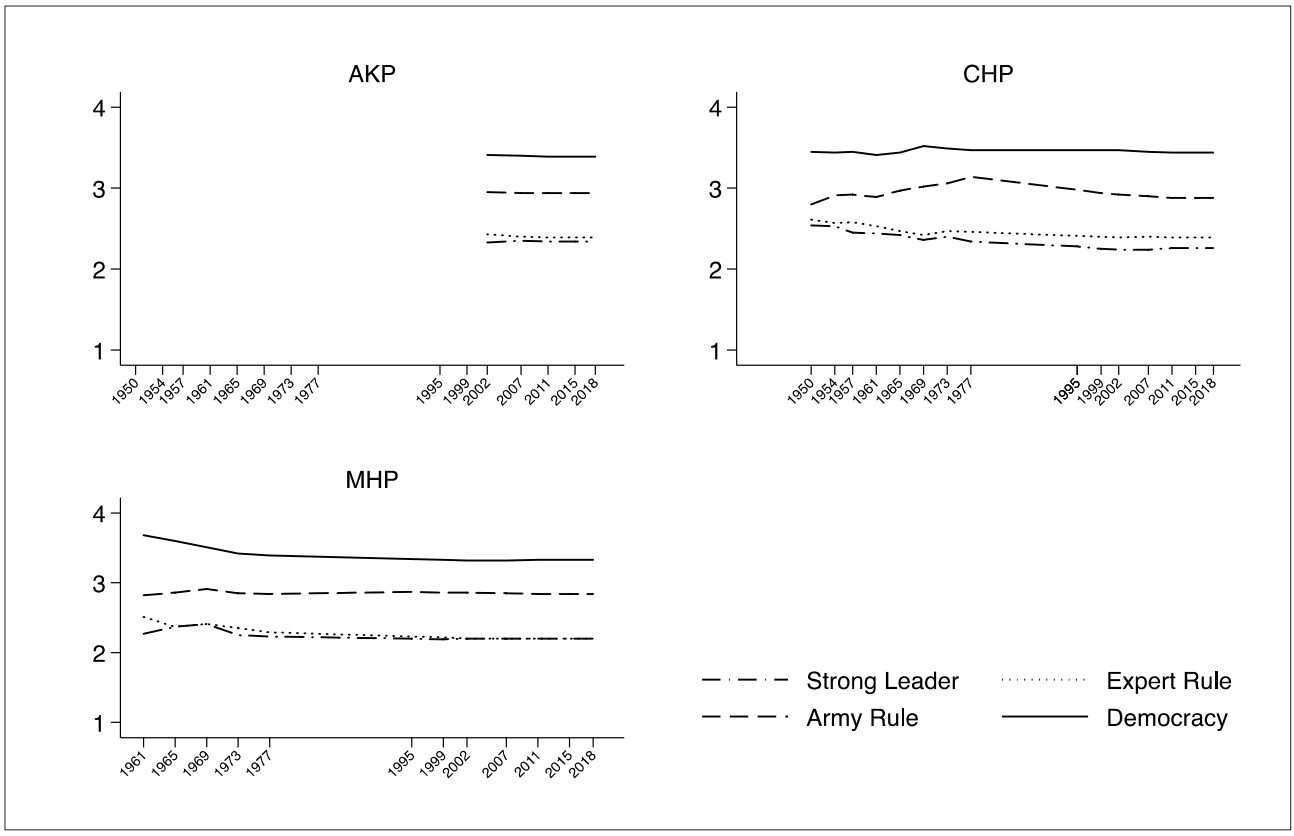

Figure 1. Public Support for Democracy and Its Alternative Forms of Government (For Three Party Constituencies, by Election Years)

Table 2. Percentage values for the three party electorates' endorsement of democracy and its alternative forms of government

	Having a strong leader			Having experts make decisions			Having the army rule			Having a democratic political system		
	AKP	CHP	MHP	AKP	CHP	MHP	AKP	CHP	MHP	AKP	CHP	MHP
Very Good	28	21	20	25	40	33	26	41	32	22	39	37
Fairly Good	37	36	37	28	36	35	24	36	38	29	36	34
Fairly Bad	19	21	23	24	35	40	29	36	34	25	28	45
Very Bad	14	19	18	19	40	42	26	32	34	30	34	34

Data: World Values Survey, rounds: 1996/2001/2007/2012.
Number of observations: 2,278

It seems that, when the election-aggregated data is nested on the party level, important significant differences emerge between party electorates' levels of endorsement of different types of regimes. The AKP electorate seems to be the strongest supporter of having a strong leader as a very good/fairly good way of governing the country (65%). The CHP and MHP electorates seem to be almost equal in this regard. Expert rule is supported by the CHP electorate as very good/fairly good by far (76%) more than the other two party electorates. While in total 68% of the MHP electorates think having experts make decisions is very good/good way of governing the country, this is 53% for the AKP supporters. For supporting the army rule as a very good and fairly good way of governing the country, the CHP electorate ranks the top by 77% and followed by the MHP and by the AKP electorates by 70% and 50% respectively. The final panel of the table shows party electorates support for a democratic political system. The same rank, which was observed in supporting the army rule, can be seen in supporting the democratic political system. While the percentage of the CHP voters who support the view that democracy is the best way of governing the country is 75%, this is 71% for the MHP and 51% for the AKP voters.

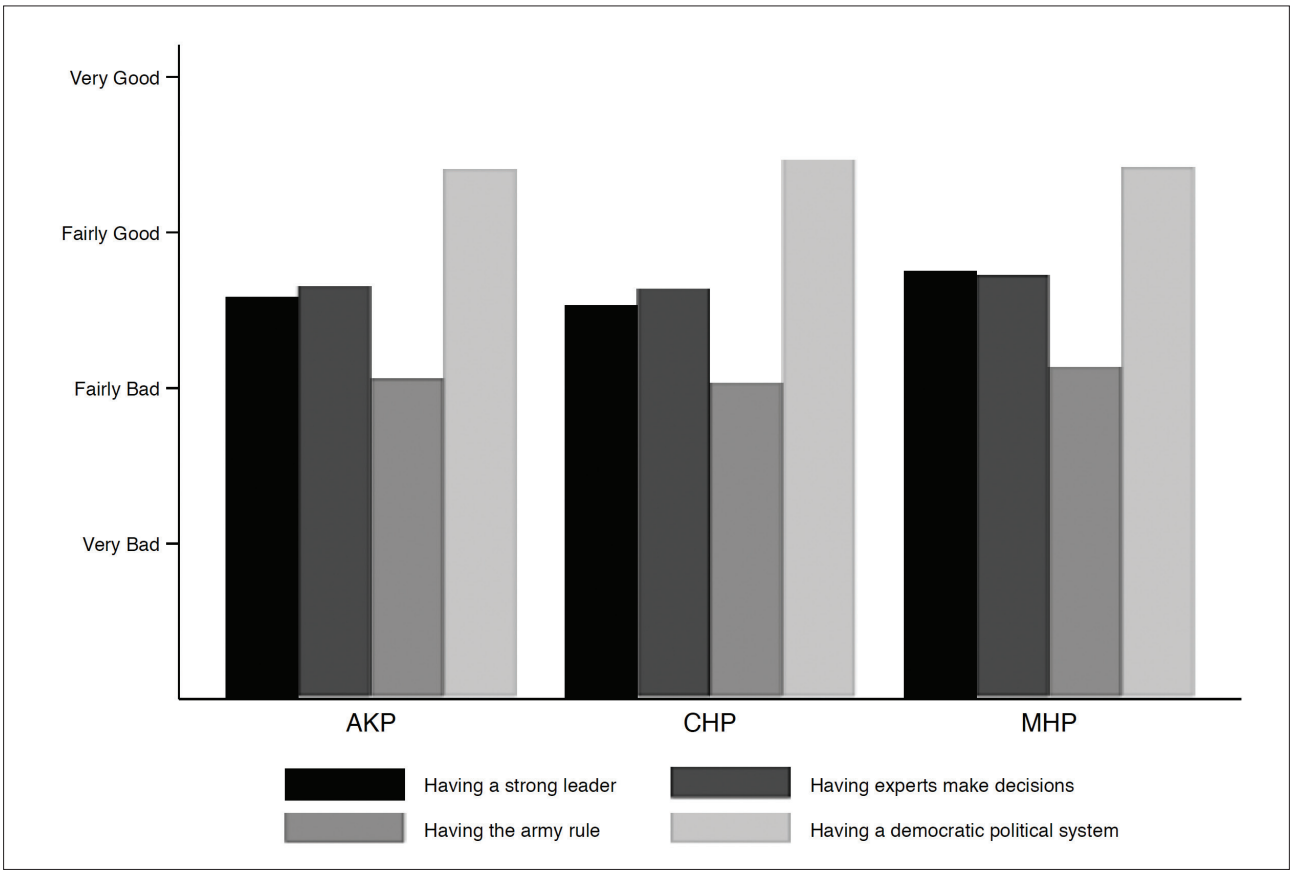

Figure 2. Popular Support for Democracy and Its Alternatives as the Best form of Government by Party Electorates

Figure 2 shows the level of endorsement of each regime type for each party electorate. It is seen that democracy is, by far, the most popular regime for all the three electorates. Support for democracy seems to be 'something' between 'fairy good' and 'very good' way of governing the country for the all three party bases. Nevertheless, democracy's all the three alternatives including the army rule still seem to be not too unpopular. Among them while for the AKP and the CHP electorate expert rule and for the MHP electorate strong leader are the most popular regime types. To be able to understand where do these four regime types locate in the minds of the three party electorates a series of factor analyses were conducted.

Factor analysis in Table 3 and loading plots in Figure 3 show concomitantly that democracy sits on a completely different place in the minds of all the three party electorates than do all its three alternatives. This is shown by the scores they tap to the first factor in the table and by the physical distance between the plots in the figure. Among the three alternatives, army rule, also appears slightly far from strong leader and expert rule for the CHP and to a lesser extent for the MHP but not that far for the AKP as shown by the plot locations in the figure. Also, democracy seems to be closer in the minds of the CHP electorate to expert rule and strong leader than it is in the minds of the AKP and MHP electorate.

Having mapped the parties' as well as their electorates' level of support for four alternative regimes across the election years and understood that democracy and its alternatives occupy different spots of the minds of the three party electorates, now we turn to explore whether these four regime types are really viewed as alternative by the Turkish public. It is expected that having a strong leader, having experts make decisions and having the army rule variables to appear as significant and negative determinants of the variable of having a democratic political system. But, is this really the case? Our findings do not lend full support for this view.

Table 4 shows the results of a series of regression analyses attempted to investigate this matter. The results show to what extent the three party electorates' legitimization of democracy is effected by their delegitimization of its alternatives.

As can be seen from the table, Turkish respondents' understanding of the relationship between support for democracy and support for democracy's alternative regimes differs categorically according to their party affiliation. While the AKP and the MHP supporters view strong leader as a mirror concept of democracy as indicated with negative and significant relationships between the terms (p=0.000 and p=0.013 respectively), the CHP voters seem not to associate democracy with strong leader neither negatively nor positively (p=. 0.667). This is perhaps the CHP voters' understanding of

Table 3. Factor analysis of forms of government for the three party electorates

	AKP			CHP		
Type of Government	**Factor 1**	**Factor 2**	**Uniqueness**	**Factor 1**	**Factor 2**	**Uniqueness**
Having a strong leader	0.59	0.01	0.64	0.66	0.06	0.55
Having experts make decisions	0.60	0.10	0.61	0.63	0.16	0.56
Having the army rule	0.42	-0.10	0.80	0.40	-0.29	0.74
Having a democratic political system	-0.13	0.24	0.91	-0.07	0.39	0.83
Eigenvalue	0.92			1.01		

	MHP			ALL		
Type of Government	**Factor 1**	**Factor 2**	**Uniqueness**	**Factor 1**	**Factor 2**	**Uniqueness**
Having a strong leader	0.61	0.06	0.61	0.61	0.06	0.61
Having experts make decisions	0.60	0.15	0.61	0.60	0.15	0.61
Having the army rule	0.40	-0.21	0.79	0.40	-0.21	0.79
Having a democratic political system	-0.14	0.32	0.87	-0.14	0.32	0.87
Eigenvalue	0.81			0.92		

Data: World Values Survey, rounds: 1996/2001/2007/2012.

Number of observations: 2.278

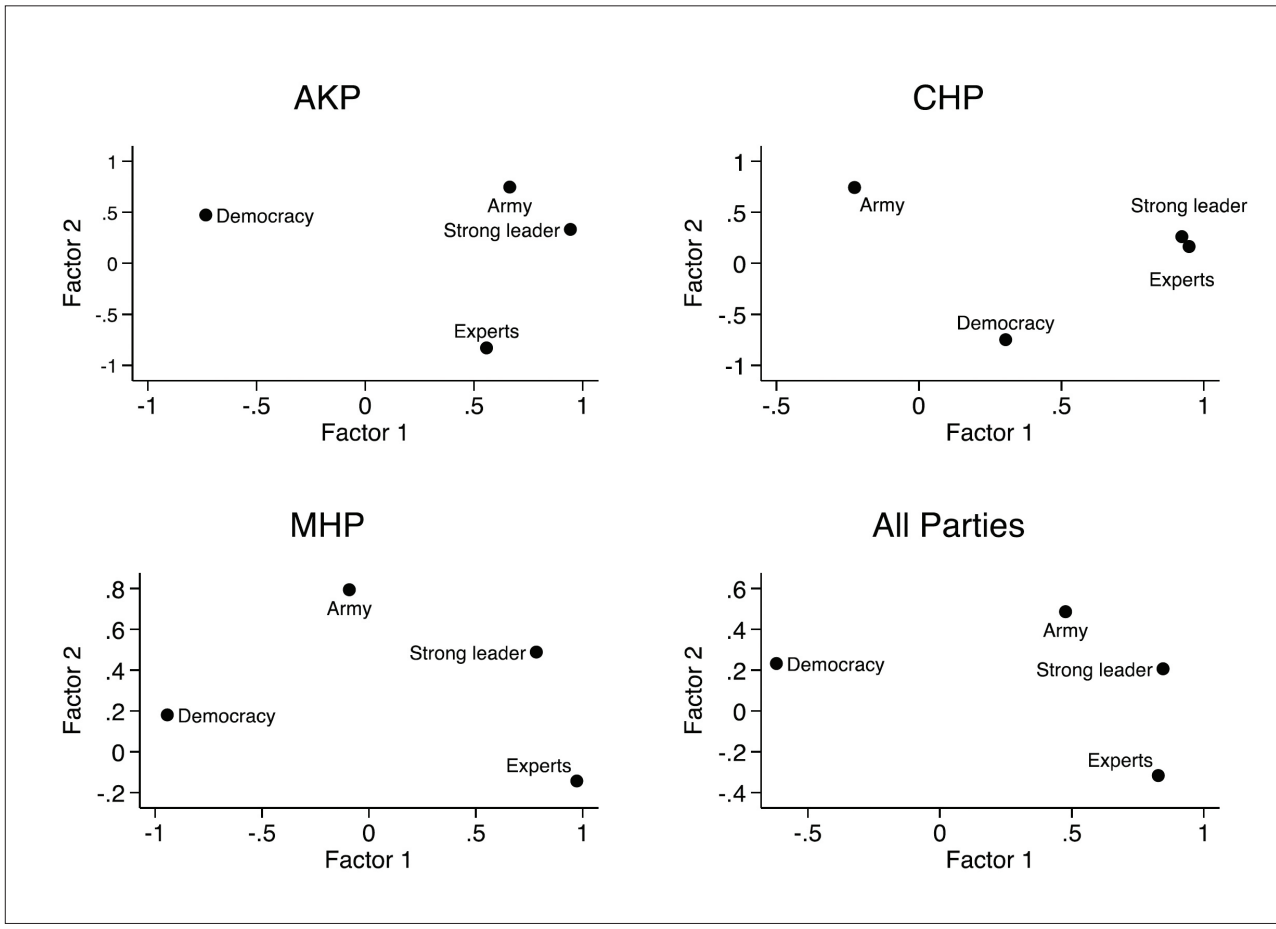

Figure 3. Loading Plots of Four Government Types by Party Consitutiencies

Table 4. Ordinary Least Square (OLS) models predicting individual level democratic support

	AKP	CHP	MHP	ALL
Strong Leader	-.10 (.02) ***	.-01 (.02)	-.07 (.03) *	-.07 (.01) ***
Expert Rule	.09 (.03)**	.10 (.03)**	.05 (.03)	.09 (.01)***
Army Rule	-.10 (.02) ***	-.18 (.02) ***	-.19 (.03) ***	-.15 (.01) ***
N. of Obs.	845	853	580	2.278
Adj. R. Sqr.	.0312	.0688	.0690	.0510

Data: World Values Survey, rounds: 1996/2001/2007/2012, Manifesto Project 1950-2018.
Number of Obs: 2.278 (WVS), 35 (Manifesto Project).
Significance levels: *p<.05, **p<.01, ***p<.001.
Note: Entries are coefficient scores with standard error values in parentheses.

Atatürk as a strong leader and having not much negative memories about the one-party CHP rule as much as the members of the other two parties. When the data for all the three party electorates are pooled the negative relationship between support for strong leader and for democracy remains significant (p=0.000). When the results related to the relationship between support for democracy and support for expert rule are observed, it is seen than for the AKP and the CHP electorates support for expert rule is a significant positive determinant of support for democracy (p=0.004 and p=0.001 respectively). There seems to exist a consensus between these two electorates in the view that support for expert rule is not to the detriment of support for democracy. This is not seen in the MHP electorate though (p=0.194). For the overall electorate there seems to be a positive and significant relationship between the two variables (p=.000) This finding can be related to the lack of a technocratic government memory in Turkish history and having an expert to rule the country may be understood as synonymous with having a qualified leaders which were still selected by means of democratic electoral processes. The third line of the regression analyses shows the relationship between support for democracy and support for the army rule. We observe a consensus between all the three party electorates here. It seems that all the three party electorates view army rule as a mirror term of democracy. The negative and strong significant relationship between support for democracy and support for army rule indicates that in the minds of the voters of the three political parties, democracy and army rule occupy opposite places. It seems that respondents in general who agree with the statement that democracy is the best regime type for Turkey are at the same time tend to disagree with the statement that army rule is the best regime form for governing the country. This is also likely for the respondents that have given opposite answers to the both questions. In other words, respondents who disagree with the statement that democracy is the best form of regime are inclined to disagree with the statement that army rule is the best regime form. This result is perhaps due to several military coups and coup attempts being held in the recent Turkish political history, which made army rule and democracy two mutually-exclusive concepts in the minds of masses in Turkey.

Having observed the three party electorates' endorsement of the four regime types now let us look at democraticness of the parties the electorates said they would vote for if there were a national election tomorrow.

Figure 4 shows the three political parties' positive mentions in their manifesto documents since their foundation. The first thing that strikes the eye that the political parties are quite different than their voters in terms of the volatility of their commitment to democracy over the election years. It seems that all the three political parties' frequency of positive mentions of democracy in their manifesto documents fluctuates immensely throughout the time. Both the CHP and the MHP have come to 1960s with quite low democratic mentions however following the 1960 coup both parties democracy mentions went up. Yet, this trend did not last long and following the 1980 coup both parties and the new-born AKP's democracy mentions followed a modest trend until the democratization wave of the 2000s which was coupled by the EU membership and rapid democratization processes of the country.

Table 5 shows the results of a series of Linear Regression Analysis predicting party level democratic positions by aggregated individual level, support for strong leader, support for expert rule, support for army rule and support for a democratic political system. Before the interpretation of the results the small number of cases for the party-level data should be noticed. Having this noted, as one can see from the coefficient scores and standard error values, for none of the parties and also for the pooled data coming from all the three parties, party level aggregated individual level support for a strong leader, expert rule, army rule and democracy predict party level democracy scores statistically significantly. Yet, although the relationships were insignificant it should be noted that while strong leader variable has a positive sign for all the political parties, expert rule has negative for AKP and positive for the other two parties, army rule has negative signs for CHP and MHP and democracy has negative sign for AKP and CHP and positive sign for MHP.

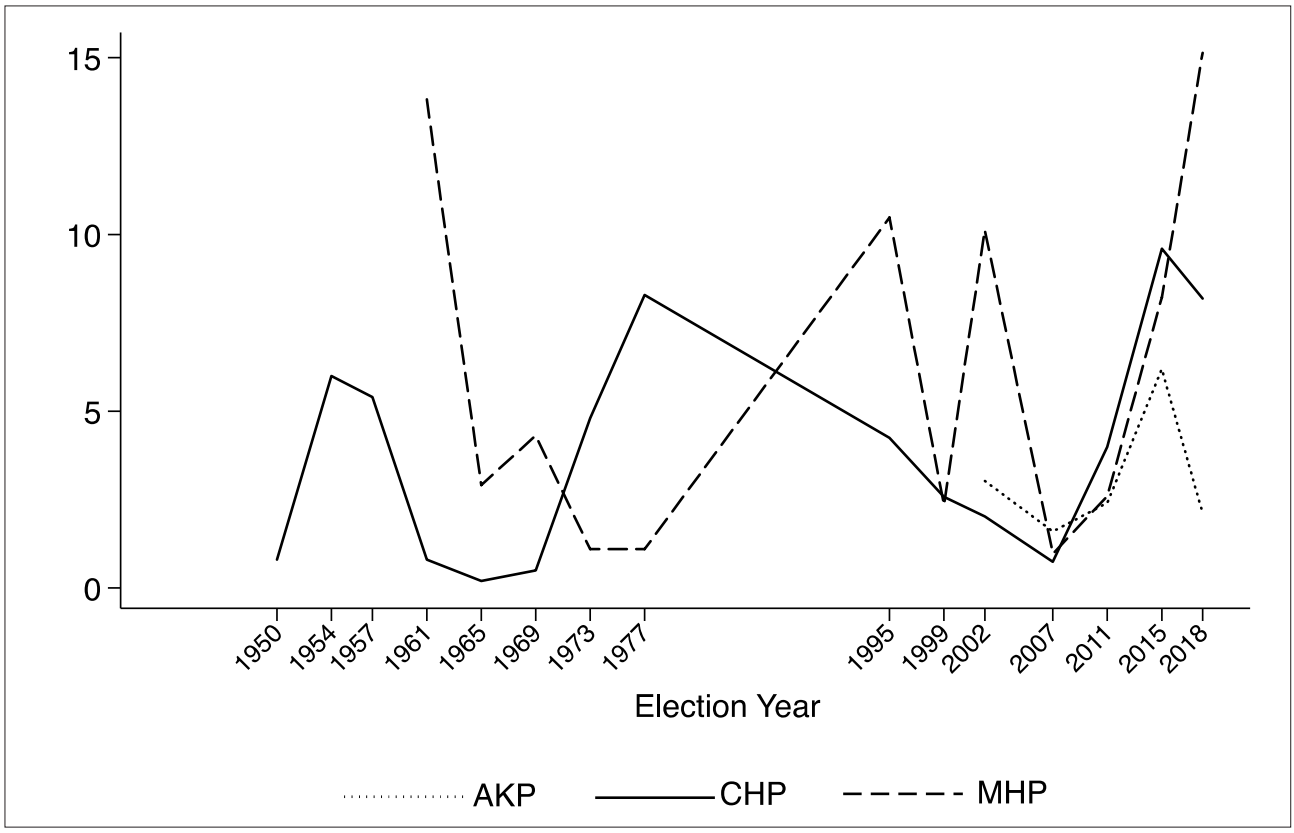

Figure 4. Democratic Support Score in Party Manifestos (By Election Years)

Table 5. Ordinary Least Square (OLS) models predicting party level democratic support

	AKP	CHP	MHP	ALL
Strong Leader	15.50 (82.77)	7.79 (41.23)	21.22 (56.75)	7.36 (9.48)
Expert Rule	-129.33 (458.38)	3.56 (29.10)	51.99 (61.67)	5.63 (11.12)
Army Rule	†	-6.98 (17.91)	-14.33 (88.08)	5.98 (12.32)
Democracy	-241.33 (270.33)	-45.13 (59.08)	54.09 (45.66)	9.53 (10.46)
N. of Obs.	6	16	13	35
Adj. R. Sqr.	-.2932	-.1862	-.2008	.0108

Data: World Values Survey, rounds: 1996/2001/2007/2012.
Significance levels: *p<.05, **p<.01, ***p<.001.
Note: Entries are coefficient scores with standard error values in parentheses.
†: Omitted due to multicollinearity.

DISCUSSION AND CONCLUSION

All the political regimes would enjoy being named by the people as the best way of governing the country. They would like to be known as the best fit policy producer to the problems related to the past, to today and to the future. Gaining people's endorsement provides all types of regimes legitimacy but especially the democratic ones. In democracies, different than in all the other regime types, political parties are ready to hand over rule in the event of being defeated by rival parties in the race of attracting public's vote support in the elections. Thus, losing the link with the people is the costliest so the desire for public's endorsement is the greatest in democratic regimes. The political culture research focuses on the link between culture and institutions. Three approaches within the political culture research suggest three different sets of values that are thought to be breeding democracy. This research had focused on the legitimacy approach, which suggests the importance of overt public endorsement for a political regime for its survival. As suggested by the advocates of the legitimacy approach, this research have mapped public affirmation of democracy together with that of its most popular alternative regimes. Including army rule, expert rule and strong leader as alternatives of democracy to the analyses, this research has inquired popular countenance of four alternative regimes in Turkey by the three major political parties and their supporters.

This research had set three objectives. The first objective was to map three political parties' as well as their supporters' level of democratic support. The second objective was to explore whether three regime forms that are known to be alternatives of democracy really appear as alternatives in Turkish electorates' minds. The third objective was to match legitimacy approach with party-voter congruence by researching the extent of the party-voter accord on the attractiveness of democracy and unattractiveness of its alternative regimes. Investigating correspondence between the representatives of a political party and its voters is important because it directly has implications for the representativeness and the legitimacy of the party in question. This research has not claimed to encompass the entire party-voter congruence issue but provided an important insight to the particular topic of party-voter congruence on regime support in Turkey. For that reason, it is not possible to assess the whole party-voter congruence picture, which makes the generalizability of the findings of this research subject to certain limitations. Nevertheless, with findings of this research in hand we are now more able to assess the democratic journey of Turkish political parties.

Regarding to the first objective of the research, the first major finding suggests that Turkish electorates are a lot more stable in their level of endorsement of democracy when compared with the political parties they would vote for over election years. Moreover, Turkish electorates are not only stable in their high level of endorsement of democracy but also low level of endorsement of its alternative regimes. With these findings in hand, one can argue that democratic political system will continue to remain to be the most popular regime in Turkey.

The second major finding is that the level of confirmation of democracy as well as its alternatives as the best way of governing the country differ slightly from one party electorate to another. Democracy is by far the most endorsed regime for the AKP, the CHP and the MHP electorates. This is obviously good news for the future of democracy. Democracy is followed by the expert rule for the AKP and the CHP electorates and by strong leader for the MHP electorate. This finding can be explained by the İslamic emphasis on the principle of 'giving the job to the competent one' for the AKP and pro-bureaucratic stance of the CHP and authoritarian tendencies among the MHP electorates. Yet, obviously this interpretation requires further empirical examination. Finally, the most unwanted regime type is the army rule on which there seems to be strong accord across all the three party bases. Expectedly, this is due to the 1980 military government's policy to ban all the political parties following the coup which created an existential threat to democratic politics.

Following revealing the differences in degree in the endorsement of different regimes this research has then turned to revealing differences in kind. It was shown that having a strong leader, having experts make decisions and having the army rule appears as alternatives of having a democratic political system in the minds of all the three electorates. Nevertheless, the distances between all the binary regime combinations differ slightly across party bases. Thus, the differences were better explained by means of causal analyses. Findings have suggested that the three party bases' understanding of the oppositeness of the four regimes is slightly different. For the AKP and the MHP electorates the endorsement of two out of three (strong leader and army rule) and for CHP one out of three (army rule) regime forms have emerged as significant and negative determinants of the endorsement of democracy. For the overall electorate this is strong leader and army rule. Sixty years of electoral democracy history together with anti-democratic interruptions by means of military coups seems to have thought well the overall Turkish electorate the mutually exclusiveness of the terms democracy and army rule.

The final major finding is that, although it should be noted that it was achieved by the analysis of a small number of cases generated by aggregating voter level data to party level for each election year, Turkish political parties do not seem to consider neither their electorates' level of endorsement of democracy nor their level of rejection of its alternative regimes while determining their pro-democratic stance.

Beyond these major findings there is one side finding that needs interpreting here. This interesting finding shades light to recent political discussions revolving around the party alignments the new presidential system has produced. Despite the People's Alliance formed by the AKP and the MHP and high vote permeability between these two parties, the similarity between the CHP and the MHP seems to be greater than the similarity between the AKP and MHP in terms of their support for these four alternative forms of government.

As the final word, these findings should be read carefully regarding to their implications for the legitimacy of the Turkish political parties and the future of democratic political system in Turkey as well as the prominent question of whether İslam is compatible with democracy.

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The Impact of Economic Growth, Trade Openness and Technological Progress on Renewable Energy Use in Turkey: Fourier EG Cointegration Approach

Mustafa NAİMOĞLU[1]

ABSTRACT

In 2019, Turkey's total energy imports increased by 287.60%, total GDP increased by 245.44%, and total renewable energy use increased by 774.26%, compared to 1990. Therefore, this study differs investigating the factors affecting the increase in renewable energy use, which is very important for energy importer Turkey in reducing foreign dependency in the field of energy. Unlike other studies, it also reveals that the long-term relationship that does not appear with a traditional test is revealed with current tests. For this, the variables of economic growth, trade openness and technological progress, and renewable energy use are analyzed with annual data for the period 1990-2019. First of all, the stationarity of the variables is investigated with standard ADF and Fourier-ADF tests. Then, the long-term relationship is investigated with cointegration tests. The research findings showed that there was no long-term relationship between the variables according to the traditional Engle-Granger cointegration test but according to the Fourier Engle-Granger and multiple structural break cointegration tests. According to the long-term coefficient estimation results, it has been obtained that economic growth and technological progress are important in increasing the use of renewable energy for Turkey.

Keywords: Economic Growth, Trade Openness, Technological Development, Fourier Engle-Granger Cointegration, Turkey.

JEL Classification Codes: N7, O1, P48, Q55.

INTRODUCTION

Increasing population and industrialization lead to an increase in energy demand. Increasing demand is generally met by fossil fuels. Fossil fuels are cheap, plentiful, easily accessible, and do not require high technology, which makes them more attractive and makes them more preferred especially for developing economies (Shahbaz et al., 2021:1371).

The oil crisis that occurred in 1973 harmed global energy security. This situation has caused all economies to face the fact that fossil fuels are not sustainable and there is a need for alternative energy sources. In addition, abandoning the use of fossil fuels emerges as a necessity, not an option, especially in an environment that started with the global epidemic of COVID-19 and in which the existing threat of a livable world future intensifies. Because the use of fossil fuels causes destructions that are difficult or impossible to compensate for the environmental quality.

Compared to 1990 in 2019, the fact that the world population increased by 45.33% and the energy need for this increasing population will be met mostly from fossil fuels is only an indicator of the magnitude of a livable world threat (World Bank, 2022). Because, while fossil fuel use per capita was 1526.84 (koe) in 1990, this amount increased in 2019 and was realized as 1526.84 (koe) (IEA, 2022). In addition, while the CO_2 emission per capita was 3.9 tons in 1990 as a result of fossil fuel use, this emission increased by 12,82% and increased to 4.4 tons of CO2 emissions per capita in 2019 (IEA, 2022). Increasing CO2 emissions cause global temperature changes and droughts. On the other hand, increasing fossil fuel use seriously threatens the world energy supply security due to the limited amount of fossil reserves in the world and shows the urgency and importance of alternative energy sources (Welsby et al., 2021:231). Renewable energy is a sustainable, reliable, and environmentally friendly energy source for the world. However, it does not seem possible to abandon the use of fossil fuels soon, especially for developing countries. The reason for this is that the initial cost of the renewable energy source is high and it is an energy source that requires high technology. In addition, the fact that the necessary tools and equipment will be imported from developed countries is an important obstacle for developing countries in the short term. On the other hand, since the existing technologies of developing economies are predominantly integrated with fossil fuels, the GDPs of the economies are more dependent on fossil fuels and renewable energy used on a small scale brings high costs. Therefore, the share of green energy consumption in developing countries is well below the desired level and is still at very low levels.

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However, all these negativities for developing economies do not mean that they should reduce the demand for renewable energy. Because, regardless of whether it has renewable energy use or not, it is important to investigate the factors that increase green energy for every economy in a cleaner, healthier, and more livable world.

Countries are classified as developed and developing economies according to the state of their economic levels. These groups, on the other hand, are classified in different ways among themselves. Emerging economies have a special place among developing economies. Emerging economies, on the other hand, are divided into two. The Turkish economy, on the other hand, is an economy that is among the advanced emerging market economies (FTSE, 2015: 2). One of the most important reasons for this is Turkey's high growth rate. While the annual average GDP growth rate in the 1990-2019 period was 4.37% in Turkey, it was 3.01% in the world and 5.14% in 22 emerging economies (World Bank, 2022). Therefore, while the Turkish economy has higher growth rates than the world average in terms of GDP, it has a slower growth rate than the 22 emerging economies[1]. However, the biggest factor behind the high growth rate of these 22 emerging economies being higher than Turkey's is the high growth rate of the Chinese economy. Because, if the Brazilian economy, which has a growth close to or above Turkey's growth rate, is excluded from among 22 emerging economies, the annual average GDP growth rate for 21 emerging economies in the relevant period is 5.45%. Where, it is seen that the effect of the high growth rate of the Chinese economy still continues. Similarly, the annual average GDP growth rate is 5.04% when the Indian economy is excluded, 5.16% when the Indonesian economy is excluded, 5.34% when the Mexican economy is excluded, and 5.66% when the Russian economy is excluded. However, when the Chinese economy is excluded, the rate of increase is 3.15%. Therefore, the annual average growth rate of emerging economies is higher than that of Turkey, due to the high population and high income of the Chinese economy. However, in the absence of a Chinese economy, Turkey's annual average GDP growth rate in the relevant period has a higher GDP growth rate than the average annual growth rate of both the world and 21 emerging economies. Therefore, Turkey is like the wheel of the global economy with its high growth rates. Turkey's high growth rates are related to the high amount of energy used as a result of its economic activities. Turkey is a foreign-dependent country that imports the vast majority of the energy it uses. In the 1990-2019 period, Turkey's annual average energy imports increased by 4.78% and the majority of energy imports are realized as fossil fuels. While the share of fossil fuels in Turkey's total energy use was approximately 81.4% in 1990, this share increased to approximately 83.2% in 2019 (IEA, 2022). However, Turkey is a country that has a high renewable energy potential and is aware of the importance of using renewable energy. While the share of green energy in Turkey's total energy use was 4.77% in 1990, this share increased to 14.53% in 2019. In addition, the annual average increase in fossil fuel use in the 1990-2019 period is 3.75% (3.47% in coal, 2.11% in oil, and 9.24% in natural gas), while the rate of increase in renewable energy use is 7.74% (hydro 4.75% and wind, solar, etc. 12.39%). As a result, it shows that the energy source with the fastest usage rate in Turkey is renewable energy. However, despite the high rate of increase in the use of green energy in the relevant period, Turkey's use of green energy is still below the desired level in the 21st century, despite the technology it has.

Turkey is still not at the desired level in energy-efficient technologies and technological developments in the field of energy. One of the important indicators of this is that the annual average energy losses have an increased rate of 5.37% for the Turkish economy in the 1990-2019 period. It is seen that this high rate of energy loss in Turkey is compared to the annual average GDP growth rate of 4.37% and 3.68% of total energy use in the relevant period, which is a high rate of increase. Therefore, there is a great need for improvement in technological developments as well as energy-efficient technologies for Turkey. As increasing energy-efficient technologies will reduce the amount of energy demanded per unit for the Turkish economy, it will decrease the overall energy demand and lead to higher growth rates by obtaining the same output with less energy or with the same energy. In addition, the increase in the use of clean energy with increasing technological developments will be very important for Turkey. The reason for this is that the increasing use of clean energy not only reduces foreign dependency in the field of energy but also causes less foreign exchange need, less current account deficit, and a less fragile economy. On the other hand, increasing the use of clean energy will be very important for sustainable energy, energy security, and sustainable development. However, the global epidemic of COVID-19, in particular, has led to a greater understanding of the importance of a livable world by world economies. Therefore, since the need for less carbon dioxide emissions, cleaner, healthier, and higher environmental quality for the world has increased, increasing the use of green energy emerges as a necessity for a livable world besides the above-mentioned economic advantages.

Therefore, for the high-growth Turkish economy, higher growth results in more energy demand, more energy loss, more energy need, higher energy imports, higher fossil fuel use, and higher CO2 emissions. In that case, increasing the use of green energy, which will reduce foreign dependency on energy for Turkey, will make significant contributions to sustainable, safe, and environmentally oriented growth.

1 In the IMF's World Economic Report published in 2015, 23 countries, including the Turkish economy, were named as emerging economies. These economies are Argentina, Bangladesh, Brazil, Bulgaria, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, Ukraine, and Venezuela (IMF; WEO, 2015:124).

Third, the long-term relationship between the variables did not emerge when tested with a traditional cointegration test but emerged with current cointegration tests. Finally, the findings to be obtained for an energy importing economy like Turkey will also contain concrete and important information for the developing countries that make up the majority of the world.

In this context, the long-term relationship between economic growth, technological progress, trade openness, and renewable energy use for the Turkish economy for the period of 1990-2019 is investigated. In the next section, similar studies from the related literature are given. In the next section, model and variables to be used in the model are introduced, and methods and findings are presented. Finally, recommendations are presented to policymakers with the help of the results obtained.

LITERATURE REVIEW

Turkey is a developing economy with high growth figures. However, like most developing economies, it is an energy importing economy that cannot meet the energy it needs with its resources. In 2019, Turkey's total GDP increased by 245.44% while total energy imports increased by 287.60% in the same period, compared to 1990. (IEA, 2022). On the other hand, due to its geopolitical position, Turkey has a high potential in the field of green energy, which will increase its independence in energy. Many factors can contribute positively to the realization of this potential. Therefore, it is very important to determine these factors. In recent years, many terms such as economic growth, trade openness, and technological progress with renewable energy have been indirectly discussed and investigated in many studies. However, when we look at the studies investigating the effect of these dynamics on green energy demand in the literature, only the study by Alam and Murad (2020) was found. Alam and Murad (2020) investigated the impact of economic growth, technological progress, and trade openness on green energy demand for 25 OECD countries. Autoregressive Distributed Lag (ARDL) approach, Pooled Mean Group (PMG), Mean Group (MG), and Dynamic Fixed Effects (DFE) methods were used as econometric methods. The findings showed that economic growth, technological growth, and trade openness significantly drive renewable energy demand.

Some studies in the literature indirectly investigate the relationship between economic growth, trade openness, and green energy. However, due to data constraints, there are not many studies investigating the relationship between technological progress and renewable energy. Technological development is represented in different ways in the studies encountered. In some of these studies, R&D expenditures were used as an indicator of technological progress. Aflaki et al. (2014) investigated the importance of innovation processes in the renewable energy industry on economic growth. For the period 1990-2012, different panel estimators such as FE, MG, and CCEMG were used for 15 European Union (EU) countries. Research findings revealed that R&D investments support renewable energy and this has a positive effect on economic growth.

Irandoust (2016) investigated the relationship between clean energy consumption, technological innovation, economic growth, and environmental quality for 4 Scandinavian countries with the Granger Causality test for the period 1975-2012. The findings show that there is a unidirectional causal relationship from technological development to renewable energy and that technological innovation plays an active role in clean energy.

Naimoğlu (2021) investigated the effect of technological innovations in the field of energy on energy consumption with the structural break Gregory-Hansen (1996) cointegration test for Germany in 1990-2019. The research findings show that the overall energy consumption for the German economy is mostly reduced by the technological innovation in the field of green energy, and therefore the technological innovations in the field of green energy increase energy efficiency.

Lee and Min (2015) investigated the effects of technological innovations in the field of green energy on the environment and company performances for Japanese manufacturing companies in the period 2001-2010 using the Minimum Mean Square Linear Estimation method. The findings have obtained that technological developments in the field of green energy increase energy efficiency by increasing the use of green energy and therefore have an effect on increasing environmental quality.

Cho et al. (2013) investigated the relationship between green energy use and R&D expenditures in the field of renewable energy for EU countries in the 1995-2006 period using the Panel SUR method. The findings show that R&D expenditures in the field of green energy have a positive effect on green energy use.

Jin et al. (2017) empirically investigated the effect of technological advances in the energy sector for China in the period 1995-2012 on environmental quality based on Spatial econometrics. Research findings have shown that technological progress increases the use of green energy and has a positive contribution to CO_2 emissions improvement.

Kahouli (2018) investigated the relationship between electricity use, R&D, economic growth, and CO2 emissions for 18 Mediterranean countries during the period 1990-2016 using SUR, 3SLS, and GMM methods. The findings showed that environmental degradation can be controlled by increasing R&D investments and using energy-efficient technologies.

Mensah et al. (2018) investigated the effects of innovation (R&D) on CO2 emissions improvement for 28 OECD countries during the 1990-2014 period using the STIRPAT method. The findings showed that the

development in innovation led to an improvement in the energy field and increased environmental quality in most OECD countries.

Some studies in the literature have investigated the possible effects of technological development on the use of renewable energy by using Patent data as an indicator of technological progress. The reason for this is that a higher number of patents will enable more efficient and more effective technologies to increase by increasing the innovation and technological level. Dinda (2011) investigated the effect of production technology on environmental quality for the USA in the period 1963-2007 using the VECM method. In this study, in which the number of patents was used as a technology variable, the findings showed that production technology had a positive effect on renewable energy and only reduced CO2 emissions in the short term.

In some studies, variables that can increase production efficiency are used as technology variables. Lantz and Feng (2006) investigated the relationship between the improvement in technological development and environmental quality for 5 regions of Canada using the Generalized Least Squares (GLS) econometric method. In this study, new equipment was used as an indicator of technological development. This is because new equipment can cause technological innovation or a change in the production structure of the economy. The findings show that increasing technological development will increase the use of alternative energy sources such as green energy, resulting in the use of more efficient technologies and thus less resource use, and thus an increase in environmental quality.

There are many studies in literature investigating the relationship between green energy use and economic growth. However, studies investigating the effect of economic growth on the use of green energy have generally been found in the literature with the conservation hypothesis, namely, one-way causality from economic growth to green energy use. Sadorsky (2009) investigated the relationship between green energy use and economic growth for 18 developing countries over the period 1994-2003. In the study using Panel cointegration, FMOLS, DOLS, and Panel VECM, the findings showed that there is a one-way and significant causal relationship between economic growth and green energy use. Similarly, in the study by Joyeux and Ripple (2011), for 56 developed and developing economies, in the study by Caraiani et al. (2015) for Romania, Poland, and Turkey, and in the study by Alper and Oğuz (2016) were found that the conservation hypothesis is valid for the Czech Republic. In this case, any savings policy that can be applied to reduce energy use in economies where the conservation hypothesis is valid will not harm economic growth. On the other hand, studies in which there is a reciprocal causal relationship between the feedback hypothesis, that is, the use of green energy and economic growth, have also been found in the literature. Apergis and Payne (2010) investigated the relationship between clean energy use and economic growth for 20 OECD countries during the 1985-2005 period. In the study using panel causality, it was found that there is a two-way causal relationship between renewable energy consumption and economic growth. Similarly, In the study by Al-Mulali et al. (2014) for 18 Latin American countries, in the study by Asafu-Adjaye (2000) for 4 Asian countries as India, Indonesia, Thailand, and the Philippines, In the study by Apergis and Payne (2011) for Six Central American countries, In the study by Salim and Rafiq (2012) for emerging economies, in the study by Apergis and Payne (2012), for 80 large country groups, in the study by Pao and Fu (2013) for the Brazilian economy and the study by Shahbaz et al. (2016) found that the feedback hypothesis is valid for the BRICS countries. Therefore, in the case where the feedback hypothesis is valid, that is, there is bidirectional causality between economic growth and clean energy use, any negative impact on economic growth and the use of renewable energy may negatively affect each other. So economies should adopt a stronger energy policy.

On the other hand, when we look at the studies on the energy use of the trade openness, Hossain (2012) investigated the causal relationship between CO2 emissions, energy use, economic growth, trade openness, and urbanization for the Japanese economy in the 1960-2009 period. The findings show that there is a causal relationship between trade openness and energy use for the Japanese economy in the short run. On the other hand, Kohler (2013) investigated the causal relationship between foreign trade, income, environmental recovery, and energy use for the South African country during the period 1960-2009. The findings showed that there is a bidirectional causal relationship between trade openness and energy use. Similarly, Shahbaz et al. (2013) For Indonesia in the period 1975:1-2011:4, Islam et al. (2013) found a mutually causal relationship between trade openness and energy use for Austria over the period 1965-2009.

Therefore, it is seen in the literature that economic growth, technological progress, and trade openness, in general, have a significant impact on energy use, with different effects.

DATA, METHODOLOGY, AND FINDINGS

In this study, which investigates the increase in renewable energy demand for the Turkish economy in the 1990-2019 period, the dependent variable of renewable energy use (lnREN) is taken as the sum (ktoe) of energy from hydro, solar, tides, wind and others.

Figure 1 shows the renewable energy usage trend for the Turkish economy in the 1990-2019 period. The fact that Turkey's renewable energy usage graph has a sensitive and increasing trend shows that renewable energy usage can be affected by many factors.

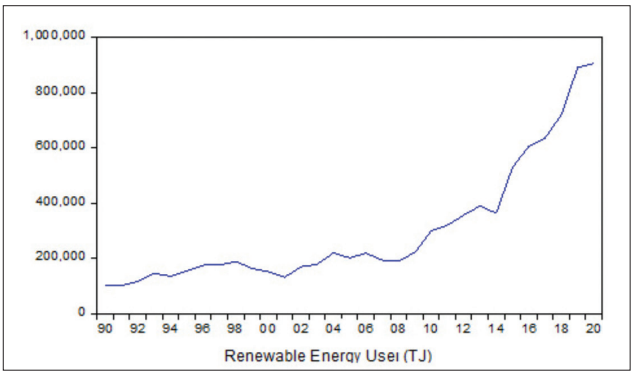

Figure 1: Renewable energy usage graph for Turkey (1990-2021)

Source: International Energy Agency, www.iea.org

High-income economies increase the use of energy-efficient technologies as well as increase the use of green energy. Therefore, the income levels of economies are important. Turkey has higher growth rates than the 21 emerging economies (except for the Chinese economy), which rank high among the world and emerging economies. While these growth rates act as leverage for the global economy, they can cause an increase in investments in the field of energy within the economy.

Figure 2 shows the GDP trends for Turkey, Emerging Economies, and the World for the period 1990-2019.

When Figure 2 is examined, it is seen that Turkey has achieved fluctuating but increasing growth. Turkey achieves these high growth rates with the energy it uses to carry out economic activities. However, Turkey imports the energy it needs from abroad. Therefore, Turkey is an economy dependent on foreign energy in the field of energy. In addition, almost all of the imported energy is realized as fossil fuel and the share of fossil fuels among Turkey's total energy sources is still highly dependent on today's technologies. Low technologies in the field of energy, on the other hand, cause high energy losses.

Figure 3 shows the trends in total energy imports, fossil fuel use, and energy losses for Turkey in the period 1990-2019.

When Figure 3 is examined, energy imports and fossil fuel use have an increasing trend for Turkey in the 1990-2019 period. In addition, the energy losses in the relevant period have an increasing trend. Therefore, a higher growth rate causes an increase in energy imports, fossil fuel use, and energy losses. This shows that higher growth in Turkey will increase energy use, fossil fuel use, energy loss, energy demand, energy imports, foreign

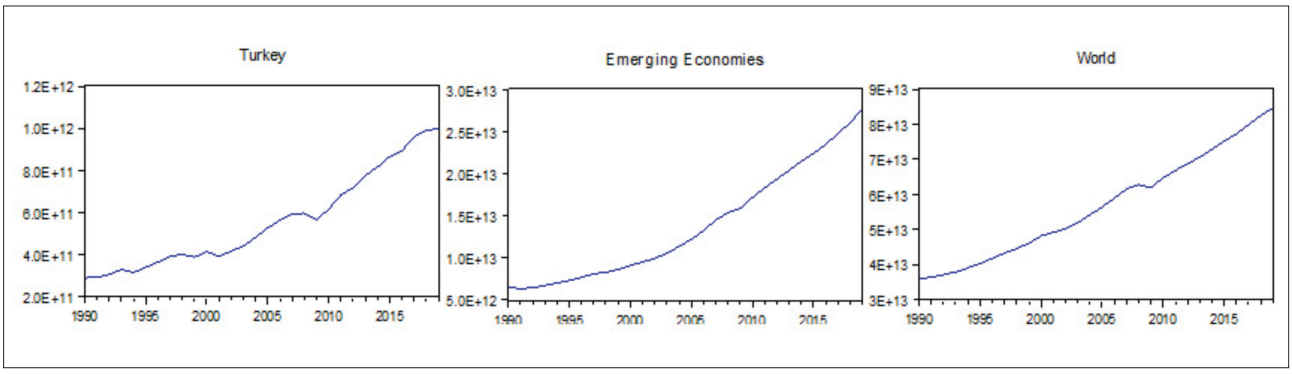

Figure 2: GDP Figures for Turkey, Emerging Economies and the World (1990-2019)

Source: World Data Bank, databank.worldbank.org

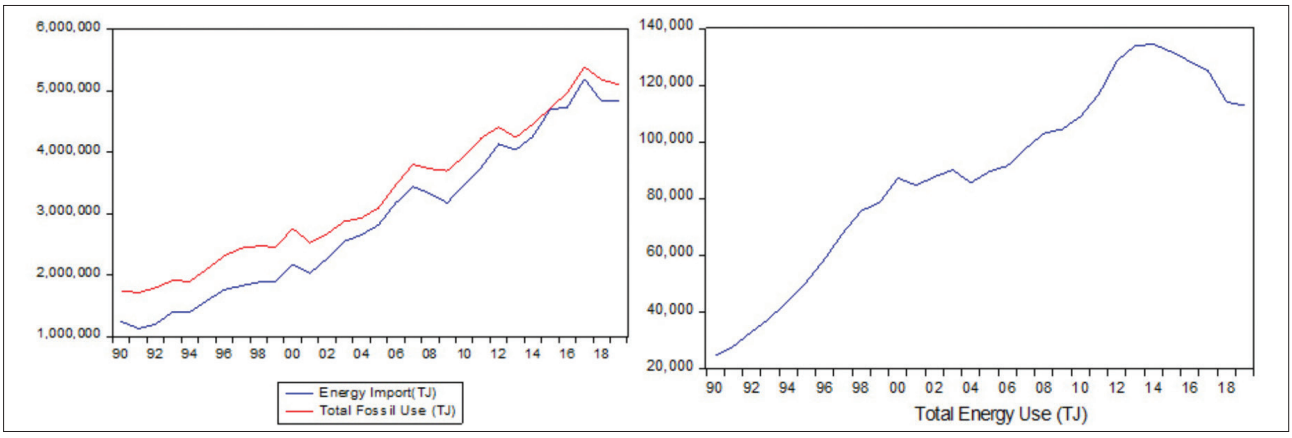

Figure 3: Figures of total energy imports, fossil fuel use, and total energy losses (1990-2019)

Source: International Energy Agency, www.iea.org

exchange need, current account deficit, and vulnerability. On the other hand, although the technological advances are not at the desired level for Turkey with high growth rates, the technology also causes an increase in the diversity of energy sources. One of the important effects of this is that Turkey is a country with high export figures. However, since the actual export is usually made with imported goods, it also increases the imports in parallel with the increased exports. While Turkey's exports have an average growth rate of 7.75% in the 1990-2019 period, its imports have an average growth rate of 6.42%.

Figure 4 shows the total export and import trends for Turkey in the period 1990-2019.

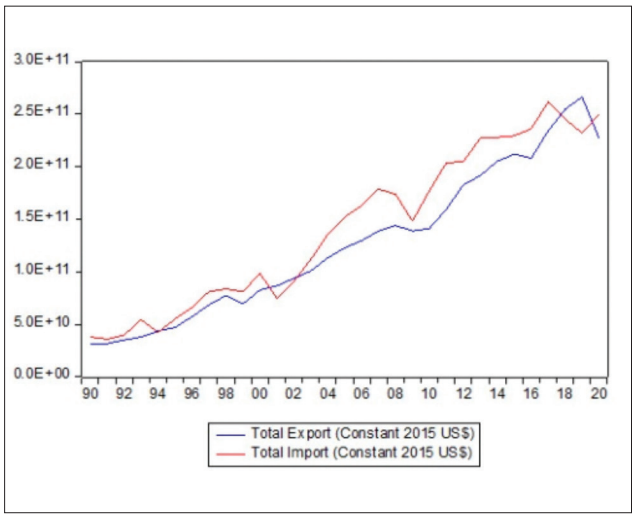

Figure 4: Export and Import graphs (1990-2019)

Source: World Data Bank, databank.worldbank.org

When Figure 4 is examined, Turkey's export and import figures for the period 1990-2019 have an increasing trend. In addition, export and import figures move together. While import values were higher than exports in 1990, it was the opposite in 2019. Therefore, Turkey has to increase its imports to increase its exports. This increasing export is provided by the energy it uses. In production, energy costs are among the most important costs. Increasing growth in Turkey brings with it increasing exports, increasing technological development, and alternative energy source diversity. It is shaped according to the superiority of any one of the negative effects of energy waste as a result of the gains arising from technological efficiency and the overproduction brought by the export ambition.

Model, and Data

In this section, the relationship between green energy use (lnREN) and economic growth (lnGDP), trade openness (lnTRD), and technological progress (lnTECH), which will reduce foreign dependence on energy for the Turkish economy, will be examined for the equation

$$\ln\mathrm{REN}_t = \beta_1 + \beta_2 \ln\mathrm{GDP}_t + \beta_3 \ln\mathrm{TRD}_t + \beta_4 \ln\mathrm{TECH}_t + u_t$$

Where renewable energy use (lnREN) is the sum of energy from Hydro, Solar, Wind, and others (ktoe), economic growth (lnGDP) (GDP per capita (2010 base year US$)) technological development (lnTECH), technological innovation (i.e. technological development) number of patents) and trade openness (index value) as a proxy measure. The economic growth, technological innovation, and trade openness series are taken from the World Bank, and the total renewable energy usage series is from the IEA. Natural logarithms of all variables were used.

Methodology, and Empirical Findings

In this part of the study, a stationarity test will be performed for each variable before the long-term relationship between the variables. Stationarity will be tested with standard ADF unit root test and Fourier ADF tests. For the long-term relationship, first, the traditional Engle-Granger (1987) cointegration test will be used. Then, with the inclusion of trigonometric functions in the model, the current Fourier Engle-Granger cointegration test and Maki (2012) cointegration tests, which allow multiple structural breaks, will be used for the long-term relationship. Finally, the direction and magnitude of the effect of the explanatory variables on the dependent variable will be investigated with the Fully Modified Ordinary Least Squares (FMOLS) and Canonical Cointegrated Regression (CCR) long-term coefficient estimators.

Standart ADF ve Fourier ADF Unit Roots Tests

When the stationarity of the variables is tested with the standard ADF unit root test, the structural changes that can be found in the series are ignored. Therefore, when the stationarity of the series is investigated with the standard ADF test, the stationarity degree can be determined incorrectly for a series with structural change, and this may cause the subsequent analysis stages to be selected incorrectly. Therefore, the use of stability tests, in which structural changes are taken into account, together with the standard ADF test, will increase the reliability of the test results.

Different stability tests followed different methods to take into account the structural changes. In the stationarity test that Enders and Lee (2012) brought to the literature, problems such as the time and number of structural breaks that can be found in the variables can be caught by adding the low-frequency sine and cosine trigonometric functions to the standard ADF model. However, Enders and Lee (2012) stated that the important thing in this test is to determine the frequency.

The standard ADF equation is as follows.

$$\Delta y_t = p y_{t-1} + \beta_1 + \beta_2 trend u_t \quad (3)$$

Table 1: Standart ADF and Fourier ADF Unit Root Test Results

	Level					
Variable	Frequency	MİNSSR	Lag	FADF	ADF	F-Test
lnREN	5	0.0774	6	3.629	0.879	5.382
lnGDP	4	0.0086	1	0.085	1.741	3.611
lnTECH	1	0.0715	2	1.046	-0.873	11.361***
lnTRD	5	0.0360	7	0.818	-1.907	6.937*
	First Difference					
Variable	Frequency	MİNSSR	Lag	FADF	ADF	F-Test
lnREN	1	0.0764	7	-4.372**	-5.266	12.395***
lnGDP	4	0.0077	1	-3.990	-5.429***	3.738
lnTECH	1	0.06667	1	-5.562***	-4.554	10.769***
lnTRD	5	0.0434	6	-9.052***	-4.885	8.073**

Note: Fourier F test critical values 1%=10.35%, 5%=7.58, 10%=6.35%, Fourier ADF k=1 critical values 1%=-4.42%, 5%=-3.81, 10%=-3.49%, Fourier ADF k =5 critical values 1%=-3.58%, 5%=-2.93%, 10%=-2.60, ADF critical values 1%=-3.753, 5%=-2.998, 10%=-2.639. *(10%), **(5%) and ***(1%) are levels of significance.

Enders and Lee (2012) added sine and cosine functions to this model and obtained the model as

$$\Delta y_t = p y_{t-1} + \beta_1 + \beta_2 trend + \beta_3 \sin\left(\frac{2\pi kt}{T}\right) + \beta_4 \cos\left(\frac{2\pi kt}{T}\right) + u_t \quad (4)$$

Where k is the frequency value, t is the trend and T is the time. Here, the k frequency value represents the frequency value with the value at which the residual sum of squares is the minimum (MinSSR). In that case, the frequency value corresponding to the MinSSR value will be used.

For all series to be used in the model, stationarity tests were performed with standard ADF and Fourier ADF tests, and the results are given in Table 1.

When Table 1 is examined, technological progress (lnTECH) and commercial openness (lnTRD) series have unit roots in their level values according to the Fourier ADF test. Other variables are unit rooted in their level values according to the standard ADF test. Renewable energy use (lnREN), trade openness (lnTRD) and technological progress (lnTECH) variables become stationary at I(1) to the Fourier ADF test. On the other hand, economic growth (lnGDP) is stationary at I(1) according to the standard ADF test. Therefore, all variables become stationary at I(1).

Cointegration Tests

According to the standard ADF and Fourier ADF stationarity test results, all variables were found to be I(1) and the long-term relationship was investigated considering that there might be a cointegration relationship between the series. The long-run relationship between the variables will first be tested with Engle-Granger (1987) test. All variables must be I(1) to use this test. Two stages are followed while applying this test. As the first step, the stationarity of the series is tested and if the series have the same degree of stationarity, the following model is used.

$$y_t = \beta x_t + e_t \quad (5)$$

For this model, an EKK estimator is used and residuals are obtained. Then, DF or ADF stability tests are applied to these residues. The stationarity of the residuals will indicate the existence of a long-run relationship between the variables.

For Turkey, the long-term relationship between green energy use (lnREN) and economic growth (lnGDP), trade openness (lnTRD), and technological progress (lnTECH) was tested with the standard Engle-Granger (1987) test and the results are given in Table 2.

If Table 2 is observed, the ADF test was applied to the residues obtained as a result of the model run. Since the test statistical value obtained is smaller than the critical values, it shows that there is no long-term relationship between the variables.

For the Fourier Engle-Granger cointegration test, which was brought to the literature by Yılancı (2019), trigonometric functions were added to the standard Engle-Granger cointegration test as follows.

$$y_t = a_0 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \beta' y_{2t} + u_t \quad (6)$$

Where, $k=1,\ldots,5$ denotes frequency values that can take values. Models are run for these values and k frequency value with MinSSR value is determined. In the Fourier Engle-Granger cointegration test, the model in which the sine and cosine trigonometric functions are added is

Table 2: Cointegration Test Results

Dependent Variable	Independent Variables	ADF Test Statistic	Critical Values
lnREN	lnGDP, lnTECH, lnTRD	-2.78	%1=4.84, %5=4.11, %10=3.73

Table 3: Cointegration Test Results

Dependent Variable	Independent Variables	Frequency	MİNSSR	Cointegration Test Statistic
lnREN	lnGDP, lnTECH, lnTRD	1	0.057256	-4.822***

Note: Critical values for Fourier EG cointegration are 1%=-4.805, 5%=-4.122, 10%=-3.767, and *(10%), **(5%) and ***(1%) are levels of significance.

estimated with the EKK and the residuals are obtained. As in the standard Engle-Granger cointegration test, the stability of the residues is tested with DF or ADF tests. However, the test statistics of the residue to be obtained here are compared with the critical values obtained by Yılancı (2019) and included in his article.

The relationship between renewable energy use (lnREN) and economic growth (lnGDP), trade openness (lnTRD), and technological progress (lnTECH) for Turkey has been tested with the Fourier Engle-Granger test and the results are given in Table 3.

If we pay attention to Table 3, models were run in the Fourier Engle-Granger test and the most appropriate frequency value for MinSSR was obtained as 3. The test statistics obtained for the appropriate frequency, on the other hand, show that there is a long-term relationship between the variables at the 1% significance level since it is greater than the critical values.

In the Gregory-Hansen (1996) cointegration test, the break is taken into account with the assumption of 1 structural break in the model, while in the Hatemi-J (2008) cointegration test, the break is taken into account with the assumption of 2 structural breaks in the model, and the break dates are determined pre-intuitively. However, in Maki's (2012) cointegration test, break dates and break numbers are determined internally in the model, not pre-intuitively. Therefore, the Maki (2012) cointegration test is considered more extended than the Gregory-Hansen (1996) and Hatemi-J (2008) cointegration tests. For Maki's (2012) cointegration test, 4 basic models are discussed as follows and the cointegration relationship is tested for each model.

$$Model\ 0:\ y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta x_t + u_t$$

$$Model\ 1:\ y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \beta x_t + \sum_{i=1}^{k} \beta_i x_t D_{i,t} + u_t$$

$$Model\ 2:\ y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \beta x_t + \sum_{i=1}^{k} \beta_i x_t D_{i,t} + u_t$$

$$Model\ 3:\ y_t = \mu + \sum_{i=1}^{k} \mu_i D_{i,t} + \gamma t + \sum_{i=1}^{k} \gamma_i t D_{i,t} + \beta x_t \sum_{i=1}^{k} \beta_i x_t D_{i,t} + u_t$$

Where, Model 0 denotes the model with no trend break, Model 1 the no trend level and break in slope, Model 3 the trended level and break in slope, and Model 4 the model with the break-in level, slope, and trend. D represents the dummy variable. In the Maki (2012) cointegration test, as in the Kapetanios (2005) stationarity test, the break dates are determined internally and a similar process is followed. First, by choosing any of the above 4 models, the model is run for each possible structural break, and the stability test statistics applied to the residues are obtained. The first break obtained in this way is the value at which the residual sum of squares is minimum among the selected models. Then, the first break obtained is added to the model and similarly, the second break is obtained with the logic of residual sum of squares. This process continues until the maximum number of breaks are taken. The basic hypothesis for Maki's (2012) cointegration test is "There is no cointegration relationship between series under structural breaks". The cointegration relationship between dependent and independent variables was tested with the Maki (2012) cointegration test and the results are given in Table 3.

Looking at Table 4, it is seen that there is a cointegration relationship between the variables in all models except for Model 3. Therefore, the series move together in the relevant period. According to Maki's (2012) cointegration test results, foreign capital outflows were experienced due to the decrease in investor confidence in many developing economies, including Turkey, with the Asian crisis that emerged on the 1997 breakout date. Therefore, the series move together in the relevant period. According to Maki's (2012) cointegration test results, Foreign Direct Investments (FDI) were experienced due to the decrease in investor confidence in many developing economies, including Turkey, with the Asian crisis that emerged on the 1997 breakout date. As FDI provides capital and technology transfer to the host country, it has also significantly affected the use of technology and renewable energy, which requires capital (Göçer and Bulut, 2015: 736). In addition, FDI, which decreased by 57% due to the effect of the 2008 global economic crisis, decreased to 8.4 billion dollars in 2009 (Göçer and Peker, 2014: 110). On the other hand, the policy changes made in the field of energy after the 2002 elections, when the new government came to power, showed their effect in 2003 and later. In addition, Turkey's coup attempt in 2016 showed its effect in the field of energy as well as in all other fields.

Table 4: Cointegration Test Results

Model	Test Statistic	Critic Values	Break Dates
Model 0	-11.715***	%1=-6.229, %5=-5.704, %10=-5.427	1997, 1999, 2014, 2017
Model 1	-6.972**	%1=-6.472, %5=-5.957, %10=-5.682	1997, 2009, 2012, 2016
Model 2	-6.960*	%1=-7.767, %5=-7.155, %10=6.868	1997, 2010
Model 3	-7.723	%1=-8.331, %5=-7.743, %10=-7.749	1995, 2003, 2009

Note: Critical values are taken from the Maki (2012) study. *(10%), **(5%) and ***(1%) are levels of significance.

Table 5: FMOLS, and CCR Long-Term Coefficient Estimation Results

lnREN	lnGDP	lnTECH	lnTRD	C
FMOLS	1.341***	0.307***	0.165	-2.783***
	(0.252)	(0.060)	(0.116)	(0.822)
CCR	1.131**	0.355***	0.140	-2.035*
	(0.317)	(0.073)	(0.131)	(1.018)

Note: *(10%), **(5%) and ***(1%) are levels of significance.

Estimation of Cointegration Coefficients

According to the standard Engle-Granger cointegration test, no long-term relationship was found between the variables. But, according to the current cointegration test of Fourier Engle-Granger and Maki (2012), it has been found that there is cointegration relationship between the variables in the relevant period. Therefore, the long-term coefficient estimation will be made to see how the explanatory variables affect the dependent variable. For this, FMOLS was brought to the literature by Philips and Hansen (1990) and where structural changes are included as dummy variables in the model, and CCR estimators developed by Park (1992) will be used.

The coefficient estimation results made to see the effect of the explanatory variables on the dependent variable are given in Table 4.

If we pay attention to Table 4, both estimation results showed similar results. According to both estimators, the variables of economic growth (lnGDP), trade openness (lnTRD), and technological progress (lnTECH) positively affect green energy consumption (lnREN). According to both estimators, it was found that economic growth (lnGDP) increased renewable energy use (lnREN) the most, while trade openness (lnTRD) increased the least. However, trade openness (lnTRD) was statistically insignificant.

The short-term coefficient estimation results are given in Table 5.

Paying attention to Table 5, the ECT coefficient was negative and statistically significant at the 1% significance level for FMOLS and 5% for CCR. Therefore, the existence of a cointegration relationship between green energy consumption and explanatory variables in the relevant period is confirmed. The ECT denotes the rate of correction in the long run and indicates that for FMOLS (-0.718)/ CCR (-0.911) approximately 0.72%/ 0.91% of a variant at period t-1 will return to equilibrium at period t.

CONCLUSION AND POLICY IMPLICATIONS

The Turkish economy, which is among the advanced emerging market economies, has an annual growth rate that is higher than the average GDP growth rate of the world and emerging economies. Energy use is among

Table 6: FMOLS, and CCR Short-Term Coefficient Estimation Results

ΔlnREN	ECT_{t-1}	ΔlnGDP	ΔlnTECH	ΔlnTRD	C
FMOLS	-0.718***	1.968***	-0.222	-0.248	0.025*
	(0.213)	(0.483)	(0.141)	(0.190)	(0.014)
CCR	-0.911**	2.516**	-0.344	-0.304	0.026
	(0.385)	(1.068)	(0.213)	(0.271)	(0.018)

Note: *(10%), **(5%) and ***(1%) are levels of significance.

the most important inputs of this growth. Turkey is a country where most of its energy demand cannot be met with its own resources and is an importer in the field of energy. Therefore, the use of clean energy is of vital importance for the Turkish economy. The share of fossil use in the total energy used by the Turkish economy in 2019 is as high as 83.18%, which is a very high rate. On the other hand, despite today's technologies, the share of green energy in 2019 is still not at the desired level, as 14.62%. Therefore, this situation shows that the Turkish economy, which is an energy importer, needs to increase its share of renewable energy more for its sustainable growth. Renewable energy is an important alternative energy source for Turkey. The fact that the renewable energy graph of the Turkey has sensitive fluctuations and an increasing trend in the relevant period shows that many factors affect the clean energy demand sensitively.

In this study, the long-term relationship between economic growth, trade openness, and technological innovation variables, which are thought to affect the use of green energy in the 1990-2019 for the Turkish economy, and the use of green energy is investigated. This study has important contributions to the literature. First of all, it is the research of the renewable energy demand for the Turkish economy, which is among the developing countries that make up the majority of the world. The second is that the Turkish economy will act as a lever for global economic growth with its high growth rates, and it will contribute more and more sustainably to global economic growth by increasing the renewable energy demand for Turkey. The third is that this study will make positive contributions to the increase in environmental quality, as Turkey's high use of fossil fuels causes the environmental quality of Turkey and the world to be negatively affected. Finally, it is an empirical investigation of the question of how to increase the clean energy demand with current methods.

In this study, which investigates the factors that will affect the green energy demand for Turkey in the 1990-2019 -, no long-term relationship has emerged the Engle-Granger (1987) test. However, with the Fourier Engle-Granger test developed by Yılancı (2019) and the current cointegration tests with multiple structural breaks introduced to the literature by Maki (2012), it has been observed that there is a long-term relationship between the variables. For this purpose, conventional ADF and Fourier ADF stationarity tests were used and it was found that the series was stationary after taking the first difference. Then, the cointeration relationship between the variables was investigated and the long-term relationship was found. Finally, FMOLS and CCR long-term coefficient estimators are used. Research findings have shown that economic growth and technological improvement increase the use of green energy in Turkey. The trade openness coefficient was positive but statistically insignificant. The increase in economic growth leads to an increase in energy-efficient technologies. In addition, increasing income leads to an increase in green energy investments by reducing energy imports, which bring the highest cost in production and one of the biggest obstacles to sustainable development. It is considered that higher technological development will have a positive impact on the field of green energy and the necessary tools and equipment will be produced within the country and contribute positively to employment and growth. The change in foreign trade has different results. While the increase in foreign trade causes gains due to technological efficiency in some economies, it is shaped according to one of the negative effects of excessive use of fossil fuels and more energy waste and energy loss as a result of excessive production with export ambition in some economies.

As a result, economic growth, technological development, and trade openness significantly affect the use of clean energy. The findings obtained in this study coincide with the technological development results of the studies conducted by Lee and Min (2015) for Japan and Lantz and Feng (2006) for the Canadian economy. It also coincides with the results of economic growth in the studies of Sadorsky (2009) for 18 developing countries and Tiwari (2011) for India. Similarly, studies by Hossain (2012) for the Japanese economy and Alam and Murad (2020) for the 25 OECD countries coincide with the results that trade openness affects renewable energy use.

According to the research findings obtained, policymakers have important duties for the Turkish economy, which is among the advanced emerging market economy. First of all, the fact that economic growth increases the use of clean energy in Turkey can be associated with technological developments and an increase in energy source diversity. Therefore, it is vital to increase investments in the field of green energy and to produce domestically the equipment to be used in the field of green energy for economic growth to be sustainable, which can positively affect the increase in the use of green energy, which reduces foreign dependency in energy. The positive effect of the increase in technological innovation on the use of clean energy can be associated with the transformations in the energy field, which brings the highest cost in production. Therefore, it is considered that increasing technological innovation will lead to the development of energy-efficient technologies and the abandonment of fossil fuels, which imposes a heavy burden. If the effect of trade openness on green energy use is the gains arising from technological efficiency, it is expected that the use of clean energy, which will reduce foreign dependency on energy, will increase. In other words, higher trade openness for economies leads to the development of efficient production techniques with technological innovations, leading to the widespread use of green energy, which has a significant positive effect on the efficient use of energy.

As a suggestion for the limitations of the study and future studies, it is thought that the literature related to this study has recently developed, and therefore, it

is thought that researching this subject with different country groups and current period data will make important contributions. In this study, researching the renewable energy demand at the general economy-level gives general information. However, researching the sectoral renewable energy demand will also contain important and detailed information. In addition, in this study, renewable energy demand is investigated only with economic variables. It is evaluated that the multidimensional research of the subject, such as social, political, demographic, and structural, as well as economic variables, will provide detailed and important information to policymakers.

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Club Convergence: Do public investments play a role in regional income per capita convergence in Turkey?

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ABSTRACT

This paper aims to examine club, conditional and absolute convergence at regional level under the assumption that public investment can be used as a tool to reduce income disparities. Therefore, following Phillips and Sul (2007, 2009) and Lyncker and Thoennessen (2017), as the first step of the empirical analysis, five convergence clubs and a divergent member are identified in real GDP per capita at Turkey NUTS II level for the period from 2004 to 2019. Additionally, the clubs' basic data reveals three important information. The first information is that regions with high GDP per capita receive more public investment than others. Second information is that the share of public investment is not distributed equally in terms of GDP per capita. Third information is that Clubs 1, 2 and TR10 (İstanbul) (the only divergent member) have higher proportion of public investments on average than others. As a result, public capital is not used as a tool to reduce regional inequalities from the government. At the end of the empirical analysis, the dynamic effects of public capital on growth is analyzed using Sys-GMM estimators. From the results, it has seen that public investment is statistically significant and has a positive effect on growth; however, it has quite low coefficient. Also, findings revealed that there isn't absolute convergence at regional level in Turkey. Therefore, when share of public investments are taken into account, there is conditional convergence. With the existence of club and conditional convergence, public capital should be used much more effectively thanks to its ability to reduce income inequalities and merge clubs, otherwise absolute convergence will not occur.

Keywords: Club Convergence, Conditional Convergence, Public capital, GDP per capita.

JEL Classification Codes: H54, R11, R58.

INTRODUCTION

Numerous theoretical and empirical studies in the literature discuss and try to explain the reason for gaps and differences in the gross domestic product per capita (GDPpc) between countries after the industrial revolution. As a pioneer work, according to Solow (1956, 1957), countries' GDPpc level will tend to converge over time under constant returns to scale and diminishing returns to production. Solow (1956) focused on sources of growth assuming that there is a single sector production in which capital and labor inputs are used and technology is considered exogenous in the model. Findings from studies based on the Solow-Swan model led to two important theoretical improvements. First, since only a small part of the growth can be explained by factor accumulation under the assumption that technology is determined externally, that necessity of including technology endogenously in the model has emerged. Thus, it has been accepted that technology is determined endogenously in the new neoclassical growth theories. Secondly, under a constant saving and population growth rate when capital and labor are considered as substitutes for each other and declining productivity prevails, countries with a lower stock of capital per labor force will have a higher rate of return and therefore grow faster, and vice versa. Countries with higher capital stocks per labor grow more slowly. Therefore, per capita income gaps should tend to decline over time between developed and developing countries and absolute convergence becomes a natural consequence of the neoclassical model.

However, although it has been tested many times, there is often no evidence of absolute convergence in the literature (Barro and Sala-i Martin (1992), Mankiw, Romer, and Weil (1992), Sala-i Martin (1996), Higgins, Levy, and Young (2006), and Young, Higgins, and Levy (2008)). According to Rodrik (2013), contrary to many studies in the literature, it has been revealed that there is absolute convergence, but only in areas with high productivity in modern production rather than in the economy as a whole.

On the other hand, the conditional convergence hypothesis, focuses on the negative relationship between real income and growth rate, after accepting that the structural factors will differ from country to country. Under the assumption of structural

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factors are identical (such as savings, preferences, human and physical capital, technology), according to the conditional convergence there is a negative relationship between growth and initial value of income per capita. Hereby, even if the initial incomes are the same, structural differences cause countries to converge to their own steady states. Finally, countries that differ in their initial level or distribution of structural factors, may cluster around a different steady state equilibrium (Galor, 1996; Aksoy et al 2019). Thus, the absolute convergence displays a single equilibrium to which all countries approach, conversely in the case of conditional convergence, each country approaches its own equilibrium with respect to its own unique structural difference. However, in the case of club convergence, different clubs have different equilibriums, as a consequence there will be different equilibriums according to number of clubs. If there is club convergence, there will be multiple equilibrium (Islam, 2003). According to Bernard and Durlauf (1996), when economies have multiple long run equilibrium, cross sectional tests tend to spuriously reject the null hypothesis of no convergence. In order to avoid spuriously rejecting the null; we use Phillips and Sul (2007) procedure to identify subgroups. In terms of the existence of club convergence, Chatterji (1992), Chatterji and Dewhurst (1996) and Quah (1996, 1997) emphasize that the β-convergence and σ-convergence methodological approaches can yield misleading results. Therefore, club convergence in income is also taken into account in this study, apart from absolute and conditional convergence. On the other hand, a great number of empirical studies have investigated the decisive role of the public capital on economic growth in regional level convergence (see Cook and Munnell, 1990; Holtz-Eakin, 1992; and Lall and Yilmaz, 2001 on USA; Shioji, 2001 on USA and Japan; Mas et al., 1998 on Spain; and Rodríguez-Pose, Psycharis, and Tselios, 2012 on Greece). Furthermore, Barro (1991) and Barro and Sala-i-Martin (1992) investigated the relationship between a country's growth expectations and fiscal policies with models based on the Ramsey framework. Regarding Turkey, while Filiztekin (1998) provides no evidence for the effect of public capital on regional convergence across the country from 1975 to 1995. On the other hand, Önder, Deliktaş, and Karadağ (2007) conclude that public capital affects the per capita GDP, suggesting regional convergence existed in Turkey at NUTS II level for the period of 1980-2001.

The impact of public capital on economic growth has been empirically studied by many scholars since Aschauer's (1989) pioneering work. As indicated in the World Development report published in 1994, public capital plays a key role in economic activity, since the former often thought of as the latter's "wheels". Additionally, public capital creates externalities for the economic environment via infrastructure, such as telecommunications, electricity and other types of public investments according to the input-output tables. With these kinds of externalities and their spillover effects, regions are able to enhance their income level. Furthermore, although our study is based on the work of Önder, Deliktaş, and Karadağ (2007), it contributes to the existing literature in a different aspect apart from previous studies. We determine the convergence clubs proposed by Phillips and Sul (2007, 2009) (PS) and discuss the relationship between income of clubs and their share of public investment expenditures. We also scrutinize the existence of conditional convergence under the assumption that the structural disparities occur because of the unequally distributed public investments. Finally, we consider the dynamic structure of the model itself to investigate the role of public capital as a determinant of conditional convergence and we investigate convergence clubs for NUTS II regions in Turkey by using Phillips and Sul (2007, 2009) (PS and PSmerging) and Lyncker and Thoennessen (2017) (LT) procedures.

The study is organized as follows. Section two presents a literature survey for Turkey and third section presents the data and theoretical model. In section four empirical results are discussed. Lastly, section five concludes the study.

LITERATURE REVIEW

This paper is focused on income convergences between regions in Turkey and tests it using the absolute, conditional and club convergences methodologies altogether, also club convergence is used in many different subjects such as the environment, housing prices, export and commercial openness (See: Kılıçaslan and Dedeoğlu (2020), Ulucak (2017), Şahin (2021), Tirgil et al. (2021), Şimdi (2021)). The existence of absolute convergence and conditional convergence has been tested by many studies in Turkey (Filiztekin (1998), Karaca (2004), Erlat (2012), Karaalp and Erdal (2009), Yamanoğlu (2008), Zeren and Yılancı (2011)). However, club convergence has been a prominent issue lately. Therefore, there are very few studies on club convergence in Turkish regions. According to Yazgan and Ceylan (2021) in the period of the study, there are eight convergence clubs, also one divergence club, which means prominent sectors and the close neighborhood are determinants to the emergence of convergence clubs. Karahasan (2020) claims that the regions do not converge on average income, but instead they converge to the different income levels which means that there is club convergence. Also the findings demonstrate that the club convergence process is affected by neighbor regions' income level. A region which has a neighbor with high income level has a higher chance to move to a higher income level. On the other hand the regions located in the poor regions may stay in the same income group or fall to the level of the lower-income groups. Önder et.al (2007) investigate conditional convergence by considering spatial relations in

Turkey for NUTS II regions. Their findings support the conditional convergence hypothesis. Besides, according to the findings, the public capital does not have a significant impact on regional convergence in the models with spatial effects. As in Önder et.al (2007), Gömleksiz et al. (2017) also find that there is convergence at the regional level. Moreover, the results indicate that the role of government, in respect to fixed investment incentives and government investment, is positive in the convergence process. The results of Yıldırım et al. (2009) also support the convergence hypothesis. Besides, as in Önder et. al (2007), this study also reveal that the government expenditures have a significant role to decrease income inequality. However, according to Gerni et al. (2015) there is absolute convergence in the regional incomes of the 26 sub-regions in Turkey. On the other hand, in the conditional convergence analysis created by adding investment incentives as a control variable to the convergence analysis, it has been revealed that investment incentives do not have a positive effect on income convergence among regions. In the analyses made on a provincial basis, it was observed that the 2009-2012 regulations have provided more effective results than the 2004-2008 incentive regulations. Another study supporting this study is made by Abdioğlu and Uysal (2013). According to the results of the study there is no convergence among the gross value added of the regions. Also the results show that the incentive law which was enacted in January 2004 is not effective in reducing income disparities, and income distribution among the regions does not occur effectively and fairly even if new incentives are introduced. Aksoy et al. (2019) test the convergence between Western and Eastern regions of Turkey. Their findings reveal that there is no absolute or conditional convergence, while there are five clubs in the 1987-2001 period and six clubs in the 2004-2001 period. Karagöl et al. (2019) claimed that cities in the clubs move towards their steady states which is specific for the club from their disequilibrium state. This finding can show that the productivity disparities, structural differences and geographical factors could affect the classifications of convergence clubs. On the other hand, findings of Karaca (2018), don't support regional convergence among the regions of Turkey between 1960-2010 period. Karaalp and Erdal (2012) revealed that the agglomeration of industrialization in certain regions has been used for regional income disparities. The findings of the study support the convergence for 73 provinces while agglomeration slows down this process, but the growth of neighboring provinces accelerates this process. Also for 7 regions it has been found that the agglomeration has a positive impact on convergence. Zeren and Yılancı (2011) study the rate of deposit in GDP as an indication of financial development which is used for as a disparity among the regions. Findings of the study support absolute and conditional convergence for the average of the regions. Whereas, at the regional level, there are 17 absolute convergence regions and 25 conditional convergence regions. So it has been concluded that there is a positive effect of deposits on per capita income. Erk et al. (2000) revealed that there was no evidence of convergence between the provinces for the period 1979-1997, on the contrary, there was divergence. At the regional level, except the Marmara region, the other regions are converging. Table 1 covers the summary of final results of the prominent studies in the literature that work on club convergence or unconditional convergence for Turkish regions.

DATA AND THE THEORETICAL MODEL

The regional per capita gross domestic product is obtained from Turkish Statistical Institute (TURKSTAT) for the period from 2004 to 2020 and as a public investment expenditure, initial funds of investment programs are extracted from the Republic of Turkey Ministry of Development for the period from 2004 to 2019. However, after 2018, the Ministry of Development was abolished and joined the Presidency of the Republic of Turkey Strategy and Budget Department. Yet, the Strategy and Budget Department still maintains the data. The collected data tested club convergence and regional convergence at 26 sub-regions by using panel data for the period 2005-2019. Due to the lags in the mathematical model, we lost an observation to test conditional convergence, so the data started with the year 2005. In addition, as a result of the lack of public investment data for the year 2020, 2019 was determined as the final year. The nominal regional GDP data in the Turkish Lira currency are transformed into real regional gross domestic product in 2009 prices using the GDP deflator (2009=100).

The regional public investments are calculated as the share of the region in the total public expenditures of that year. In other words, regional public capital is the share of total public investment expenditures in the year.

As can be seen from the Table 1, TR 10 (İstanbul) has the highest real GDP per capita in 2019 (6236.31 TL), while TR C2 (Trabzon, Ordu, Giresun) has the lowest value (1466.27 TL). Compared to the data of the real GDP per capita as a proportion of Turkey's average in 2019 or share of total GDP better reflect the inequality between regions. TR 10 has the highest value for the data GDP per capita as a proportion of Turkey's average. Other regions with higher values than Turkey's average are TR 51 (Ankara), TR 42 (Kocaeli, Sakarya, Düzce, Bolu, Yalova), TR 21 (Tekirdağ, Edirne, Kırklareli), TR 31 (İzmir), TR 41 (Bursa, Eskişehir, Bilecik) and TR 61 (Antalya, Isparta, Burdur). Moreover, TR 10 (İstanbul) with 13 percent has the highest share of total public investment in 2019 and it has highest share of total public investment on average with 17 percent . Other regions with higher values after TR 10 (İstanbul) are TR 41 (Bursa, Eskişehir, Bilecik), TR 51 (Ankara), TR 90 (Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane), TR63 (Hatay, Kahramanmaraş, Osmaniye), TR 31 (İzmir), TR 42 (Kocaeli, Sakarya, Düzce, Bolu, Yalova) respectively. As can be seen from the data in the table,

Table 1: Summary of the Literature for Turkey.

Writer(s)	Region/ Data	Date	Theoretical Model	Method	Findings
Yazgan and Ceylan (2021)	NUTS II	2004-2018	Club Convergence	Phillips and Sul (2007)	There is club convergence.
Karahasan (2020)	NUTS III	1975-2017	Club Convergence	Spatial Markov Chain	Mixed Results exist.
Aksoy et al. (2019)	NUTS-III	1987-2001 2004-2017	Club Convergence	Phillips and Sul (2007)	There is club convergence.
Karagöl et al. (2019)	NUTS-III	2004-2017	Club Convergence	Phillips and Sul (2007)	There is club convergence.
Önder et al. (2007)	NUTS-I	1980-2001	Conditional Convergence	Panel Spatial Analysis	There is conditional convergence.
Karaca (2018)	NUTS-II	1960-2010	Absolute Convergence	Cross-Sectional Analysis, Panel Data Analysis.	There is no absolute convergence.
Gömleksiz et al. (2017)	NUTS-II	2004-2014	Conditional Convergence	Panel Data Analysis	There is conditional convergence.
Gerni et al. (2015)	NUTS-II and NUTS-III	2004-2012	Absolute Convergence and Conditional Convergence	Panel Data Analysis	There is absolute convergence. There is mixed results for conditional convergence.
Abdioğlu and Uysal (2013)	NUTS-II	2004-2008	Conditional Convergence	Panel Unit Root Test	There is no conditional convergence.
Karaalp and Erdal (2012)	73 provinces and 7 Regions	1993-2001	Conditional Convergence	Panel Data Analysis	There is conditional convergence.
Zeren and Yılancı (2011)	NUTS-II	1991-2000	Absolute Convergence and Conditional Convergence	Panel Data Analysis	There is absolute convergence and conditional convergence.
Yıldırım et al. (2009)	NUTS-II and 67 provinces	1987-2001	Absolute Convergence and Conditional Convergence	The Theil Coefficient Of Concentration Index	There is absolute convergence and conditional convergence
Erk et al. (2000)	67 provinces and 7 regions	1979-1997	Absolute Convergence and Conditional Convergence	Cross Sectional Analysis	There is no absolute convergence and conditional convergence

there is a huge regional disparity in GDP per capita. Moreover, public investment expenditures are far from reducing regional inequalities in the country, as regions with high GDP per capita receive more public investment than regions with low GDP per capita except TR 90 (Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane). Huge disparities in income distribution between regions may be a signal of multiple long run equilibria. Therefore, this study aims to investigate the existence of convergence clubs in Turkey. Despite regional differences in income and accompanying public investment distributions, this study also scrutinizes the existence of conditional convergence.

According to Bernard and Durlauf (1996), when economies have multiple long run equilibrium, cross sectional tests tend to spuriously reject the null hypothesis of no convergence. As before we mentioned in order to avoid spuriously reject the null; we use Phillips and Sul (2009) (PS) procedure to identify convergence clubs in Turkey at regional level. This procedure has four steps to identify the subgroups. In the first step, we order individuals in the panel according to the last observation of the log of rGDPpc. In the second step we select the first "k" highest individuals in the panel from the subgroup and run log(t) regression. After the regression, then we calculate the convergence test statistic for this subgroup. Step three is about adding individuals to the subgroups. Finally, the last step is about stopping the rule. After determining clubs, we also investigate the effect of public capital in these clubs. To test the regional conditional convergence in Turkey, under constant

Table 2: Summary of the Basic Data for Turkish Regions at NUTS II Level.

NUTS II Regions	GDP per capita in 2019 (1000 TL, in 2009 prices)	Real GDP per capita as a proportion of Turkey's Average in 2019	Share of total GDP in 2019	Real public investment in 2019 (1000 TL, in 2009 prices)	Share of total public investment in 2019	Share of total public investment on average
Year	**2019**	**2019**	**2019**	**2019**	**2019**	**2004-2019**
TR10	6236.31	165.86	7.75	75247.64	13.11	17.47
TR21	4460.04	118.62	5.54	5147.39	0.90	1.84
TR22	3384.80	90.02	4.21	20029.42	3.49	2.13
TR31	4350.93	115.72	5.41	34262.30	5.97	3.90
TR32	3337.62	88.77	4.15	22622.92	3.94	2.60
TR33	3173.87	84.41	3.94	11862.40	2.07	2.66
TR41	4180.45	111.18	5.20	46924.26	8.17	4.20
TR42	4703.40	125.09	5.84	33115.75	5.77	4.22
TR51	5114.59	136.03	6.36	46121.17	8.03	9.62
TR52	2978.76	79.22	3.70	14196.56	2.47	3.29
TR61	4049.80	107.71	5.03	18126.54	3.16	3.85
TR62	2855.28	75.94	3.55	25310.34	4.41	3.16
TR63	2319.40	61.69	2.88	40801.68	7.11	3.26
TR71	2627.52	69.88	3.27	8223.98	1.43	4.26
TR72	2811.62	74.78	3.49	15963.35	2.78	2.59
TR81	2608.63	69.38	3.24	8158.34	1.42	1.62
TR82	2631.90	70.00	3.27	5091.07	0.89	1.51
TR83	2340.32	62.24	2.91	13999.56	2.44	3.14
TR90	2519.81	67.02	3.13	44286.17	7.71	6.00
TRA1	2461.56	65.47	3.06	10569.55	1.84	1.93
TRA2	1675.31	44.56	2.08	3783.36	0.66	1.42
TRB1	2259.82	60.10	2.81	12975.93	2.26	2.33
TRB2	1556.72	41.40	1.93	13594.88	2.37	2.16
TRC1	2430.66	64.65	3.02	8944.48	1.56	2.25
TRC2	1466.27	39.00	1.82	28826.32	5.02	4.54
TRC3	1933.82	51.43	2.40	5968.00	1.04	4.06
Turkey's GDP per capita in 2019:		3759.94	**Total public investment in 2019:**		574153.38	

return of scale following Mankiw, Romer, and Weil (1992), and Barro and Sala-i Martin (1992), we start with Cobb Douglas production function as follows:

$$Y = K^{\alpha}{}_{t}(A_t L_t)^{1-\alpha} \qquad 0 < \alpha < 1 , \qquad (1)$$

where Y denotes output, K stands for capital, L for labor and A for technological progress.

$y = Y_t / L_t$ is the output per unit of labor and $k = K_t / L_t$ is the stock capital per unit of labor. Also, $\tilde{y} = Y_t / A_t L_t$ and $\tilde{k} = K_t / A_t L_t$ are the output per unit of effective labor and the stock of capital per effective labor, respectively. Hence, we can rewrite the production function as follows:

$$\tilde{y} = \tilde{k}^{\alpha} \qquad (2)$$

s_K represents the investment ratio while $s_K Y_t$ stands for the investment portion of income. It is assumed that δ is the depreciation rate, technology and labor grow at exogenously determined rates g and n respectively. As shown in equation (3), the dynamic version of $\tilde{k}$ indicates the convergence to its steady state value. It can be written as:

$$\overset{0}{\tilde{k}} = s_K \tilde{y} - \tilde{k}(g + n + \delta) \qquad (3)$$

Since $\tilde{k}$ represents a constantly rising function, the derivatives of the logarithm of time become zero, equaling the steady-state $\overset{0}{\tilde{k}}$ to zero.

We obtained steady state production function ($\tilde{y}^* = (\tilde{k}^*)^{\alpha}$) using equation (3). Its logarithmic form can be expressed by:

$$\ln \tilde{y}^* = \alpha \ln \tilde{k}^* \qquad (4)$$

Combining equation (3) and (4) under the assumption of steady state $\overset{0}{\tilde{k}}$ equals zero. We acquire the following form:

$$\ln \tilde{k}^* = \frac{1}{1-\alpha} \ln s_K - \frac{1}{1-\alpha} \ln(n+g+\delta) \qquad (5)$$

In the above equation, $\tilde{k}^*$ refers to the steady state value of $\tilde{k}$.

Substituting Equation (5) with Equation (4), gives:

$$\ln \tilde{y}^* = \frac{\alpha}{1-\alpha} \ln s_K - \frac{\alpha}{1-\alpha} \ln(n+g+\delta) \qquad (6)$$

Furthermore, the derivative of Equation (4) as to time is as thus:

$$\frac{d \ln \tilde{y}}{dt} = \alpha \frac{d \ln \tilde{k}}{dt} k \qquad (7)$$

Solving $\frac{d \ln \tilde{y}}{dt}$ with first-order Taylor expansion we reach the following equation:

$$\frac{d \ln \tilde{y}}{dt} = -(1-\alpha)(n+g+\delta)(\ln \tilde{y} / \ln \tilde{y}^*) \qquad (8)$$

Defining $(1-\alpha)(n+g+\delta) = \lambda$ in equation (8). With first order linear differential equation we obtain the following form:

$$\ln(\tilde{y} / \tilde{y}_0) = -(1-e^{-\lambda t}) \ln \tilde{y}_0 + (1-e^{-\lambda t}) \ln \tilde{y}^* \qquad (9)$$

Using the definition of output per unit of effective labor ($\tilde{y} = Y_t / A_t L_t$) and defining public capital as a technology shifter, equation (10) can be rewritten as:

$$\ln(y / y_{t-1}) = -(1-e^{-\lambda t}) \ln y_{t-1} + (1-e^{-\lambda t})(\ln \tilde{y}^* + g + pc_{t-1}) \qquad (10)$$

The parameters are defined as $\beta_1 = -(1-e^{-\lambda t})$, $\beta_2 = (1-e^{-\lambda t})$ and $\beta_0 = (1-e^{-\lambda t}) \ln \tilde{y}$ In equation (10), following Islam (1995), we obtain the panel case of the theoretical model:

$$\ln(y_{it} / y_{it-1}) = \beta_0 + \beta_1 \ln y_{it-1} + \beta_2 pc_{it-1} + u_{it} \qquad (11)$$

where u_t implies the error term.

The GMM model developed by Blundell Bond (1998) depends on first differences (14) and level equation (13).

$$\ln(y_{it}/y_{it-1}) = \beta y_{it-1} + \gamma pc_{it-1} + \theta + \eta_i + \nu_{it} \qquad (13)$$

$$\Delta \ln(y_{it}/y_{it-1}) = \beta \Delta y_{it-2} + \gamma \Delta pc_{it-1} + \Delta v_{it} \qquad (14)$$

$$u_{it} = \eta_i + \nu_{it}$$

where fix effects are represented by ηi and idiosyncratic shocks are vi in the model.

EMPIRICAL RESULTS

In this section we report the empirical results of two different convergence frameworks: club convergence and conditional convergence. In the first step of empirical analysis, we investigate the existence and significance of the club convergence. For this purpose, we apply Hodrick-Prescott filter to extract trend and cyclical components for each individual in the panel from real GDP per capita and after that, we apply log(t) test as mentioned as in PS and Du (2017). The second step of the empirical analysis is to identify the clubs after determining that there are multiple equilibria. In the third step of the empirical analysis, PSmerge and LT procedures are used to examine whether there are merging clubs. Finally, the fourth step is to investigate whether there is conditional convergence between regions.

The coefficient, standard error, and t statistic of log(t) test are reported in Table 3. Due to the fact that t statistic is less than -1.65 (calculated as -18.76), which indicates that the null hypothesis of convergence is rejected at 5 percent significance level, there are multiple equilibria. As a consequence of the log (t) test result, we can use PS algorithm to investigate sub grubs in the panel. The PS algorithm initially identified 6 convergence clubs and one divergence club as stated in Table 4.

Following Sichera and Pizzuto (2019) we use PSmerge and LT club merging algorithms respectively to seek for possible mergers. Our findings revealed that PSmerge and vLT club-merging algorithms have identical results in terms of the number of final clubs and members of the clubs. Since they have the same results, this study reports just PSmerge statistics instead of reporting both of them in Table 5.

Table 5 shows the final members of the clubs after employing club-merging algorithms. According to the club-merging algorithm, Club 4 and Club 5 should merge with each other. The final number of clubs (five) and their members are illustrated in Table 5.

As a result, we concluded that there are five convergence clubs in NUTS II regions in Turkey. Figure 1 illustrates the average of the real GDP per capita in 2019 (mean(lny)) and share of total public investment on average (2005-2019) (meanpcavg) values of each club[1]. It is seen that Club 1 and TR 10, which have a high income, also receives a high share of public investment.

[1] Figure 1 was prepared in Excel. Figure 2, 3 and 4 are drawn in the GEODA program and Figure 5 is created in the R package program.

Table 3: Club Convergence log(t) Test

Variable	Coef (log(t))	sth	t-stat	prob
log(t)	-0.522	0.028	-18.76	0.00

Coef is the coefficient of log (t) test and sth is the standard error of the coefficient. Besides, t-stat is the t statistics of log (t) test.

Table 4: Coefficient of log(t) Test for Initial Clubs

Initial Clubs	Coeff log(t)	Std err.	t value	N	Members
Club 1	0.51	0.15	3.36	2	TR42,TR51
Club 2	2.96	0.31	9.64	2	TR21,TR31
Club 3	-0.05	0.06	-0.87	12	TR22, TR32, TR33, TR41, TR52, TR61, TR62, TR71, TR72, TR81, TRA1, TRC1
Club 4	0.16	0.08	1.94	5	TR63, TR82, TR90, TRB1, TRC3
Club 5	-0.04	0.07	-0.52	2	TR83, TRA2
Club 6	4.85	1.34	3.31	2	TRB2, TRC2
Divergent				1	TR10

Coeff is the coefficient of log (t) test, std err. is the standart deviation of the coefficient. The results are obtained from using R following Sichera and Pizzuto (2019).

Table 5: Club-Merging Algorithm Results

Final Clubs	Coeff log(t)	Std err.	t value	N	Members
mClub 1 (1)	0.51	0.15	3.36	2	Club 1
mClub 2 (2)	2.96	0.31	9.64	2	Club 2
mClub 3 (3)	-0.05	0.06	-0.87	12	Club 3
mClub 4 (4)	0.16	0.08	1.94	7	Club 4 and 5
mClub 5 (5)	-0.04	0.07	-0.52	2	Club 6
mDivergent (0)				1	TR10

Coeff is the coefficient of log (t) test, std err. is the standard deviation of the coefficient. The results are obtained from using R following Sichera and Pizzuto (2019).

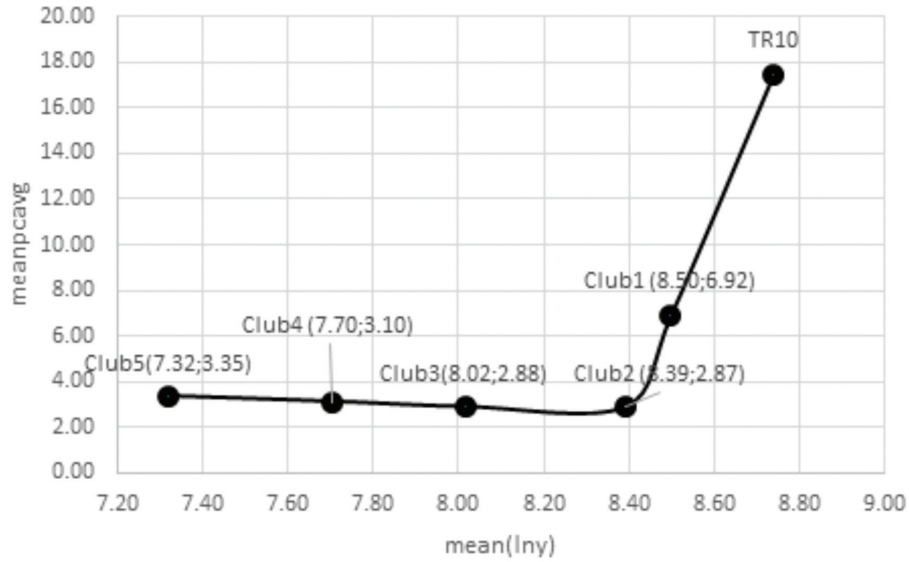

Fig. 1: Basic data of Convergence/Divergent Clubs: Real GDP per capita in 2019 and Share of Total Public Investment on Average (2005-2019)

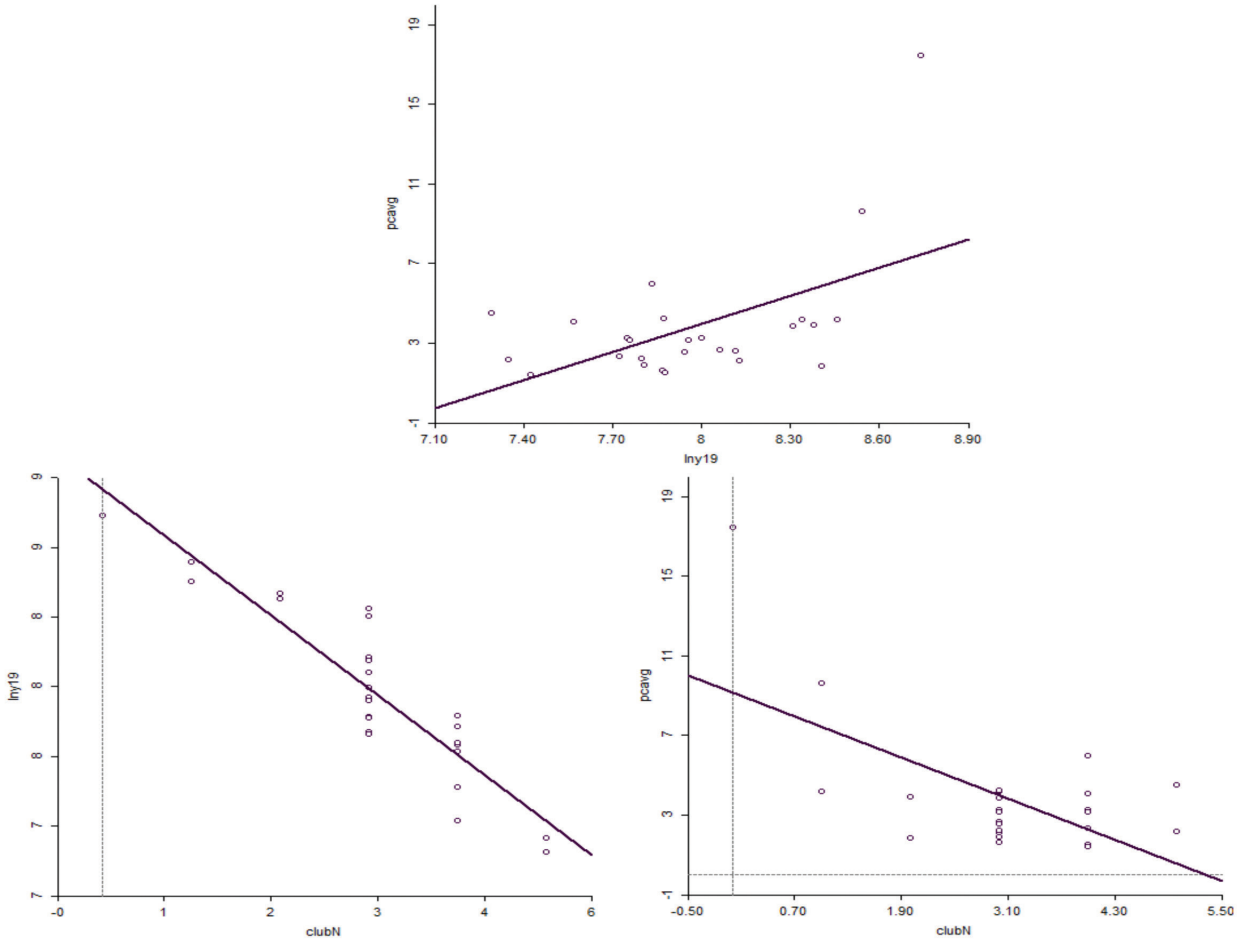

Fig. 2: The Relationship Between Log of Real GDP per capita in 2019 (lny19) and Share of Total Public Investment on Average (2005-2019) (pcavg).

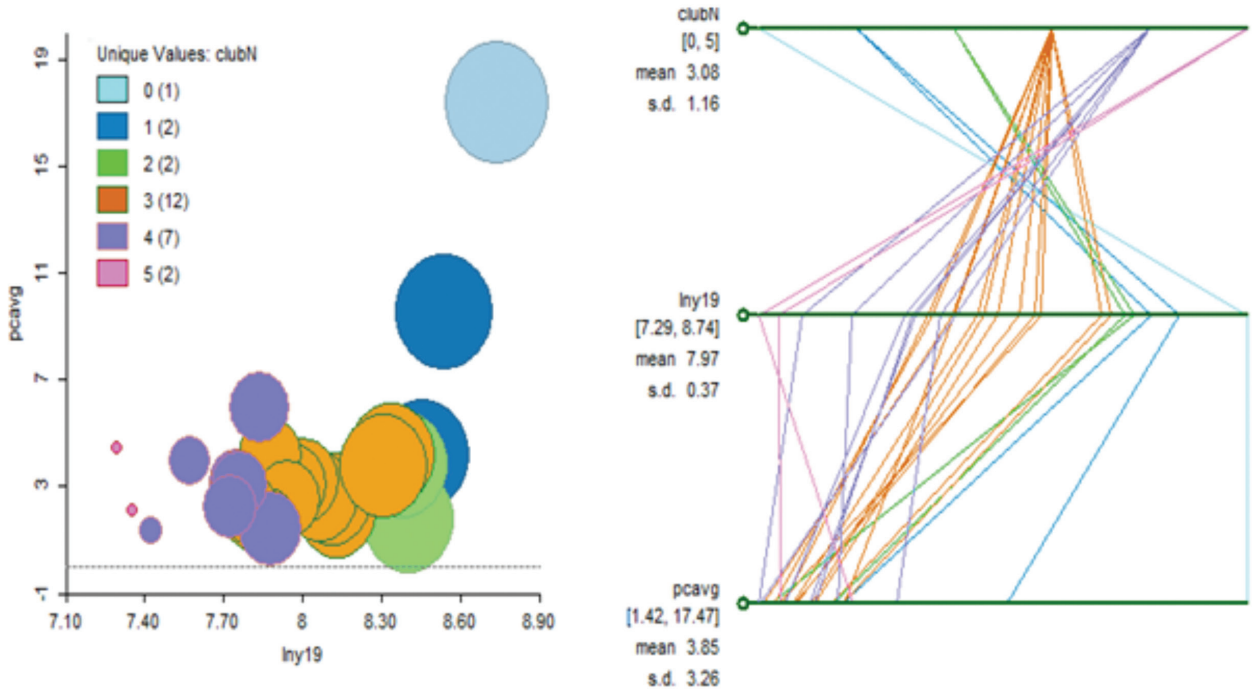

Fig. 3: The Bubble Chart and Parallel Coordinates of lny19 and pcavg.

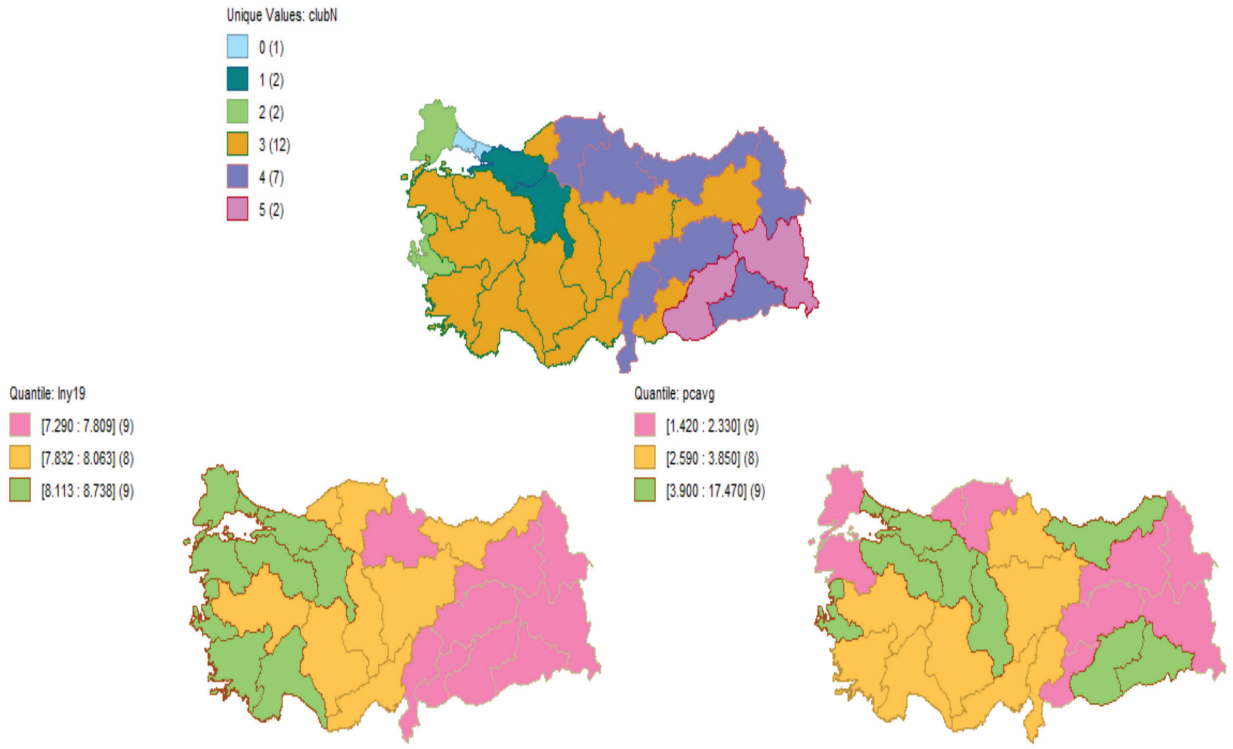

Fig. 4: The Quantile Map of Clubs, Log of Real GDP per capita in 2019 (lny19) and Share of Total Public Investment on Average (2005-2019) (pcavg).

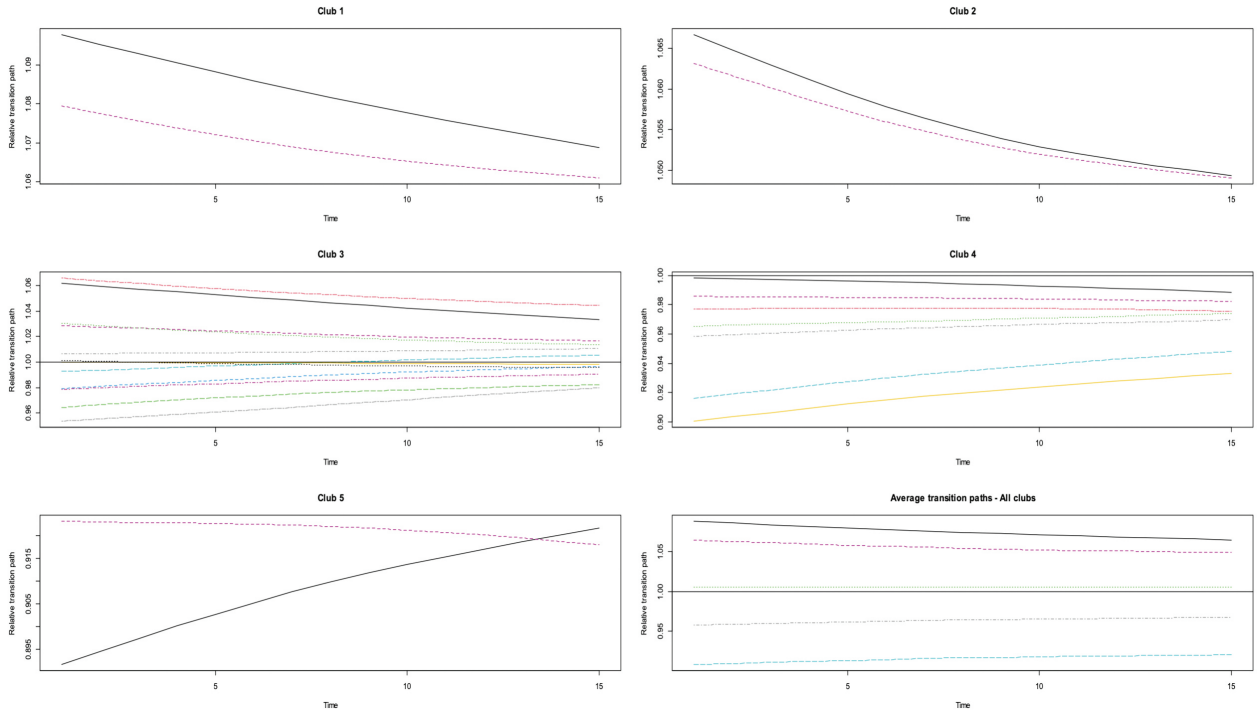

Fig. 5: The Relative and Average Transition Paths of Initial Convergence Clubs

Figure 2, the relationship between log of real GDP per capita in 2019 (lny19) and share of total public investment on average (2005-2019) (pcavg), highlights the positive relationship between income and share of public investments distribution as in Figure 1. Also, Figure 2 shows that convergence clubs and their member's classification in terms of lny19 and pcavc variables.

The bubble chart and parallel coordinates plot of lny19 and pcavg are illustrated in Figure 3. According to Figure 3, as in Figure 1 and Figure 2, clubs with high income level have a relatively high amount of share of public investment. Therefore, the bubble chart shows that public investment expenditures are not aimed to reduce regional inequalities in the country. The parallel coordinates graph shows that the share of public capital is not distributed equally in terms of GDP per capita. Figure also illustrates that clubs 1, 2 and TR10 (only member of divergent club) have a higher proportion of public investment rates on average than others.

The members of convergence and divergent clubs are colored in Turkey's NUTS II level map and quantile map also shown for income and share of public investment data in Figure 4. Although there are neighboring regions within the same clubs, there are cases where non-neighboring regions are also located in the similar clubs. On the other hand, according to Figure 4, most of the regions have high level of public investments with high income levels, but in some cases vice versa. It also supports the unequal distribution of public capital.

Figure 5 illustrates relative transition parameters and paths for club members and average transition parameters and paths of convergence clubs, respectively. These parameters in the figure calculated from log of real GDP per capita for the 26 sub regions over the period 2005 to 2019 after eliminating the business cycle following Phillips and Sul (2009). Figure shows how regions' real GDP per capita approach their steady state of each club.

Figure 5 also indicates that relative transition paths get closer over time which is the signal of convergence. However, average transition paths of clubs in the figure shows that the speed of convergence over time is quite low between clubs which may be a signal of multiple equilibria or invalidity of absolute convergence. Despite the low speed of convergence with respect to average transition paths of clubs in the figure, as stated in the introduction section public capital investment has the capacity to achieve convergence. However, Figure 1-4 and Table 2 illustrate that public investments are not used to reduce regional income differences. Therefore, share of public capital may be a distinguishing structural factor, for conditional convergence. For this purpose, this study also tests the conditional and unconditional convergences.

System GMM (Sys-GMM) test results are indicated in Table 6. We obtained the Sys- GMM results by using the written STATA modules (Roodman, 2009). The Arellano & Bond (AR (#)) test developed by Arellano & Bond (1991) tests the hypothesis of no correlation in the series. Therefore, the high probability value of the AR(2) test statistic is important for the estimator to give reliable results. In this study, if the probability value of the AR(2) test statistic is less than 0.05, the number of lags that can be used for the dependent variable is increased. If the problem persists, the number of lags that can be used for the independent variables has been increased. In this way, the appropriate number of lags was determined. The most important difference of the Sys-GMM estimator, outlined by Blundell & Bond (1998) and Arellano & Bover (1995), from the Arellano & Bond (1991) Difference-GMM estimator is that it relies on estimating a two-equation regression system in levels and first differences in order to increase efficiency (Roodman, 2006).

According to Table 6, public capital is statistically significant at 5 % level with a positive sign. However, it has a low impact on growth because of the low magnitude of coefficient. Meanwhile, as stated in the conditional convergence framework, the results revealed that negative relationship exists and is statistically significant at 5 % level between real income and growth rate. This result is consistent with the literature and theoretical framework for conditional convergence. Therefore, after accepting that the share of public capital is an important structural factor, conditional convergence is valid for NUTS II regions in Turkey during the period 2005-2019. However, the unconditional convergence findings revealed that there is no significant relationship between real income and growth rate. Besides, the coefficient of the real income is positive which indicates the divergence. This result is consistent with Figure 5.

Table 6: Sys-GMM Results

Dependent Variable is Growth	Conditional Convergence Sys-GMM Results				Absolute Convergence Sys-GMM Results			
	Coef	Std. Err.	t- stat	prob.	Coef	Std. Err.	t- stat	prob.
c	3.39	1.26	2.68	0.01	0.48	0.44	1.09	0.28
y_{t-1}	-0.35	0.16	-2.1	0.04	0.03	0.06	0.53	0.59
pc_{t-1}	0.014	0.006	2.2	0.03				
	Hansen-J p-value	0.18	Sargan p-value	0.02	Hansen-J p-value	0.20	Sargan p-value	0.22
Second order serial correlation (p-value of AR(2) Test)				0.26	Second order serial correlation (p-value of AR(2) Test)			0.20
All equations include year dummies. GMM is the Blundel-Bond System GMM estimator using lagged growth rates and levels as instruments, also uses levels of independent variables and share of public capital on average as instruments. Robust t-statistics are used.								

CONCLUSION

This study examines club convergence at regional level and the impact of share of public investments expenditures on conditional convergence for the period 2005 to 2019. It does so by observing 26 sub-regions (NUTS II level) in Turkey using PS, PSmerge, LT procedures to determine the convergence clubs and also System GMM estimators to test the validity of conditional and unconditional/absolute convergence. Initial empirical results show that there are six convergence clubs in Turkey and one divergent club. However, after utilizing merging algorithms proposed by PSmerge and LT, we reach five convergence clubs and one divergent club.

On the other hand, the results of Sys-GMM developed by Arellano and Bover (1995), and Blundell and Bond (1998), shows that initial GDP is statistically significant for conditional convergence, while it is not for unconditional convergence. Thus, if the club convergence or conditional convergence is not taken into consideration, divergence occurs between NUTS II regions. Additionally, public investment is found significant for the conditional convergence model, while basic data of the regional level reveal that public investment does not target to reduce regional disparities. Therefore, its impact on growth is relatively low according to the Sys-GMM results supporting the claim. This result is also compatible with the summary of the basic data (Table 2 and Figure 1-5) and literature. According to the basic data of the regions, there are some huge regional disparities in real GDP per capita and public investment expenditures distributions. Moreover, public capital investment expenditures are far from reducing regional inequalities in the country since regions with high GDP per capita receive more public investment expenditures than the regions with low GDP per capita except TR 90 (Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane). Club averages from the basic data also highlights the positive relationship between income and share of public investments distribution which is another important signal that the public capital is not aim to reduce regional disparities. Additionally, the parallel coordinates graph of the clubs in the empirical findings also shows that the share of public capital is not distributed equally in terms of GDP per capita. Moreover, Clubs 1, 2 and TR10 (member of the divergent club) have higher proportion of public investment rates on average than others. These findings are compatible with the results of Karadağ, Önder, and Deliktaş (2004, 2007) for Turkey. They argue that public capital has no or low impact on convergence as Turkey invests in less developed regions without considering the rate of return and the effectiveness of public capital.

Overall, the results support that the government does not use public capital as a tool to reduce regional disparities. On the other hand, one of the underlying reasons for the differentiation of structural factors between regions is public investments. Besides, the findings revealed that there is conditional convergence when the share of public investments among regions are taken into consideration. Also, the findings emphasize the existence of convergence clubs, which indicates multiple equilibria while, there is no unconditional convergence at NUTS II level in Turkey. Therefore, public capital should be used much more effectively because of its capability to reduce regional disparities. As a result, policy makers should implement policies that consider the effectiveness of public capital.

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Appendix

NUTS II Level	Province Names
TRA1	Erzurum, Erzincan, Bayburt
TRA2	Ağrı, Kars, Iğdır, Ardahan
TRB1	Malatya, Elazığ, Bingöl, Tunceli
TRB2	Van, Muş, Bitlis, Hakkâri
TRC1	Gaziantep, Adıyaman, Kilis
TRC2	Şanlıurfa, Diyarbakır
TRC3	Mardin, Batman, Şırnak, Siirt
TR10	İstanbul
TR21	Tekirdağ, Edirne, Kırklareli
TR22	Balıkesir, Çanakkale
TR31	İzmir
TR32	Aydın, Denizli, Muğla
TR33	Manisa, Afyonkarahisar, Kütahya, Uşak
TR41	Bursa, Eskişehir, Bilecik
TR42	Kocaeli, Sakarya, Düzce, Bolu, Yalova
TR51	Ankara
TR52	Konya, Karaman
TR61	Antalya, Isparta, Burdur
TR62	Adana, Mersin
TR63	Hatay, Kahramanmaraş, Osmaniye
TR71	Kırıkkale, Aksaray, Niğde, Nevşehir, Kırşehir
TR72	Kayseri, Sivas, Yozgat
TR81	Zonguldak, Karabük, Bartın
TR82	Kastamonu, Çankırı, Sinop
TR83	Samsun, Tokat, Çorum, Amasya
TR90	Trabzon, Ordu, Giresun, Rize, Artvin, Gümüşhane

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The Relationship Between Foreign Direct Investment, Economic Growth, Energy Consumption and Co2 Emissions: Evidence from ARDL Model with a Structural Break for Turkey

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ABSTRACT

This paper investigates the impact of foreign direct investments, energy consumption and economic growth on CO2 emissions in Turkey for the period of 1974-2015 by using autoregressive distributed lag (ARDL) model with a structural break. The robustness of the model is tested by using FMOLS, DOLS and CCR estimators. The findings reveal a long-run relationship between the variables, and show that FDI contributes positively to CO2 emissions, validating pollution haven hypothesis. Economic growth (measured by GDP) has a significantly positive relationship with CO2 emissions whereas impact of its squared on CO2 emissions is also significant but negative which confirms Environmental Kuznets Curve (EKC) hypothesis. Energy consumption is also positively associated with CO2 emissions, implying that larger levels of energy consumption lead to a higher environmental degradation. The dummy variable including the structural break is similarly statistically significant and positive. It is concluded that because of FDI inflows engender an increase in carbon emissions, Turkey should adopt cleaner technologies to avoid environmental pollution.

Keywords: CO2 emissions, pollution haven hypothesis, foreign direct investment, energy, economic growth.

JEL Classification Codes: O13, O44, Q56

INTRODUCTION

Environmental issues in economics are typically ignored until the late 1980s, but the topic has secured an increasing interest among economists for a few decades. The environment which we live in is affected by various sorts of economic activity. The industry, households, governments, the institutions and the state of technology altogether construct an economy that operates within the environmental system. The environment provides the aforementioned economic system with inputs of raw materials, energy and natural resources which are eventually transformed by economic system into outputs (Hanley et al., 2013). As a result, the environment is regarded as an economic asset that is crucial to the operation of the economic system. Although the higher economic activity may lead major improvements in human life, it arises through a tradeoff in use of environmental resources, resulting in increased scarcity (Barbier, 2011). The depletion of natural resources is a matter of interest and it is widely acknowledged that economic activity is in some forms are related with this depletion. Natural resources are becoming increasingly scarce over time and thus it is important to consider how to leave a clean and safe environment for future generations. The extensive interest on the awareness on environmental degradation has found an expansion area with the influential paper of Grossman and Krueger (1991) which assumes an inverted-U shaped relationship between income and environmental pollution. However, the ongoing debate on the nexus between income and environmental pollution is still contentious (Panayotou, 1997; Stern, 2004; Apergis and Payne, 2009). Obviously, income is not the sole factor in influencing environmental quality. Several other factors such as exponential energy consumption (Menyah and Wolde-Rufael, 2010; Zakari et al., 2021), foreign direct investment inflows (He, 2006; Tang, 2015; Solarin et al., 2017), trade openness (Shahbaz et al., 2013b; Zhang et al., 2017), urbanization (Hossain, 2011; Lv and Xu, 2019), corruption (Cole, 2007; Sinha et al., 2019; Go et al., 2021) and financial development (Sadorsky, 2011; Omri et al., 2015; Bekhet et al., 2017) are also directly related with the environmental quality of a country.

Turkey has experienced a significant increase in energy consumption, CO2 emissions and foreign direct investments during the last few decades. CO2 emissions (metric tons per capita) have been almost quadrupled in the last five decades. CO2 emissions were measured as 1.22 metric tons per capita in 1970, and the employed quantity was 5.01 metric tons per capita in 2018. Greenhouse gas emissions of Turkey increased significantly during the period of 1990-2010, primarily

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due to CO2 emissions, and according to Carbon Dioxide Information Analysis Center (CDIAC) of the United Nation (UN)'s data of 2008, Turkey was among the top 25 CO2 emitting countries in the world (Seker et al., 2015; Mutafoglu, 2012). The noticeable increase in CO2 emissions is mostly induced by increased rate of energy consumption. In 1970, the energy consumption has measured as 522.2 kg of oil equivalent per capita and it was estimated as 1651.3 kg of oil equivalent per capita in 2015 (World Bank, 2022). According to the International Energy Agency, the industry in Turkey is highly energy-intensive and is admitted as one of the most energy-intensive among OECD countries (Isiksal et al., 2019). Although, it has had some fluctuating performances, particularly during periods of crisis, foreign direct investment inflows have followed a similar path, with FDI (foreign direct investment) inflows accounting for 34 percent of GDP in 1970 and 105 percent of GDP in 2020. A brief glance to Turkish economy reveals that it has encountered several structural changes during the last half-century. In the early 1980s, Turkey has started to implement liberalization policies which resulted in significant economic growth emanated by considerable increase in international trade, financial sector inflows and foreign direct investments. This makes Turkey as an important case involving the relevant variables.

As a major tool on transferring technology, financial capital and other skills, foreign direct investments (FDIs) have three types of impacts on host country that they are economic political and social. The political effects focus mostly on the insecurity of national independence and the social effects are primarily concerned with the possibility of cultural transformation of society and creation of foreign elite in host country. Economic effects, on the other hand, imply a variety of outcomes in terms of output, the balance of payments and market structure (Moosa, 2002). The majority of the studies agree that FDI contributes to economic growth via providing capital, increasing productivity, creating new job probabilities and boosting competitiveness (De Mello, 1999; Mallampally and Sauvant, 1999; Hermes and Lensink, 2003; Batten and Vo, 2009; Faras and Ghali, 2009; Alfaro et al., 2010; Chee and Nair, 2010; Choong et al., 2010; Lee, 2013; Iamsiraroj, 2016). However, some studies have explained that there is no direct impact of FDI on growth (Carkovic and Levine, 2002; Durham, 2004) or the occurrence of positive effects of FDI on welfare and growth requires the presence of other factors or preconditions, such as a specific level of human capital stock or adequate level of investment in the absorption of foreign technologies and skills (Borensztein et al., 1998; Blomström and Kokko, 2003; Mencinger, 2003; Akinlo, 2004). Although the nexus between foreign direct investment and growth is highly debated, the economic effects of FDI mainly neglect to consider environmental issues (Pazienza, 2014). However, there is a direct impact of FDI on environmental degradation and the contributions on this area have extended during the last decades.

We investigate the impact of foreign direct investments, energy consumption and economic growth on CO2 emissions by using autoregressive distributed lag (ARDL) modeling approach to cointegration with a structural break. The study assumes that there is at least one structural break in certain specific periods for each variable because the investigation spans a reasonably long-period. The main aim of the study is to explore the relationship between environment, foreign direct investments, economic growth and energy consumption by including a structural break to the analysis. The study also aims to explain whether pollution haven hypothesis is valid by investigating the impact of FDI on CO2 emissions. Although there are several studies using ARDL methodology, this study differs from the literature by including a structural break to ARDL model as an exogenous variable. The following chapter includes a literature review on the nexus of related variables. The third chapter presents the basic methodologies used in the analysis and continues with the findings. The study is finalized with conclusion chapter.

LITERATURE REVIEW

Environmental degradation related issues such as energy consumption, economic growth, foreign direct investment, financial development or trade openness are highly popular among economists and there are increasing number of studies attempting to explore new aspects of this area. Several new theories have emerged as a result of the contribution of these studies. The investigation of the relationship between income and environment has caused Environmental Kuznets Curve (EKC) to be discovered which suggests an inverted-U shaped association between economic growth and environmental degradation (Grossman and Krueger, 1991). Some studies have validated EKC hypothesis (Acaravci and Ozturk, 2010; Ren et al., 2014; Boluk and Mert, 2015; Shahbaz et al., 2018), whereas others have found no support for it (Chandran and Tang, 2013; Al-Mulali et al., 2015; Dogan and Turkekul, 2016). The relevant literature on Turkey has also yielded conflicting results. Gurluk and Karaer (2004)'s study is among the first which investigates the relationship between economic growth and CO2 emissions, and they find an inverted-U type relationship over the period 1975-2000. Basar and Temurlenk (2007), on the other hand, discover an N-shaped relationship and find no evidence for the validity of EKC hypothesis in Turkey between 1950 and 2005. By using the Johansen cointegration methodology, Akbostanci et al. (2009) find a unique long-run relationship between economic growth and CO2 emissions, but reject the validity of EKC hypothesis and suggest a monotonically increasing relationship for the period of 1968-2003. Katircioglu and Katircioglu (2018) support the increasing relationship for Turkey in the period of 1960-2013, demonstrating that the association between economic growth and CO2 emissions is not inverted-U shaped. By using an ARDL approach, Halicioglu (2009) proposes a long-run relationship between economic growth and CO2

Table 1. Studies on the relationship between GDP, EC, FDI and CO2 emissions for Turkey

Author(s)	Period	Variables	Methodology	Results
Halicioglu (2009)	1960-2005	GDP, CO_2, EC, TRA	ARDL bound test	No support on EKC hypothesis.
Ozturk and Acaravci (2010)	1968-2005	GDP, CO_2, EC, EMP	ARDL bound test	No evidence on supporting EKC hypothesis.
Mutafoglu (2012)	1987-2019	GDP, CO2, FDI	Johansen cointegration, Granger causality	No evidence of FDI-led growth and supporting evidence on PHH.
Kocak (2014)	1960-2010	GDP, CO2	ARDL bound test	EKC hypothesis is not supported in the long-run.
Balibey (2015)	1974-2011	GDP, CO2, FDI	Johansen cointegration test, Granger causality	A long term relationship exists between variables and an increase in FDI causes an increase in CO2 emissions.
Seker et al. (2015)	1974-2010	GDP, CO_2, EC, FDI	ARDL, ECM, Granger causality	Although it is relatively small, FDI has positive impacts on CO2.
Gokmenoglu and Taspinar (2016)	1974-2010	GDP, CO_2, EC, FDI	ARDL bound test, Toda-Yamamoto causality	Economic growth, energy consumption and foreign direct investments are long-run determinants of environmental degradation.
Kaya et al. (2017)	1974-2010	GDP, CO2, FDI, TRA	ARDL, Granger causality	FDI has a negative impact on CO2 in short run, but affects positively in long run.
Kilicarslan and Dumrul (2017)	1974-2013	CO2, FDI	Johansen cointegration test, VECM model	PHH is valid.
Kizilkaya (2017)	1970-2014	GDP, CO_2, EC, FDI	ARDL bound test.	No significant relationship between FDI and CO2 emissions.
Ozturk and Oz (2017)	1974-2011	GDP, CO_2, EC, FDI	Maki cointegration test, Granger causality	EKC hypothesis is valid. FDI has positive effects on environment, validating pollution halo hypothesis both in long- and short-run.
Kocak and Sarkgunesi (2018)	1974-2013	GDP, CO2, FDI, EC	Maki cointegration test, DOLS, Hacker and Hatemi-J test	Long-run relationship between the variables and pollution haven hypothesis is valid in Turkey.
Haug and Ucal (2019)	1974-2014	GDP, CO2, FDI, TRA, POP, FD	Linear and non-linear ARDL	Increases in FDI have no significant impacts on CO_2 emissions in long-run. Increases in imports cause an increase in CO2.
Isiksal et al. (2019)	1980-2014	GDP, CO_2, EC, FDI, TRA, RIN	ARDL bound test, Hatemi-J cointegration test	The EKC hypothesis and PHH are valid.
Mert and Caglar (2020)	1974-2018	FDI, CO2	Hidden cointegration tests	Increases in FDI cause a decrease in CO2 both in long and short-run. Supports the validity of asymmetric pollution halo hypothesis.
Bildirici (2021)*	1975-2017	GDP, CO_2, EC, FDI, TER	Pedroni, Kao and Westerlund cointegration tests	FDI contributes to GDP and increases environmental pollution.
Agboola et al. (2022)	1970-2020	GDP, CO_2, EC, FDI, URB	Dynamic ARDL	Supports the validity of PHH in short run and the pollution halo in long run.

*This paper investigates not only Turkey, also three other countries (China, India and Israel). Explanations for variables are GDP= economic growth, EC= energy consumption, CO2= Carbon dioxide emissions, FDI= foreign direct investment, TR= trade openness, EMP= employment, CF= capital formation, POP= population density, RIN= real interest rates, URB= urbanization, TER= terrorism, FD= financial development.

emissions. However, the findings of the study do not support EKC hypothesis. Omay (2013) and Tirgil et al. (2021) find an N-shaped relationship for Turkey which contradicts EKC hypothesis. Ozcan et al. (2018) also find no evidence on supporting EKC for the period of 1961-2013 for Turkey. Balibey (2015) finds an inverted-U shaped relationship, but after a turning point, when increased income causes an increase in pollution, the association becomes an N-shaped in long-run. Pata (2018, 2019), on the other hand, confirms EKC hypothesis for Turkey by using both ARDL and bootstrap ARDL cointegration tests. There are also several more studies for Turkey that

employ a variety of other variables for environment such as SO2 (Elgin and Oztunali, 2014; Karahasan and Pinar, 2021; Tirgil et al., 2021) or ecological footprint (Dogan et al., 2020; Sharif et al., 2020; Bulut, 2021) and the findings of these studies are also contradictory. The findings of Elgin and Oztunali (2014), Sharif et al., (2020) and Bulut (2021) support EKC hypothesis, whereas Dogan et al. (2020) find no evidence for it. Finally, Karahasan and Pinar (2021) find a U-shaped relationship between economic growth and environment, while Tirgil et al. (2021) assume an inverted N-shaped relationship.

There have also been numerous studies on the relationship between environmental degradation and energy consumption, with income being one of the key variables in these analyses. The interrelated relation between these variables has caused the expansion of the literature. Kraft and Kraft (1978)'s influential paper on economic growth and energy consumption is one of the early papers and it resulted in a considerable increase in studies on environmental degradation. Soytas (2007) for the U.S., Menyah and Wolde-Rufael (2010) for South Africa, Zhang and Chang (2009) for China, Pao and Tsai (2010) for BRIC countries, Alam et al. (2012) for Bangladesh, Chandran and Tang (2013) for ASEAN-5 economies, Shahbaz et al. (2013a) for Indonesia, Boutabba (2014) for India, Al-Mulali et al. (2015) for Vietnam, Alshehry and Belloumi (2015) for Saudi Arabia, Omri et al. (2015) for MENA countries, Gokmenoglu and Taspinar (2016) and Balli et al. (2020) for Turkey, Ssali et al. (2019) for 6 Sub-Saharan African countries, Bekun et al. (2019) for South Africa, Adebayo and Akinsola (2021) for Thailand, Abbas et al. (2021) for Pakistan and Ahmed et al. (2022) for 22 OECD countries are some examples of these studies. Most basically, higher energy demand is linked to higher environmental pollution in these studies and they found a causal relationship between energy consumption and environmental pollution.

The studies concerning the relationship between foreign direct investment and carbon emissions are abundant. A large number of these studies support the idea that increased foreign direct investment leads to an increasing rate of environmental degradation, especially if the environmental regulations are inadequate or non-existent (Pazienza, 2014). This concept is known as *pollution haven hypothesis* and scientific studies have been unable to provide systematic evidence of its presence and have produced controversial results. Several studies confirm the validity of pollution haven hypothesis (Bukhari et al., 2014; Shahbaz et al., 2015; Solarin et al., 2017; Mert et al., 2019; Essandoh et al., 2020; Mike, 2020; Balli et al., 2021). However, some other studies (Tamazian and Rao, 2010; Al-Mulali and Tang, 2013; Tang and Tan, 2015; Zhu et al., 2016; Jugurnath and Emrith, 2018; Salehnia et al., 2020) suggest that FDI reduces CO2 emissions, rejecting pollution haven hypothesis and arguing that FDI has positive impacts on economies of host countries. This view is mostly based on pollution halo hypothesis which contends that FDI helps developing countries to find the opportunity to improve cleaner technologies with investments on high-level research and development (Jalil and Feridun, 2011; Kocak and Sarkgunesi, 2018; Huynh and Hoang, 2019). The literature on pollution halo hypothesis is also contentious and presents a diverse nature (Balsalobre-Lorente et al., 2019; Mert and Caglar, 2020; Duan and Jiang, 2021; Kisswani and Zaitouni, 2021; Xu et al., 2021; Shinwari et al., 2022). According to He (2008), the relationship between FDI inflows and environmental pollution is significantly more complicated than a simple one-way relationship. FDI can enhance the production scale, transform the industrial structure, provide technical requirements and support host country to embrace advanced technology to control environmental degradation by increasing the income level. Therefore, FDI's impact on environment can be divided into three categories which are *scale, structure (composition) and technique effects* (Grossman and Krueger 1991; Copeland and Taylor 1994; Grossman, 1995; He, 2008; Pazienza 2014; Bakhsh et al. 2017). The scale effect implies the change in the scale of production which leads to a shift in pollution. The technique effect, on the other hand, depicts the change in pollution as a result of the use of environment-friendly technologies in production (Liang, 2014). The increment in the scale of the production will cause higher pollution levels, indicating that the scale effect is predicted to be hazardous to the environment. The technique effect refers to the utilization of cleaner technologies which are beneficial for environment (Pazienza, 2019). A growing number of studies investigate these effects. Bakhsh et al. (2017), for Pakistan during the period of 1980-2014, find that an increase in economic growth leads to an increase in pollutant emissions due to the results of technique and composition effects, using the 3SLS model. Pazienza (2019), for OECD countries, highlights the beneficial role of FDI on environment, mentioning that the scale of inflows increases, the impact of FDI decreases. He (2008), for China, concludes that scale and technique effects are the key operators of FDI's effects on environmental pollution. Pao and Tsai (2011), for BRIC countries, support the scale effect. Bin and Yue (2012), for Chinese industries, find that technological effect reduces emissions, while scale and composition effects increase emissions; however the impact of technological effect is greater than other two effects, indicating that pollution haven hypothesis is also not valid for China. Jun et al. (2018) apply the wavelet approach for China for the period of 1980-2016 and suggest that FDI causes CO2 both in short and long term and emphasize that China's participation to the World Trade Organization (WTO) in 2001 has accelerated the inflows of dirty industries, resulting in both scale and composition effects. *Table 1* denotes a literature review on economic growth, energy consumption, foreign direct investment and CO2 emissions for Turkey. As can be seen, ARDL is a common methodology among these studies. However, the results may differ. Although the majority of studies have discovered a long-term relationship between the relevant variables, the findings on both EKC and pollution haven hypotheses are controversial for Turkey.

DATA AND METHODOLOGY

The study includes the data of Turkey in the period of 1974-2015. The following model is defined to examine the relationship between CO2 emissions and foreign direct investment, economic growth and energy consumption:

$$lnCO2E_t = \alpha_0 + \alpha_1 lnFDI_t + \alpha_2 lnGDP_t + \alpha_3 lnGDP\hat{}2_t + \alpha_4 lnEnUse_t + \alpha_5 DU_t + \varepsilon_t \quad (1)$$

The data is obtained from World Bank database and the natural logarithms of the variables are taken to minimize skewness and make the relationship between economic variables more convenient to interpret. The dependent variable in the model is CO2 emissions (measured by CO2 emissions per capita) and we have four independent variables that they are foreign direct investment (measured by FDI inflows), economic growth (measured by GDP per capita), economic growth squared and energy consumption (measured by energy use per capita). DU_t is the dummy variable, denoting the break year and will be included in the model based on the results of the relevant unit root test. STATA 14.0 and EViews 12.0 software[1] are used to employ econometric analyses.

The simplest way to test unit root begins with AR(1) model which is $y_t = \rho + \alpha y_{t-1} + e_t,\ t = 1, 2\ldots$ and if ρ is left as unspecified, the null hypothesis of y_t has a unit root, H_0:α=1 and the alternative hypothesis is that H_1:α<1. When |α|<1, then y_t is a stable AR(1) process (Wooldridge, 2002, p. 578). Two of the most common unit root tests are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests (Dickey and Fuller, 1979; Phillips and Perron, 1988). ADF is primarily concerned with the estimation of α. The null hypothesis is defined as α=0 and the alternative hypothesis is α<0. Δ denotes the first difference and t is the time trend (Glynn et al., 2007):

$$\Delta y_t = \rho + \beta_t + \alpha y_{t-1} + \sum_{i=1}^{k} c_i \Delta y_{t-1} + e_t$$

We chose the optimal lag length according to the Schwert (1989)'s rule of thumb for determining the upper bound for k (k_{max}). Then, $k_{max} = 12\,(\frac{T}{100})^{1/4}$.

Zivot-Andrews unit root test with one structural break is then used. Although Dickey and Fuller (1979, 1981)'s unit root testing procedure is one of the most common methodology in economics, as Nelson and Plosser (1982) pointed out, current shocks will have a permanent effect on long-run level of most macroeconomic variables. Zivot and Andrews (1992) have developed Perron (1989)'s methodology and Perron (1989)'s unit root test allows a structural break for three alternative models. The crash model (A) allows for a shift in the intercept; the changing growth model (B) undertakes the change in the trend. The third model (C), on the other hand, considers the change both in the intercept and the trend. The null hypothesis of Perron test investigates whether the variable contains a unit root with drift by allowing an exogenous structural break at a time $1<T_B<T$. The alternative hypothesis is that the series is trend-stationary which denotes a one-time break in trend variable at time T_B. Zivot and Andrews (1992, p. 28) treat the structural break (T_B) as an endogenous occurrence and construct their regression equations to test unit root as;

$$y_t = \hat{\mu}^A + \hat{\theta}^A DU_t\left(\hat{\lambda}\right) + \hat{\beta}^A t + \hat{\alpha}^A y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^A \Delta y_{t-j} + \hat{e}_t(A)$$

$$y_t = \hat{\mu}^B + \hat{\gamma}^B DT_t^*\left(\hat{\lambda}\right) + \hat{\beta}^B t + \hat{\alpha}^B y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^B \Delta y_{t-j} + \hat{e}_t(B)$$

$$y_t = \hat{\mu}^C + \hat{\theta}^C DU_t\left(\hat{\lambda}\right) + \hat{\beta}^C t + \hat{\gamma}^C DT_t^*\left(\hat{\lambda}\right) + \hat{\alpha}^C y_{t-1} + \sum_{j=1}^{k} \hat{c}_j^C \Delta y_{t-j} + \hat{e}_t(C)$$

DU_t is the dummy variable which implies a shift in intercept and DT^*_t defines a shift in the trend occurring in time T_B. $DU_t(\lambda)$=1 if t>T_B and 0 otherwise. $DT^*_t(\lambda)$=t-T_B if t>T_B, 0 otherwise. Similar to Perron (1989)'s approach, Model A includes a one-time shift in the intercept. Model B is concerned with the change in a broken trend. Finally, model C checks the stationarity of the series by taking into account the change of both intercept and broken trend (Rahman and Saadi, 2008).

After employing the unit root tests, we used Pesaran & Shin (1998) and Pesaran et al. (2001)'s autoregressive distributed lag (ARDL) model to investigate long- and short-run cointegration between variables. Since ARDL model is more indifferent whether the variables are stationary at $I(0)$ or $I(1)$, it is more effective than the previous approaches. Thus, we rewrite the equation (1) in ARDL model form is shown below:

$$\Delta InCo2E_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1,i} \Delta InCo2E_{t-i} + \sum_{i=0}^{q} \alpha_{2,i} \Delta InFDI_{t-i} +$$

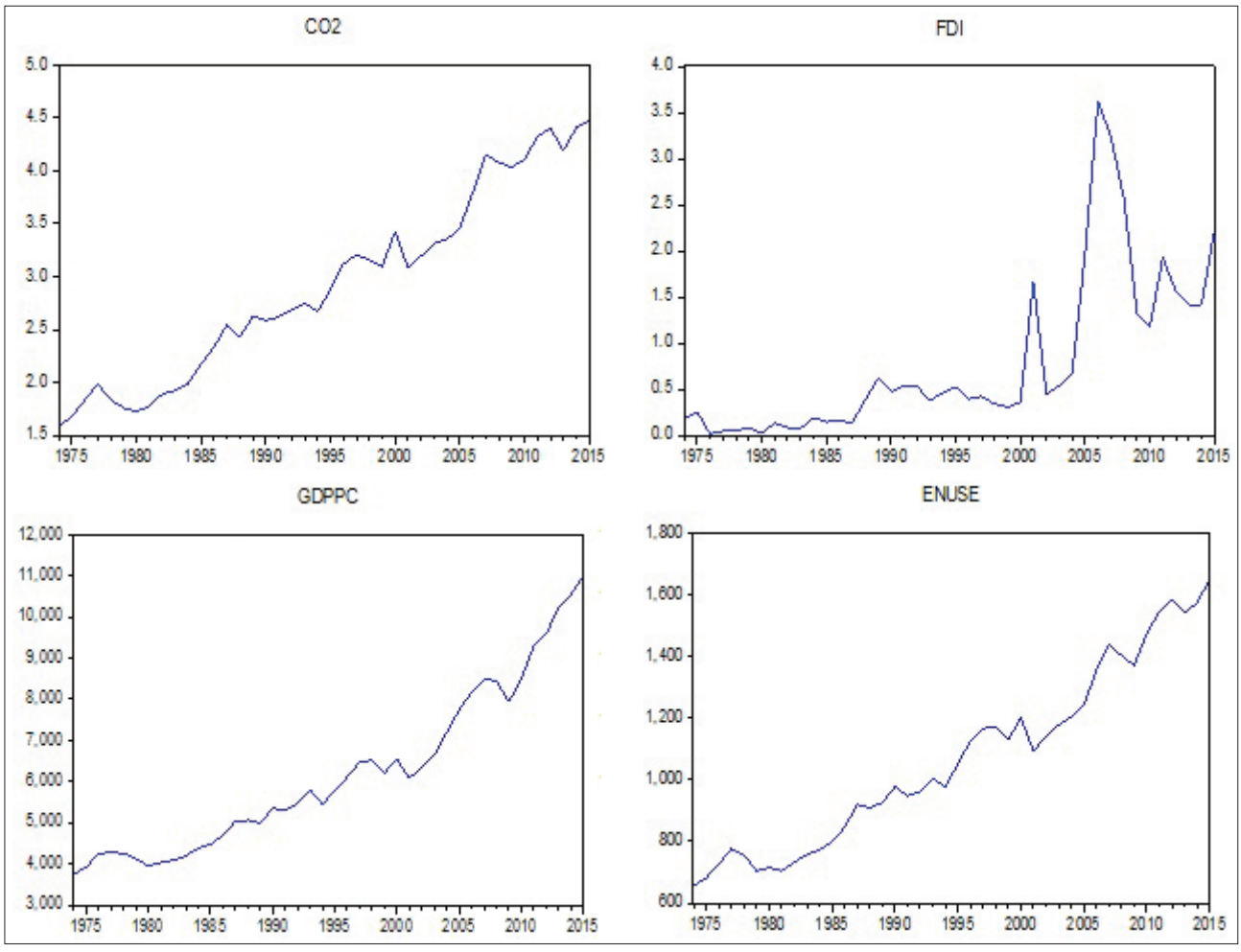
$$\sum_{i=0}^{v} \alpha_{3,i} \Delta lnGDPpC_{t-i} + \sum_{i=0}^{y} \alpha_{4,i} \Delta lnGDPpC\hat{}2_{t-i} + \sum_{i=0}^{w} \alpha_{5,i} \Delta lnEnUSE_{t-i} +$$

$$\alpha_6 DU_j + \alpha_7 lnFDI_{t-1} + \alpha_8 lnGDP_{t-1} + \alpha_9 lnGDP\hat{}2_{t-1} + \alpha_{10} lnEnUse_{t-1} + \nu_t$$

According to the test, the null hypothesis which implies no cointegration, H_0:α_6=α_7=α_8=α_9=α_{10}=0 and the alternative hypothesis is H1: $\alpha_6 \neq \alpha_7 \neq \alpha_8 \neq \alpha_9 \neq \alpha_{10} \neq 0$.

Finally, we employed Phillips and Hansen (1990)'s Fully Modified OLS (FMOLS) and Stock and Watson (1993)'s Dynamic OLS (DOLS) regressions to obtain efficient results for cointegrated variables. Both regressions are useful long-run estimators as they do not include endogeneity, small sample bias and serial correlation (Ahmad and Du, 2017). The robustness of the coefficients is assessed by using Park (1992)'s Canonical Cointegrating Regression

[1] ADF and PP unit root tests and FMOLS, DOLS regressions and CCR are estimated with EViews, Zivot-Andrews unit root tests and ARDL model are ran with Stata, and ARDL model is estimated by using Kripfganz & Schneider (2018)'s ARDL command. The optimal lag is chosen automatically due to the Akaika Information Criteria. For detailed information on the step of the analysis, see Kripfganz & Schneider (2018).



(CCR) which permits asymptotic Chi-square testing together with normal mixture distribution and deals with the problem of nonscalar nuisance parameters (Khan et al., 2020).

FINDINGS

The graphs depict the performances of time-series variables. As can be seen, CO2 variable has tended to decline, especially prior to the 1980 liberalization policies and following the 2001 economic crisis. FDI, on the other hand, has increased dramatically since the early 2000s. However, the performance of FDI is more volatile than the performance of other variables in the study. GDP and energy consumption variables also denote an increasing pattern and show a similar performance like CO2 emissions.

The findings of the traditional unit root tests (ADF and PP) revealed that the variables are stationary at their first difference, with the exception of FDI. FDI is stationary at I(0) at 1% level of significance. The findings indicate that CO2 emissions, GDP, GDP^2 and energy consumption variables are stationary at their first difference at the 1% level of significance. The assumption of null hypothesis of these tests assumes that the variable is non-stationary, while the alternative hypothesis implies the stationarity of the variable. We performed the unit root tests with a model including both trend and intercept, and the findings are summarized in *table 2*. The results confirm the applicability of ARDL model which is indifferent to the stationarity of the variables at $I(0)$ or $I(1)$.

Then, we employed Zivot-Andrews unit root test with a structural break and the findings are shown in *table 3*. Zivot-Andrews unit root test results demonstrate that all series are stationary in their first difference at least at 1% significance level both in model A and in model C. The results reveal that FDI is stationary at $I(0)$ at 5% level of significance in model A and model C and I(0) at 1% level of significance in model B. According to model C, which includes both the change in time trend and intercept, the statistically significant time break for $CO2$ emissions is 1981, which is also the same time break for GDP variables. Turkey implemented considerable trade liberalization policies in 1980, which will have an impact on crucial variables in the following years.

After employing the unit root tests, we estimated whether some series are bound together to understand the long-run relationship between the series. ARDL bound test procedure is appropriate whether the variables are integrated of $I(0)$ or $I(1)$ (Pesaran et al., 2001). According to ARDL bound test, the null hypothesis is $H_0^F:(\alpha = 0) \cap \sum_{j=0}^{q} \beta_j = 0$ and the alternative hypothesis is $H_1^F:(\alpha \neq 0) \cap \sum_{j=0}^{q} \beta_j \neq 0$.

Table 2. The findings of ADF and PPP unit root tests

Test-stat	***Level***		***1st Difference***	
Variables	*ADF*	*PP*	*ADF*	*PP*
lnCO2E	-2.988 (0.147)	-3.111 (0.117)	-6.785* (0.000)	-8.170* (0.000)
lnFDI	-4.622* (0.003)	-4.580* (0.004)	-	-
lnGDPpC	-1.868 (0.652)	-1.868 (0.653)	-6.279* (0.000)	-6.276* (0.000)
lnGDPpC^2	-1.678 (0.743)	-1.678 (0.743)	-6.282* (0.000)	-6.279* (0.000)
lnEnUSE	-3.136 (0.111)	-3.252*** (0.089)	-6.586* (0.000)	-7.157* (0.000)

Note: *, ** and *** shows 1%, 5%, 10% level of significance, respectively. Schwarz Information criterion is used and prob-values are shown in parenthesis. Test critical values are -4.192, -3.521 and -3.191 for 1%, 5% and 10% level of significance respectively.

Table 3. The findings of Zivot-Andrews unit root test

Model A	***Level***		***1st difference***	
	t-stat	*Time break*	*t-stat*	*Time break*
lnCO2	-3.965(0)	1985	-6.655(0)*	1982
lnFDI	-5.169(0)**	1988	-9.493(0)*	1981
lnGDPpC	-2.777(0)	2004	-6.334(0)*	2003
lnGDPpC^2	-2.670(0)	2004	-6.352(0)*	2003
lnEnUse	-3.348(0)	2001	-6.391(0)	1998
Model B	***Level***		***1st difference***	
	t-stat	*Time break*	*t-stat*	*Time break*
lnCO2	-3.147(0)	1990	-6.429(0)*	1987
lnFDI	-4.939(0)*	2008	-10.146(0)*	1981
lnGDPpC	-3.155(0)	2002	-6.227(0)*	1981
lnGDPpC^2	-3.182(0)	2002	-6.227(0)*	1981
lnEnUse	-3.634(0)	1981	-6.242(0)*	1981
Model C	***Level***		***1st difference***	
	t-stat	*Time break*	*t-stat*	*Time break*
lnCO2	-4.446(0)	1985	-7.601(0)*	1981
lnFDI	-5.323(0)**	2005	-10.032(0)*	1983
lnGDPpC	-3.321(0)	2001	-6.910(0)*	1981
lnGDPpC^2	-3.352(0)	2001	-6.815(0)*	1981
lnEnUse	-3.891(0)	1985	-6.789(0)*	1982

Note: The values in parenthesis are lag orders. *, ** and *** shows 1%, 5%, 10% level of significance, respectively.

Table 4. ARDL bound test results

	Coef. (p-value)	10% I(0), I(1)	5% I(0), I(1)	1% I(0), I(1)
F-Stat	26.250 (0.000)	2.632, 3.863	3.185, 4.571	4.489, 6.228
t-stat	-10.619 (0.000)	-2.538, -3.648	-2.887, -4.054	-3.597, -4.870

Note: The critical values are belong Kripfganz & Schneider (2018).

If H_0^F is rejected, testing the null hypothesis of t-stat as $H_0^t: \alpha = 0$ versus $H_1^t: \alpha \neq 0$. The definitions of the test decisions are specified as follows: we do not reject H0F or H0t, respectively, if the test statistic is closer to zero than the lower bound of the critical values; and we reject the H0F or H0t, respectively, if the test statistic is more extreme than the upper bound of the critical values (Kripfganz and Schneider, 2018). The findings of ARDL bound test shown at *table 4* depict that the null hypothesis of no cointegration between the variables is rejected, as the F-stat and t-stat go over the upper bounds in all levels, implying the statistical evidence of the presence of long-run relationship between the variables.

Since we achieved a cointegration relationship between the variables, we then estimated the long- and short-run coefficients of foreign direct investment, economic growth, and energy consumption variables. After determining the optimal lag according to Akaike information criteria, the ARDL $(1, 0, 1, 1, 0)$ regression model is estimated. The results of the ARDL cointegration test is given at *table 5*.

As it can be seen, all of the short-run and long-run coefficients are statistically significant. The positive value of GDP per capita and the negative value of GDP per capita squared confirm the validity of EKC hypothesis for Turkey, implying that income has a positive impact on CO2 emissions until a certain income level, after which the impact reverses. In the long run, a 1% increase in energy consumption leads to a 1.01% increase in CO2 emissions. FDI variable is also statistically significant at 10% level, implying a positive contribution to CO2 emissions which supports pollution haven hypothesis in the long-run for Turkey. On the other hand, the dummy variable is also statistically significant at the 5% level, indicating that the structural break in 1981 produced an increase in CO2 emissions. It stands to reason that the implementation of liberalization

Table 5. Short and long-run coefficients of ARDL (1, 0, 1, 1, 0) model

	Coefficient	t-stat	Prob.
Long-run coefficients			
lnFDI	0,008 (0,005)	1.71	0.097***
lnGDPpC	3,257 (1.156)	2,82	0.008*
lnGDPpC^2	-0,182 (0.061)	-2,99	0.005*
lnEnUSE	1,012 (0.127)	7,98	0.000*
Short-run coefficients			
ΔlnFDI	0,009 (0,005)	1,71	0.097***
ΔlnGDPpC	9,535 (2,859)	3,33	0.002*
ΔlnGDPpC^2	-0,553 (0.163)	-3,40	0.002*
ΔlnEnUSE	1,165 (0.148)	7,85	0.000*
Dum81	0,037 (0.013)	2,76	0.010**
C	-23,685 (6,568)	-3,61	0.001*
R^2	0.875	Log likelihood	107.503
ECMt(-1)	-1,151 (0.108)	-10,62*	0.000
Diagnostic Tests			
Normality: Skewness/Kurtosis test, chi^2=1.34 (prob:0.5120)			
Serial correlation: Breusch-Godfrey LM test, chi^2=0.672(prob:0.4123)			
Heteroscedasticity: Breusch-Pagan / Cook-Weisberg test, chi^2=1.13 (prob: 0.2870)			
Functional form: Ramsey RESET test, F (3, 34)=2.21 (prob: 0.1050)			
CUSUM and CUSUMSQ: Stable			

Note: *, **, *** show 1%, 5%, 10% significance levels, respectively. The values in parentheses on coefficient column are standard errors.

Table 6. FMOLS, DOLS and CCR results[2]

	FMOLS		***DOLS***		***CCR***	
	Coef. (Std. Err.)	*t-stat (prob.)*	*Coef. (Std. Err.)*	*t-stat (prob)*	*Coef. (Std. Err.)*	*t-stat (prob)*
lnFDI	0,014 (0,006)	2,280** (0.029)	0,012 (0,006)	1,868*** (0.069)	0,014 (0,006)	2,144** (0.039)
lnGDPpC	3,269 (1,413)	2,314** (0.026)	4,019 (1,450)	2,772* (0.008)	3,027 (1,555)	1,947*** (0.059)
lnGDPpC^2	-0,191 (0,074)	-2,571** (0.014)	-0,232 (0,076)	-3,058* (0.004)	-0,176 (0,081)	-2,176** (0.036)
lnEnUSE	1,160 (0,154)	7,497* (0.000)	1,132 (0,166)	6,810* (0.000)	1,160 (0,181)	6,395* (0.000)
C	-21,021 (5,820)	-3,611* (0.000)	-24,206 (5,936)	-4,078* (0.000)	-19,965 (6,345)	-3,146* (0.003)

Note: *, ** and *** shows 1%, 5%, 10% level of significance, respectively.

policies after the early 1980s would be accompanied by an increment in energy consumption, trade and foreign direct investment, all of which could eventually influence CO2 emissions. The statistically significant and negative lagged error correction term (ECT) coefficient represents that the deviations in the short run will be ameliorated by 151% per year in the long-run which indicates that the equilibrium will be ensured in less than a year. The final lines show the diagnostic test results, and there are no heteroscedasticity and serial correlation problems in the residuals and the normality results show that the residuals follow a normal distribution. Ramsey-Reset test confirms the reliability of the functional form of the model. Finally, the CUSUM and CUSUMSQ tests confirm the stability of the coefficients. The findings of the study are consistent with the results of Mutafoglu (2012), Balibey (2015), Gokmenoglu and Taspinar (2016), Kocak and Sarkgunesi (2018), Isiksal et al. (2019) and Bildirici (2021), while the study does not support the results of Halicioglu (2009), Acaravci and Ozturk (2010), Kizilkaya (2017) and Mert and Caglar (2020) for Turkey.

The cointegrated long-run coefficients can also be denoted by several regression tests and the study utilized fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) regressions, as well as canonical cointegrating regression (CCR). Despite there are few differences in significance levels of some variables, the regression results show that all variables are statistically significant, confirming the robustness of the coefficients and bolstering the long-run results of ARDL model in terms of sign and significance for all variables. The findings of the regressions also demonstrate that all variables have significantly positive impacts on CO2 emissions, with the exception of the GDP per capita squared which is also identical in ARDL model.

CONCLUDING REMARKS

The discussion on the relationship between economic growth, energy consumption, foreign direct investment and CO2 emissions has been popular, but contentious among economists for a long time. In the most fundamental sense, it is widely accepted that increased energy consumption leads to increased economic activity, which results in a reduction in environmental quality. The impact of foreign direct investments on CO2 emissions is similarly unclear, but growing numbers of studies suggest that an increase in foreign direct investments causes environmental degradation in economies with no strict environmental policies. By using an ARDL model with a structural break, the findings of the study reveal that there is a statistically significant long-run relationship between CO2 emissions and foreign direct investment, economic growth and energy consumption. The cointegrated long-run coefficients are also investigated and the robustness of the model is checked by FMOLS, DOLS and CCR estimators. The findings confirm EKC hypothesis and validate pollution haven hypothesis for the period of 1974-2015 in Turkey. EKC hypothesis argues that the environmental degradation will diminish after a threshold of a certain income level. The pollution haven hypothesis, on the other hand, implies that an increase in foreign direct investments may reinforce environmental pollution if there are weak or non-existent environmental regulations. Finally, because the considered period is marked by series of structural changes in the Turkish economy, a structural dummy variable has been included in the analysis. The aforementioned structural break is also statistically significant and it has an increasing effect on CO2 emissions after the break year. According to the findings, policymakers in Turkey should strengthen environmental regulations and invest more on environment-friendly technologies to ensure a sustainable future.

[2] The results of FMOLS, DOLS and CCR including the dummy variable is presented at the appendix 1. According to those findings, although FDI is statistically significant in both FMOLS and CCR, it is statistically insignificant in DOLS regression.

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Appendix

Appendix 1. FMOLS, DOLS and CCR results with dummy variable

(with dummy)	***FMOLS***		***DOLS***		***CCR***	
	Coef. (Std. Err.)	*t-stat (prob.)*	*Coef. (Std. Err.)*	*t-stat (prob)*	*Coef. (Std. Err.)*	*t-stat (prob)*
lnFDI	0,010 (0,005)	1,934*** (0.061)	0,007 (0,005)	1,455 (0.154)	0,010 (0,006)	1,724*** (0.094)
lnGDPpC	2,630 (1,161)	2,266** (0.029)	3,375 (1,229)	2,745* (0.009)	2,568 (1,300)	1,975*** (0.056)
lnGDPpC^2	-0,152 (0,061)	-2,483** (0.018)	-0,193 (0,065)	-2,989* (0.005)	-0,147 (0,068)	-2,167** (0.037)
lnEnUSE	1,097 (0,127)	8,594* (0.000)	1,089 (0,139)	7,842* (0.000)	1,089 (0,152)	7,142* (0.000)
Dum81	0,034 (0,012)	2,795* (0.008)	0,033 (0,013)	2,548** (0.015)	0,034 (0,012)	2,887* (0.007)
C	-17,996 (4,794)	-3,754* (0.000)	-21,258 (5,060)	-4,201* (0.000)	-17,720 (5,311)	-3,336* (0.002)

Note: *, ** and *** shows 1%, 5%, 10% level of significance, respectively.

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From Discrete to Continuous: Garch Volatility Modeling of the Bitcoin

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ABSTRACT

The aim of the study is to determine the most appropriate discrete model for the volatility of Bitcoin returns using the discrete-time GARCH model and its extensions and compare it with the Lévy-driven continuous-time GARCH model. For this purpose, the volatility of Bitcoin returns is modeled using daily data of the Bitcoin / United States Dollar exchange rate. By comparing discrete-time models according to information criteria and likelihood values, the All-GARCH model with Johnson's-SU innovations is found as the most adequate model. The persistence of the volatility and half-life of the volatility of the returns are calculated according to the estimation of the discrete model. This discrete model has been compared with the continuous model in which the Lévy increments are derived from the compound Poisson process using various error measurements. In conclusion, it is found that the continuous-time GARCH model shows a better performance in predicting volatility.

Keywords: Volatility, GARCH, COGARCH, Compound Poisson, Lévy Process, Bitcoin, Stochastic Modeling.

JEL Classification Codes: C22, C52, C58.

INTRODUCTION

Cryptocurrencies are electronic currencies that use cryptography to secure the transactions made with it and to control the process of introducing new currencies. They are considered as a subset of alternative currencies in general and, in a narrower sense, digital currencies. Cryptocurrencies show the peculiarities of their distribution and having a public book, rather than the centralization of the control mechanism. Moreover, they are not controlled by any government, financial institution, or central bank. Therefore, the process of creating new currencies, in other words, the mechanism of money supply through emissions, does not depend on monetary and fiscal policies. New currencies, in publicly known amounts, are produced by the system they are linked to. This production is done collectively by the created system. Cryptocurrencies can be evaluated in the category of virtual currencies that are not regulated and in digital format according to the classification made by the European Central Bank. Accordingly, non-regulation states that the currency is not in a market-traded structure regulated by any official institution. However, the fact that it has a digital format indicates that money does not need to be represented theoretically with any physical material (Plassaras, 2013).

Although cryptocurrencies were initially traded in the market under the leadership of very few cryptocurrencies, they are being used by more and more people day by day due to their accepted positive features. These features can be listed as being anonymous, low transaction fees and being available anywhere with an internet connection. Blockchain technology, a technological innovation brought by cryptocurrencies and especially the predecessor currency Bitcoin, has led to transformation in many areas that affect people's lives.

Satoshi Nakamoto introduced Bitcoin to the world with an article titled "Bitcoin: A Peer-to-Peer Electronic Cash System " written in 2008. The innovation brought by Nakamoto is that it avoids double spending, with a mechanism that uses diffuse processor power that approves the transfer every 10 minutes. Nakamoto proposed a new solution to the problem of information sharing in a potentially fraudulent, insecure, and scattered processor network without using a central authority. Further, he proposed a solution to the double-spending problem using a peer-to-peer network (Nakamoto, 2008).

Nakamoto disappeared in April 2011 and despite this, the system is completely transparent and continues to perform its operations in the same manner within the framework of mathematics principles. The total speed of the Bitcoin network, which started operating in 2009, is higher than the power of the fastest computers in the world. In 2010, it was seen that Bitcoin was used for the first time in history by ordering pizza as a means of payment. Many cryptocurrencies have been derived since the first Bitcoin exchange platform, Mt-Gox, was founded. These currencies have become financial products that are

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traded on many exchange platforms and future contracts on cryptocurrencies are done in the markets. 2013 was the first turning point for Bitcoin, which was valued between $ 10 and $ 50 in 2011-2013. Rising above $ 100 in the first months of 2013, Bitcoin caught a serious break during the year and managed to reach over $ 1000 by the end of the year. This output, which is very important for the early investors of Bitcoin, was welcomed in the Bitcoin communities, while it was talked that the crypto money is now entering an uptrend period, but just two weeks later, Bitcoin, which was traded below $ 1000 again, to exceed $ 1000 for the second time. he had to wait another year or so. Bitcoin price exceeded $ 10,000 in 2017. Then, within a very short time, Bitcoin reached its highest value of $ 20,089 (btcturk.com, 2019). Now it is traded below $ 10 thousand. These price fluctuations show that the volatility in the cryptocurrency market is quite high. Therefore, the importance of modeling volatility has emerged in the cryptocurrency market.

Financial markets may act quite overdramatically, also the prices of the financial products may seem very volatile with fundamental changes. These kinds of facts have been studied over the years and are still extensively studied. Volatility as a phenomenon and a concept is at the center of modern financial markets and academic research. The link between volatility and risk has been somewhat incomprehensible, but volatility in financial markets should not be perceived as a bad thing. In fact, while naturally, existing volatility in the financial markets can be the basic structure for effective price setting, dependence in volatility refers to predictability.

The volatility studies have an extensive area in the field of financial economics. The changes in the volatility of a financial asset affect the asset pricing models used for obtaining equilibrium prices. Therefore, the mean-variance theory is a basis for investment management while derivative pricing methods are based on reliable volatility estimates. Market analysts, corporate treasurers, and portfolio managers closely monitor volatility trends since price changes can have a great impact on investment and risk management decisions.

Kalotychou et al. (2009) elaborated on the four proposals that reveal the relationship between information, volume (liquidity), and volatility. These approaches can be counted as the mixture of distributions hypothesis (MDH), the sequential information hypothesis (SIH), the dispersion of beliefs approach (DBA), and the information trading volume model (ITVM). MDH assumes that volume and volatility are simultaneously and positively related and act in partnership with a stochastic variable that is defined as the information flow. SIH shows that price volatility is predictable based on transaction volume information. The DBA approach states that financial markets involve both informed and uninformed sets of investors and that uninformed investors react to volume/price changes as if these changes include new information. On the other hand, since informed investors have homogeneous beliefs, they make transactions that reflect their prices at fair values. Therefore, uninformed investors are expected to undermine prices and make the prices highly volatile. The ITVM approach is based on the idea that volume has an important place in the information in an environment where investors receive different signals from the pricing level. Although these mentioned approaches have shortcomings, it shows that the effect of volatility on information and liquidity is indisputable.

Mandelbrot (1963) stated that the financial time series has no autocorrelated increments and are not usually stationary, but their squares present autocorrelation. Further, he showed that there exist volatility clusters which are the characteristic of financial returns mirror non-normal returns' distribution. The distribution of financial returns is not normal because of the leptokurtic shape (fat tails). The source of the volatility clusters is the direction and magnitude of the price changes. Volatility clustering occurs towards major/minor price changes after major/minor changes in both directions.

Volatility is a natural consequence of the trade that takes place with the arrival of news and the subsequent reactions of investors. After reaching information to the markets, the successive movements of market actors will force the price to reach the equilibrium point. The updates of expectations and the subsequent positions of market actors will be reflected in the liquidity of a market. Since the information flow is continuous, information, liquidity, and volatility are expected to be related.

The leverage-effect, which is introduced by Black (1976), is caused by fluctuations in prices and is assumed as one of the important stylized facts of financial time series. The leverage-effect helps to describe that unexpected negative shocks have a greater influence on the volatility than positive shocks. Thus, it can be concluded as bad news in stock markets affect volatility more than good news. Furthermore, the leverage effect shows that the volatility of an asset has asymmetric properties.

In financial studies, it is assumed that if the relationship between expected return and expected volatility is positive and future cash flow is not affected by this, the instantaneous index value will decrease and vice-versa. This situation is known as volatility feedback in the literature. This theory is based on the assumptions that there is a positive relationship between expected return and expected volatility, while at the same time volatility is being persistent. Another important topic to examine and discuss for financial time series is the long-term persistence of volatility. It is a measure of how persistent the shock of today's price will have an impact on future unconditional variance. Volatility is persistent if unconditional variance converges to infinity. The duration of volatility persistence can be measured over its half-life.

In recent years, researchers have made remarkable progress in modeling the volatility of financial markets, considering the characteristics of asset returns that were not previously considered. The time intervals between

observations of financial data are constant is one of the underlying assumptions of time-series studies. However, the changes in prices and the receiving of new information can occur at irregular time intervals.

From this point of view, Engle opened a new page in the volatility modeling in his study using the UK inflation data in 1982, and Engle won the Nobel Prize in 2003 for this work. Engle (1982) proposed that, while the unconditional variance is fixed, when the conditional variance is time-dependent, this conditional variance is a function of the squares of the residuals obtained from a conditional mean equation. In ARCH model the squares of the returns/log-returns can be used instead of the squares of the residuals. This work by Engle has taken its place in the world of economy and finance under the name of ARCH (Autoregressive Conditional Heteroskedastic). The ARCH model is important not only it considers some of the empirical findings in financial asset returns, but also it finds application in many different areas such as microeconomics, macroeconomics, electronics, computer sciences and brain wave studies. The variance prediction in the ARCH model also includes information from previous periods. The model allows defining error term variance as a function of squares of previous term error terms. The ARCH model, which was insufficient to capture some of the stylized features of the financial time series mentioned above, was developed as a generalized ARCH (GARCH) model by Bollerslev (1986). In GARCH models, the conditional variance in the instant period is not only dependent on the historical values of the error terms, but also on the conditional variances in the past. Therefore, the conditional variance is affected by both past values of residuals and conditional variance values.

Bollerslev (2010) provide an easy-to-use encyclopedic-type reference guide to the long list of ARCH acronyms. Although he has listed well over 100 variants of the original model, the GARCH model extensions are defined utilizing Hentschel's approach in "rugarch" R-package of Ghalanos (2020a; 2020b) in this paper. Furthermore, along with the discrete volatility models, this paper contains the Lévy Driven Continuous GARCH (COGARCH) model, which is introduced to the literature by Klüpellberg et al (2004). COGARCH model is applied via R-based software "yuimagui" developed by Iacus and Yoshida (2018).

In this study, the eight extensions of discrete GARCH-type and Lévy Driven COGARCH models are utilized to model the volatility of Bitcoin returns. Volatility is estimated using discrete and continuous GARCH models and forecasting performances are measured. For this purpose, this paper is organized as follows. The paper first starts with a section with a short literature review on Bitcoin volatility studies. In the third section, the features of the discrete-time GARCH model and the extensions of this model are examined in detail. Afterward, the continuous-time GARCH model is introduced in the fourth section. In the following chapters, the descriptive of the data set and the findings of applied models are given, respectively. The study is ended with a brief conclusion part.

LITERATURE REVIEW

Naturally, studies in this area have accelerated with the rapid increase of the value of Bitcoin and the volume of the cryptocurrency market. Especially the introduction of other cryptocurrencies in the financial markets under the leadership of Bitcoin and the development of regulations for cryptocurrencies have gradually increased the number of studies. From this part of the study, the abbreviation BTC has been used for Bitcoin. Studies on BTC volatility can be briefly listed as follows.

Chen et al. (2016) conducted an econometric analysis of Crypto Money Index (CRIX) returns in their study. The CRIX index is created from the 30 most traded cryptocurrencies in the market. ARIMA-GARCH model was applied for conditional mean and variance on CRIX index returns. At the same time, the volatility relationship between CRIX, Exact CRIX (ECRIX) and Exact Full CRIX (EFCRIX) indices, which are from the CRIX family, was estimated by multivariate GARCH models. They concluded that student-t GARCH(1,1) satisfied the best fit in the univariate case and DCC-GARCH(1,1) was the proper process to show the volatility clustering and time-varying covariances between three CRIX indices.

Dyhrberg (2016) estimated the BTC volatility by using the GARCH model in his study of variables such as exchange rate and gold in addition to the BTC variable and concluded that BTC showed that it could be used as a hedging tool for investors who avoided risk due to bad news expectations.

Bouri et al. (2017a) examined the relationship of BTC with other assets such as gold, oil, general commodity index and US Dollar. GARCH volatility model was used in the study and, unlike Dyhrberg (2016), it was found that BTC has a weak hedge structure. Analyzes show that BTC can serve as an effective diversifier in some cases. The study also concludes that BTC is a safe harbour against weekly excessive fluctuations in Asian stocks.

Bouri et al. (2017b) examined the return-volatility relationship in the Bitcoin market around the price crash of 2013 using symmetrical and asymmetrical GARCH models. They examined the relationship between the GJR-GARCH model, which is an asymmetric model, and the volatility of the BTC series before and after 2013. After their comparison, they found that the GJR-GARCH model explained BTC returns better volatility. At the same time, the researchers found an inverse relationship between the US volatility index and BTC volatility.

Bouri et al. (2017c) try to find out whether Bitcoin can serve as a diversifier, hedge, or safe-haven for commodities in general and for energy commodities in particular. Their study shows that BTC exhibits hedge and safe-haven properties for the general commodity index and for the energy commodity index, for the entire period and the pre-crash period in 2013. They fit a multivariate GARCH model and concluded that there is a weak correlation between BTC and energy commodities.

Chu et al. (2017) modelled the volatility of the seven most popular cryptocurrencies via twelve GARCH models and compared them according to five criteria. Moreover, they made a model comparison of the best fitting models using forecasts and acceptability of value at risk estimates. The normal distributed integrated GARCH (IGARCH) was founded best-fitting model depends on information criteria for the BTC volatility. Katsiampa (2017) compared the volatility forecast of BTC with the appropriate GARCH models. It is concluded that AR-CGARCH model is an adequate model and gives the optimal fit for the volatility of daily closing prices of BTC. Urquhart (2017) compared the heterogeneous autoregression (HAR) model with the GARCH models depending on their forecasting ability for the BTC market. As a result, they illustrated that HAR models are more robust in modelling Bitcoin volatility than traditional GARCH models.

Klein et al. (2018) first analyzed and compared the conditional variance properties of BTC and Gold in their studies that questioned whether BTC is new Gold. As a result, they found a structural difference in conditional variances. They continued their work by applying BEKK-GARCH, which is a multivariate model that predicts the correlation transition between BTC and Gold. They concluded that BTC behaves as the exact opposite and it positively correlates with downward markets. Stavroyiannis and Babalos (2017) examined the dynamic properties and the relation of Bitcoin and the Standard and Poor's index, using a variety of econometric approaches through univariate FIAGARCH and multivariate BEKK-GARCH models and vector autoregressive specifications. Their results indicate that Bitcoin does not exhibit any of the hedge, diversified, or safe-haven properties; rather, its attributes are independent of US market developments.

Peng et al. (2018) estimated the conditional mean and volatility of the three cryptocurrencies including BTC using the Support Vector Regression GARCH (SVR-GARCH) model and compared with the GARCH family models. They combined the traditional GARCH model with a machine learning approach to estimate volatility. As a result of their work, they found SVR-GARCH models showed better performance than GARCH, EGARCH and GJR-GARCH models with Normal, Student's t and Skewed Student's t distributions.

Cermak (2018) stated in his thesis that the biggest obstacle for BTC to be an alternative currency is price volatility. Cermak (2018) analyzed the volatility of the currencies of the countries with the highest BTC transaction volume and BTC volatility by applying the GARCH (1,1) model. The researcher pointed out that BTC already behaves similarly to fiat currencies in China, the U.S. and the European Union but not in Japan. Moreover, as a result of the thesis, Cermak indicated that BTC acts as a safe-haven asset in China and the volatility of BTC has been steadily decreasing throughout its lifetime. The most important interpretation of the study is that BTC has a decreasing trend of volatility for six years and if this trend continues the volatility of BTC reaches the volatility levels of fiat currencies soon and become a functioning alternative to fiat currencies.

Ardia et al (2019) show that there exist regime changes in the log-returns volatility of BTC using the Markov–switching GARCH (MSGARCH) models. Moreover, they compare the MSGARCH to traditional single–regime GARCH via one–day ahead Value–at–Risk (VaR). The most significant part of the study is that they use the Bayesian approach to estimate the parameters and the VaR forecasts. They conclude the study there is strong evidence that MSGARCH models outperform single–regime specifications when predicting the VaR.

Mba and Mwambi (2020) claim that the returns of Bitcoin have a form regime-switching, therefore regime-switching models could be more successful to capture these dynamics and Markov-switching COGARCH-R-vine (MSCOGARCH) model is fitted to select portfolio. They also compare the MSCOGARCH with the single-regime COGARCH-R-vine using the expected shortfall risk. According to the comparison result, MSCOGARCH outperforms the single-regime.

Studies show that while modeling the return volatility of cryptocurrencies is a new field of study, discussions such as increasing rules in the crypto money market and taxation are important for investors' perception. The consequences of these discussions and the increased transaction costs of cryptocurrencies affect the volatility of returns. In particular, the volatility of BTC, the largest currency in the cryptocurrency market, becomes more important. In this study, the volatility of BTC will be estimated using discrete and continuous GARCH models.

GARCH MODEL

One can state the log-return of the financial time series X_t as

$$X_t = \mu_t + a_t \tag{3.1}$$

where μ_t is conditional mean and a_t is residuals. The residuals can be expressed

$$a_t = \sigma_t \varepsilon_t, \varepsilon_t \sim f_v(0,1) \tag{3.2}$$

where σ_t and ε_t are volatility process and innovation process respectively and $f_v(0,1)$ represent probability density function that has zero mean and unit variance. In a non-normal distribution case, is a set of additional distributional parameters which are used for the scale and shape of the distribution.

The variance equation of the GARCH (p,q) model (Bolerslev, 1986) can be expressed in two ways which are given in equations (3.3) and (3.4) as

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{p} \alpha_i a_{t-i}^2 + \sum_{i=1}^{q} \beta_i \sigma_{t-i}^2 \tag{3.3}$$

$$\sigma_t^2 = \alpha_0 + \alpha(B)a_{t-1}^2 + \beta(B)\sigma_{t-1}^2 \quad (3.4)$$

where $\alpha(B)$ and $\beta(B)$ are polynomials of degrees p and q respectively, where B denotes backward shift operator.

GARCH(p,q) model is assumed covariance stationary when $E(a_t) = 0, var(a_t) = \alpha_0 / (1 - \alpha(1) - \beta(1))$ and $\text{cov}(a_t, a_s) = 0$ for $t \neq s$ if and only if $\alpha(1) + \beta(1) < 1$. Bolerslev (1986) used the Maximum Likelihood Estimation Method (MLE) for the model's parameter estimation. There are many Bayesian methods that have been developed for parameter estimation of the GARCH model. Although Bayesian methods give better results, MLE method, which is a frequentist approach, is widely used due to the calculation difficulty encountered in some Bayesian methods. The MLE method by maximizing the given log-likelihood function

$$L(\omega) = ln\prod_t f_v\left(a_t, E(a_t|I_{t-1}), \sigma_t\right) \quad (3.5)$$

where $E(a_t|I_{t-1})$ denotes the expected mean of residuals and ω is set of parameters the variance equation $\omega = \left(v, \alpha_0, \alpha_1, \ldots, \alpha_p, \beta_1, \ldots, \beta_q\right)$.

The Properties of GARCH Models

The GARCH (1,1) model is successful in capturing the characteristics of financial time series. Therefore, the general features of the GARCH model is represented via GARCH (1,1) model.

i. The GARCH (1,1) model, which has a similar structure to the Autoregressive Moving Average (ARMA) model, is as follows

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (3.6)$$

where $\alpha_0 > 0, \alpha_1 > 0, \beta_1 > 0.$ If $\alpha_1 + \beta_1 < 1$ GARCH process is weak stationary.

ii. GARCH models can also be fitted without the need for a conditional mean model, accepting observed log-returns as residuals. First, $z_t = a_t^2 - \sigma_t^2$ is defined to show that the GARCH model is an ARMA process. So,

$$a_t^2 - z_t = \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1(a_{t-1}^2 - z_{t-1})$$
$$a_t^2 = \alpha_0 + (\alpha_1 + \beta_1)a_{t-1}^2 + z_t - \beta_1 z_{t-1} \quad (3.7)$$

which is an ARMA(1,1) process on squared residuals.

iii. The unconditional variance of a_t is

$$Var(a_t) = \alpha_0 + \alpha_1 E[a_{t-1}^2] + \beta_1 E[\sigma_{t-1}^2]$$
$$= \alpha_0 + (\alpha_1 + \beta_1)E[a_{t-1}^2]$$

and since a_t is a stationary process and $\alpha_1 + \beta_1 < 1$.

$$Var(a_t) = \frac{\alpha_0}{1 - \alpha_1 - \beta_1} \quad (3.8)$$

iv. ARCH(∞) is equivalent to GARCH(1,1).

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$
$$= \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1\left(\alpha_0 + \alpha_1 a_{t-2}^2 + \beta_1 \sigma_{t-2}^2\right)$$
$$\ldots.$$
$$= \alpha_0\left(1 + \beta_1 + \beta_1^2 + \beta_1^3 + \ldots\right) + \alpha_1(a_{t-1}^2 + \beta_1 a_{t-2}^2 + \beta_1^2 a_{t-3}^2 + \ldots)$$
$$\sigma_t^2 = \frac{\alpha_0}{1 - \beta_1} + \alpha_1 \sum_{i=0}^{\infty} \beta_1^i a_{t-1-i}^2 \quad (3.9)$$

So, it is possible to say that the conditional variance at time t is equal to the weighted sum of past squared residuals. Further, the weights decrease as going further back in time.

v. The unconditional variance of returns $E[\sigma^2] = \alpha_0/(1 - \alpha_1 - \beta_1)$ is plugged into the Equation (3.6) where $\alpha_0 = (1 - \alpha_1 - \beta_1)E[\sigma^2]$, then it is

$$\sigma_t^2 = (1 - \alpha_1 - \beta_1)E[\sigma^2] + \alpha_1 a_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \quad (3.10)$$

vi. This form of the GARCH(1,1) model makes it easy to observe that the next period's conditional variance is equal to the weighted combination of the unconditional variance of returns, last period's squared residuals and last period's conditional variance with weights $(1 - \alpha_1 - \beta_1), \alpha_1, \beta_1$ respectively.

vii. α_1 and β_1 are considered ARCH term and GARCH term respectively in the GARCH equation given in Equation (3.6). The ARCH term α_1 measures how much the volatility shock that exists today affects volatility tomorrow. It also shows the short-run persistence of the shocks on the return variance.

viii. The model given in Equation (3.6), the coefficient of the lag value of the conditional variance, that is, the GARCH term coefficient β_1 shows the effect of the old shocks on the long-run persistence of volatility. In the literature, there are various studies that show GARCH(1,1) is an adequate model to capture the volatility clustering, one of the most important ones is Akgiray (1989). As the frequency of the observed data decreases, that is, from daily to weekly, from weekly to monthly, the ARCH effect decreases. In the model, the sum of the coefficients of the terms ARCH and GARCH $(\alpha_1 + \beta_1)$ indicates volatility persistence and measures the rate of decay of the volatility feedback effect over time. The sum of $(\alpha_1 + \beta_1)$ close to 1 indicates high persistence, meaning that volatility shocks will be felt even less in the future. Although the decay of shocks occurs over a period of more than a month, the reversion to the mean of long-run variance occurs within a few days. The fall in persistency when monthly data is used weakens the predictability of volatility based on available information. Volatility persistence makes able to predict future economic variables and the changes in the risk-return trade-off over business cycles.

ix. In relation to the volatility persistence measurement, the 'half-life' (denoted by $h2l$) defined as the number of days it takes for half of the expected reversion back towards to the expected variance value, can be calculated as following.

$$h2l = -ln2/ln(\alpha_1 + \beta_1) \tag{3.11}$$

The Estimation of GARCH Model

In this section, parameter estimation of GARCH (p, q) process, in which innovations follow a normal distribution, is done using MLE method. If $f_v(0,1)$ is assumed a normal distribution with zero mean and unit variance then the likelihood function is

$$f\left(a_t \middle| \omega, a_0, a_1, \ldots, a_{t-1}\right) = \prod_{t=p+1}^{T} \frac{1}{\sqrt{2\pi\sigma_t^2}} e^{-\frac{a_t^2}{2\sigma_t^2}} \tag{3.12}$$

and the log-likelihood function is

$$L = ln(\underline{x}|\omega) = \sum_{t=p+1}^{T} \{-\frac{1}{2} ln\,(2\pi) - \frac{1}{2} ln(\sigma_t^2) - \frac{1}{2}\frac{a_t^2}{\sigma_t^2}\} \tag{3.13}$$

For the MLE of the GARCH(p,q) process under the normality assumption the conditional likelihood of the t^{th} observation is $l_t = -\frac{1}{2} ln(\sigma_t^2) - \frac{1}{2}\frac{a_t^2}{\sigma_t^2}$ where the constant term is omitted. The partial derivatives of l_t with respect to parameter vector are

$$\frac{\partial l_t}{\partial \omega} = \left(\frac{a_t^2}{2\sigma_t^4} - \frac{1}{2\sigma_t^2}\right)\frac{\partial(\sigma_t^2)}{\partial \omega}$$

$$\frac{\partial^2 l_t}{\partial \omega\, \partial \omega^T} = \left(\frac{a_t^2}{2\sigma_t^4} - \frac{1}{2\sigma_t^2}\right)\frac{\partial^2(\sigma_t^2)}{\partial \omega\, \partial \omega^T} + \left(\frac{1}{2\sigma_t^4} - \frac{a_t^2}{\sigma_t^6}\right)\frac{\partial(\sigma_t^2)}{\partial \omega}\frac{\partial(\sigma_t^2)}{\partial \omega^T}$$

where

$$\frac{\partial(\sigma_t^2)}{\partial \omega} = \left(1, a_{t-1}^2, \ldots, a_{t-p}^2,\ \sigma_{t-1}^2, \ldots, \sigma_{t-q}^2\right)^T + \sum_{i=1}^{q} \beta_i \frac{\partial(\sigma_{t-i}^2)}{\partial \omega}$$

The gradient of the log-likelihood function is

$$\nabla L = \frac{1}{2}\sum_{i=1}^{T}\left(\frac{a_t^2}{2\sigma_t^4} - \frac{1}{2\sigma_t^2}\right)\frac{\partial(\sigma_t^2)}{\partial \omega} \tag{3.14}$$

where $L = \sum_{t=1}^{T} l_t$.

The Fisher information matrix

$$I = \frac{1}{2}\sum_{i=1}^{T} E\left[\left(\frac{a_t^2}{2\sigma_t^4} - \frac{1}{2\sigma_t^2}\right)\frac{\partial^2(\sigma_t^2)}{\partial \omega\, \partial \omega^T} + \left(\frac{1}{2\sigma_t^4} - \frac{a_t^2}{\sigma_t^6}\right)\frac{\partial(\sigma_t^2)}{\partial \omega}\frac{\partial(\sigma_t^2)}{\partial \omega^T}\right]$$

$$I = -\frac{1}{2}\sum_{i=1}^{T} E\left[\frac{1}{\sigma_t^2}\frac{\partial^2(\sigma_t^2)}{\partial \omega\, \partial \omega^T}\right] \tag{3.15}$$

So, the ML estimates can be found using the iteration scheme $\underline{\alpha}_{k+1} = \underline{\alpha}_k - J^{-1}\nabla L$ where. J^{-1} is inverse of Fischer information matrix.

Parameter estimation of Normal-GARCH (1,1) model is easily done by putting $\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1 \sigma_{t-1}^2$ in log-likelihood function in equation (3.13) and taking partial derivatives of log-likelihood function with respect to parameter set $\omega = (\alpha_0,\ \alpha_1,\ \beta_1)$ and applying the Equations (3.14) and (3.15).

The Discrete Time GARCH-type Models

In this study, the maximum order of the model is determined as one since simplicity and the model is adequate (Akgiray, 1989) and better (Jafari *et al*., 2007). In addition to standard GARCH, ten of its extension models are considered. Moreover, the distribution of innovations, respectively, the normal distribution (norm), skew-normal distribution (snorm), Student's t distribution (std), skew Student's distribution (sstd), generalized error distribution (ged), skew generalized error distribution (sged), normal inverse Gaussian distribution (nig) and Johnson's SU distribution (jsu) is considered. In the continuation of this section, Ghalanos' (2020b) study "Introduction to the rugarch package – Version 1.3-8" is followed which is a well-written manual for R. The mentioned models are

i. The standard GARCH model of Bollerslev (1986) that is discussed in details in the previous section is denoted by GARCH(1,1) and given in equation (3.6) as following

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \beta_1 \sigma_{t-1}^2$$

ii. Engle and Bollerslev (1986) proposed a model that is a strictly stationary form of the standard GARCH model is denoted integrated GARCH (iGARCH) where the persistence parameter $\alpha_1 + \beta_1 = 1$. Due to unit persistence, unconditional variance, half-life and other results cannot be calculated. The stationarity of the model has been discussed and demonstrated in many studies in the literature. However, before accepting iGARCH as the preferred model, it is necessary to investigate the possibility of a structural break.

iii. Nelson (1991) proposed the exponential GARCH (EGARCH) since the positive and negative errors have the same effect on the volatility in standard GARCH models. In other words, the effect of negative and positive errors have an asymmetric effect is a weakness of the standard model. As it is mentioned before, although the negative errors have the same magnitude as positive ones, the influence of negative shocks is greater than the positive shocks in real. In light of all of these facts, the EGARCH model is based on the idea of the weighted innovations to allow for asymmetric effects between positive and negative asset returns. Thus the model can be expressed as follows

$$\log\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1} + \gamma_1\left[\left|a_{t-1}\right| - E\left(\left|a_{t-1}\right|\right)\right]. \tag{3.16}$$

where $\alpha_0 > 0, \alpha_1 > 0, \beta_1 > 0$ and $\gamma_1 > 0. \alpha_1$ is a measure of the sign effect, and γ_1 is a measure of the size effect. Further, β_1 is a persistence parameter. In the standard model, the conditional variance is a function of past innovations. The difference of the EGARCH model from the standard model is that the conditional variance is written as a function of standardized innovations.

iv. The GJRGARCH model which is developed by Glosten et al. (1993) has an indicator function that asymmetrically models positive and negative shocks on conditional variance. The conditional variance of GJRGARCH(1,1) is

$$\sigma_t^2 = \alpha_0 + \alpha_1 a_{t-1}^2 + \xi_1 I_{t-1} a_{t-1}^2 + \beta_1 \sigma_{t-1}^2 \tag{3.17}$$

where ξ_1 shows the leverage term and the indicator function I takes on value of 1 when $a_i < 0 \text{ for } i = 0,1,2,..$ for otherwise 0. In this case, persistence is $\alpha_1 + \beta_1 + \xi_1 \kappa$ where κ is the expected value of the standardized residuals a_t below zero (efectively the probability of being below zero).

$$\kappa = E\left[I_{t-j} a_{t-j}^2\right] = \int_{-\infty}^{0} f(a,\ 0,\ 1,\ldots) da$$

where f is the standardized conditional density with any additional skew and shape parameters. Half-life and unconditional variance follow from the persistence parameter are calculated as in Section 3.1.

v. The asymmetric power ARCH model (APARCH) of Ding et al. (1993) is successful to capture leverage effect of financial time series, in addition to capturing the effect that the sample autocorrelation of absolute returns was usually larger than the sample autocorrelation of squared returns.So, APARCH(1,1) is

$$\sigma_t^\delta = \alpha_0 + \alpha_1 \left[\left| a_{t-1} \right| - \xi_1 a_{t-1} \right]^\delta + \beta_1 \sigma_{t-1}^\delta \tag{3.18}$$

where $-1 < \xi_1 < 1$ is leverage term and $\delta \in \mathbb{R}^+$ is a Box-Cox transformation of σ_t. The persistence of the APARCH process is $\beta_1 + \xi_1 \kappa_1$ where κ_1 is the expected value of the standardized residuals a_t under the Box–Cox transformation of the term including leverage term. Hence, it is computed by

$$\kappa_1 = E[|a| - \xi_1 a]^\delta = \int_{-\infty}^{\infty} [|a| - \xi_1 a]^\delta f(a, 0, 1, \ldots)\, da \tag{3.19}$$

One can easily obtain the extensions of the standard GARCH model using APARCH model. For instance, when $\delta = 2$ and $\xi_1 = 0$ APARCH model is reduced to a standard GARCH model.

vi. The Absolute Value GARCH (AVGARCH) model of Taylor (1986) and Schwert (1990) is a particular case of APARCH model. APARCH(1,1) model is reduced to a AVGARCH (1, 1) model of for when $\delta = 1$ and $\xi_1 = 0$.

vii. The Threshold GARCH (TGARCH) model of Zakoian (1994) is another particular case of the APARCH model when $\delta = 1$.

viii. The ALL GARCH (1, 1) model due to Hentschel (1995) has:

$$\sigma_t^\delta = \alpha_0 + \alpha_1 \sigma_{t-1}^\delta [|a_{t-1} - \eta_1| - \xi_1 (a_{t-1} - \eta_1)]^\delta + \beta_1 \sigma_{t-1}^\delta \tag{3.20}$$

where $\alpha_0 > 0, \alpha_1 \geq 0, \beta_1 > 0, -1 < \xi_1 < 1, \delta \in \mathbb{R}^+$ and $-\infty < \eta_1 < \infty$. The persistence of the model is equal to where is given in Equation (3.19).

ix. The Nonlinear GARCH (NGARCH) model due to Higgins and Bera (1992) is a particular case of the ALLGARCH model when $\xi_1 = 0$ and $\eta_1 = 0$.

x. The Nonlinear Asymmetric GARCH (NAGARCH) model of Engle and Ng (1993) for $\delta = 2$ and $\xi_1 = 0$ is another reduced form of the ALLGARCH model.

COGARCH MODEL

This section that contains the derivation of the Continuous-Time GARCH (COGARCH) process and its second-order moment properties, is constructed on the studies of Klüppelberg et al (2004 and 2011) and Arı (2019).

Klüppelberg et al. (2004) preserved the structure and basic features of the discrete-time GARCH model and built the COGARCH model by replacing the innovations in this model with the increments obtained from the Lévy process. That is, they created a continuous-time analogue using the discrete-time GARCH (1,1) model. The basic idea is to use increments derived from Lévy processes instead of the white noise process present in the discrete-time model. So, the continuous time GARCH process $(G_t)_{t\geq 0}$ can be obtained by replacing the $\beta = \alpha_0, \eta = -\log\beta_1$, and $\varphi = \alpha_1/\beta_1$ in the discrete time GARCH(1,1) model, then the continuous volatility process can be expressed as follows

$$(G_t)_{t\geq 0} = \int_0^t \sigma_{s-} dL_s \tag{4.1}$$

and the variance process $\sigma^2 = (\sigma_t^2)_{t\geq 0}$ are defined by the stochastic differential equations

$$dG_t = \sigma_{t-} dL_t \tag{4.2}$$

$$d\sigma_t^2 = (\beta - \eta\sigma_{t-})dt + \varphi\sigma_{t-} d[L,L]_t^d \tag{4.3}$$

for $t \geq 0$ and $G_0 = 0, \beta > 0,\ \eta > 0, \varphi \geq 0$ and $[L,L]_t^d$ is the discrete part of the quadratic variation Lévy process.

The definition shows that the size of the jumps of the process G is the same as L, and the size of the jumps is $\Delta G_t = \sigma_t \Delta L_t$ for $t \geq 0$. So, it is observed that ΔL_t has same behaviour as innovations in case of discrete GARCH models.

One can use several frequentists and Bayesian methods for the parameter estimation of COGARCH and its extensions models. Maller et al. (2008) proposed an approximation in which the model is fitted by deriving a pseudo-maximum likelihood (PML) function. In this method, PML function is maximized numerically in order to estimate the corresponding parameters. one of the advantages of the method is that it can be applied for either equally or unequally spaced time data. They suppose that the observations are $G(t_i)$ where $0 = t_0 < t_1 < \ldots < t_N = T$, on the integrated COGARCH $\left(\mathrm{G_t}\right)_{\mathrm{t}\geq 0} = \int_0^{\mathrm{t}} \sigma_{\mathrm{s}-}\mathrm{dL_s}$ and assumed to be stationary. The $\{t_i\}$ are assumed fixed time points. Let $a_i = Y_i = G(t_i) - G(t_{i-1})$ denote the observed returns and the difference between the observations is $\Delta t_i := t_i - t_{i-1}$. So, the observed return can be written as following $Y_i = \int_0^{\mathrm{t}} \sigma_{\mathrm{s}-}\mathrm{dL_s}$ where L is a Lévy process with $E[L(1)] = 0$ and $E[L^2(1)] = 1$.

The purpose is to estimate (β, η, φ) from the observed $Y_1, Y_2, \ldots, Y_N$ using pseudo-maximum likelihood (PML) method. Y_i is conditionally independent of $Y_{i-1}, Y_{i-2}, \cdots$ given information set F_{t-1} since σ is Markovian. So, $E(Y_i|F_{i-1}) = 0$ for the conditional expectation of Y_i, and, for the conditional variance,

$$\rho_i^2 =, E(Y_i^2|F_{t-1}) = \left(\sigma^2(t_{i-1}) - \frac{\beta}{\eta-\varphi}\right)\left(\frac{e^{(\eta-\varphi)\Delta t_i}}{\eta-\varphi}\right) + \frac{\beta\Delta t_i}{\eta-\varphi} \tag{4.4}$$

$E(\sigma^2(0)) = \beta/(\eta-\varphi)$, with $\eta > \varphi$ and $E[L^2(1)] = 1$ satisfy the stationarity of the model. The pseudo-maximum likelihood function for $Y_1, Y_2, \ldots, Y_N$ can be written as following with the assumption of Y_i, are conditionally $N(0,\rho_i^2)$

$$L = L(\beta, \eta, \varphi) = \sum_{i=1}^{N}\left(-\frac{1}{2}log(2\pi) - \frac{1}{2}ln\rho_i^2 - \frac{1}{2}\frac{Y_i^2}{\rho_i^2}\right) \tag{4.5}$$

Above equation (2.5) needs a calculable quantity for ρ_i^2. Hence $\sigma^2(t_{i-1})$ should be substituted by $\sigma_i^2 = \beta\,\Delta t_i + e^{-\eta\Delta t_i}\sigma_{i-1}^2 + \varphi e^{-\eta\Delta t_i}Y_i^2$. After substituting σ_i^2 for $\sigma^2(t_{i-1})$ and resulting modified ρ_i^2, pseudo-maximum likelihood function can be found for fitting a GARCH model to the unequally spaced series. The recursion of σ_i^2 can be easily done taking $\sigma^2(0) = \beta/(\eta-\varphi)$ as an initial value. The maximization of $L = L(\beta, \eta, \varphi)$ gives PMLEs of (β, η, φ). In this study, PMLE method is applied for parameter estimation of COGARCH model.

DATA

The Bitcoin versus USD exchange rate (BTC-USD) data is downloaded from "finance.yahoo.com" via "quantmod" package (Ryan et al., 2018) in R. The dataset consists of the daily log-returns of the BTC-USD exchange rate between 2015-01-02 and 2020-05-01. The mentioned models in Section 3.3 and Section 4. are fitted to log-returns of the BTC-USD of which time series plot is given in Figure 1. using the "rugarch" package (Ghalanos, 2020a) and later a COGARCH(1,1) by R package "yuima" by Iacus et al. (2015).

The descriptive statistics of log-returns of BTC-USD exchange rate is given below Table 1.

FINDINGS

The discrete-time GARCH-type models are compared according to the Akaike information criterion $(AIC = 2k - 2lnL(\hat{\hat{\omega}}))$, Bayesian information criterion $(BIC = kln(n) - 2lnL(\hat{\hat{\omega}}))$, Shibata information criterion $(SIC = ln(n+k) - 2lnL(\hat{\hat{\omega}}))$ and Hannan–Quinn information criterion $(HQC = 2kln(ln(n)) - 2lnL(\hat{\hat{\omega}}))$ where n: number of observations, k: number of parameters and $L(\hat{\hat{\omega}})$ maximum log-likelihood of estimated parameter set $\hat{\hat{\omega}}$. The model comparison results are given in Table $A1$ at Appendix A. According to the comparison results, it is understood that the jsu-ALLGARCH(1,1) model is the discrete-time volatility model that best fits the BTC-USD log returns. The ALLGARCH (1, 1) model is

$$\sigma_t^{\delta} = \alpha_0 + \alpha_1\sigma_{t-1}^{\delta}\left[\left|a_{t-1} - \eta_1\right| - \xi_1(a_{t-1} - \eta_1)\right]^{\delta} + \beta_1\sigma_{t-1}^{\delta}$$

with Johnson's SU distributed innovations. So, the log likelihood function is

$$L = ln(\underline{x}|\omega) = nln(\varphi_1) - nln(\sigma) - \frac{n}{2}ln(2\pi) + \sum_{t=p+q+1}^{T}\left[g\left(\frac{a_t}{\sigma}\right) - \frac{1}{2}\left(\varphi_2 + \varphi_1 g\left(\frac{a_t}{\sigma}\right)\right)^2\right]$$

where φ_1 and φ_2 are skew and shape parameters respectively. One can easily estimate the parameters of the jsu-ALLGARCH(1,1) by following the MLE method given in Section 3.2. The estimation of the model parameters and the time-series plot of the volatility are given in Table 2 and Figure 2 respectively.

The persistence of jsu-ALLGARCH(1,1) volatility is equal to 0.9840795 that is calculated using to $\beta_1 + \xi_1\kappa_1$ where κ_1 is given in Equation (3.19). The half-life is 43.1905 that is the number of days the volatility takes for half of the expected reversion back towards to the expected variance value. The asymmetry parameter η_1 for rotation is non-significant but the other asymmetry parameter ξ_1 that is used in persistence calculation is statistically significant. The conditional sigma power parameter δ is statistically significant.

The all discrete-time GARCH-type models assume that there is no autocorrelation between standardized residuals and no remaining ARCH effect on standardized residuals. The Ljung-Box test on standard residuals assesses the dependence of the first moments with a time lag. In other words, it tests the presence of autocorrelation between the residuals. The Ljung-Box test and the ARCH-LM test on the squares of standardized residuals evaluate the dependence of the second moments with

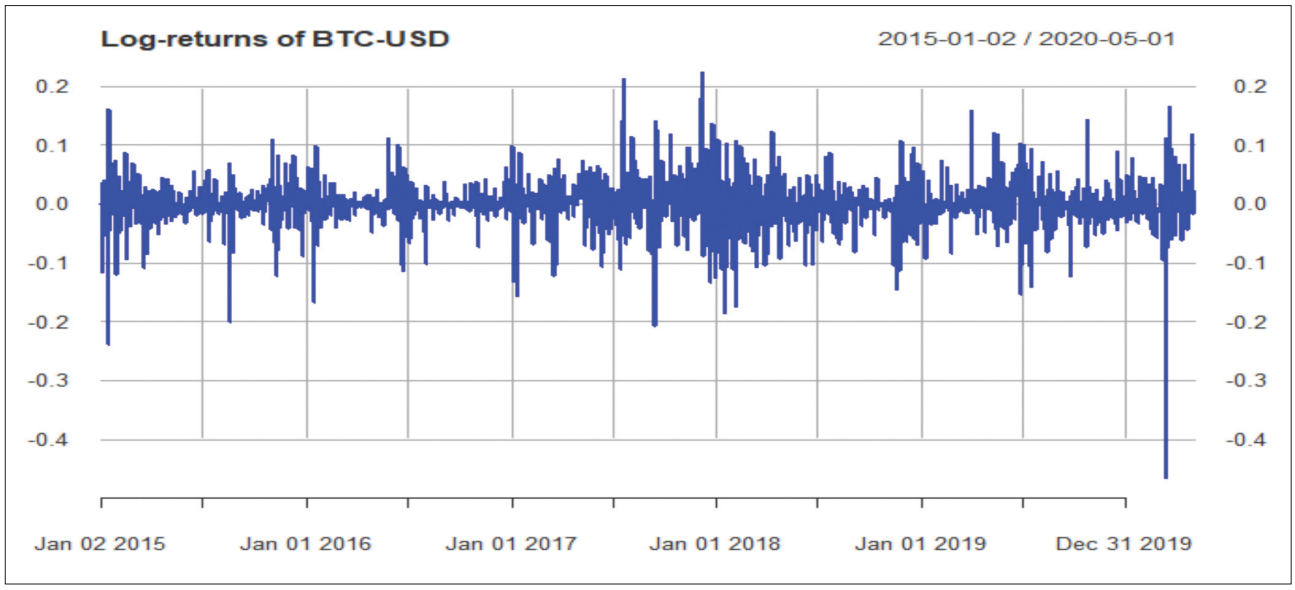

Figure 1. The plot of log-returns of BTC-USD

Table 1. Descriptive Statistics

Descriptive Statistics of Log-Returns of BTC-USD (sample size)					
min	*max*	*range*	*sum*	*median*	*mean*
-4.66E-01	2.23E-01	6.90E-01	7.26E-16	2.15E-04	3.73E-19
SE.mean	*CI.mean.0.95*	*var*	*std.dev*	*kurtosis*	*skew*
9.11E-04	1.79E-03	1.62E-03	4.02E-02	1.34E+01	-1.00E+00

Table 2. The Parameter Estimation of jsu-ALLGARCH(1,1) Model

Optimal Parameters				
parameter	estimate	Std.Error	t value	Pr(>|t|)
	0.001614	0.001248	1.29307	0.19599
	0.174181	0.01727	10.08586	0
	0.8668	0.011607	74.678	0
	0.037569	0.133442	0.28154	0.7783
	-0.223334	0.034805	-6.41667	0
	0.734313	0.269369	2.72605	0.00641
	-0.033581	0.029939	-1.12165	0.26201
	1.004228	0.04972	20.19762	0

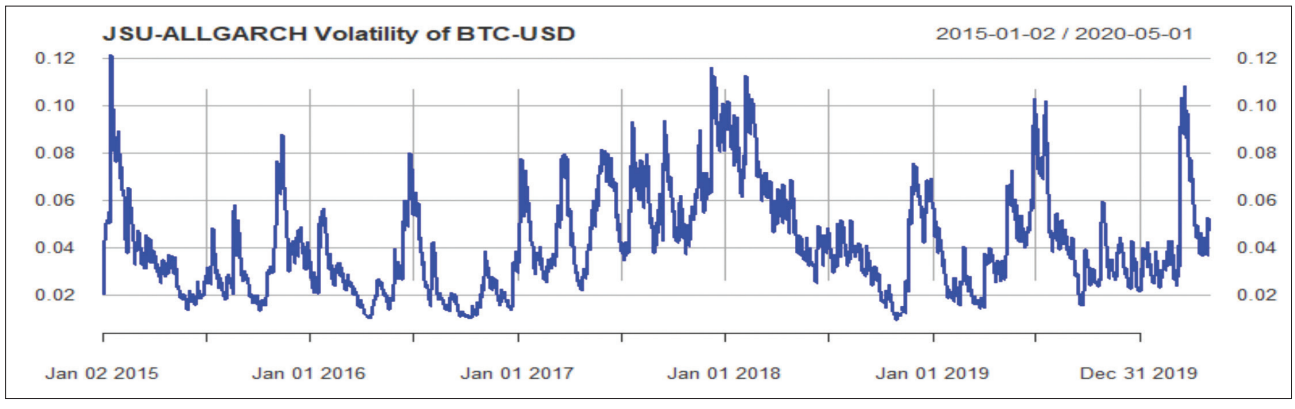

Figure 2. Time-series Plot of the JSU-ALLGARCH Volatility

Table 3. The Parameter Estimation of COGARCH(1,1) Model

Coefficients:				Var-Cov Matrix			
	initial	Estimate	Std.Error		a0	a1	b1
a0	7.61E-05	0.001666256	5.05E-09	a0	2.55E-17	5.15E-15	7.95E-15
a1	1.71E-01	1.022156927	1.08E-01	a1	5.15E-15	1.17E-02	1.10E-02
b1	8.08E-01	1.053472221	1.04E-01	b1	7.95E-15	1.10E-02	1.09E-02

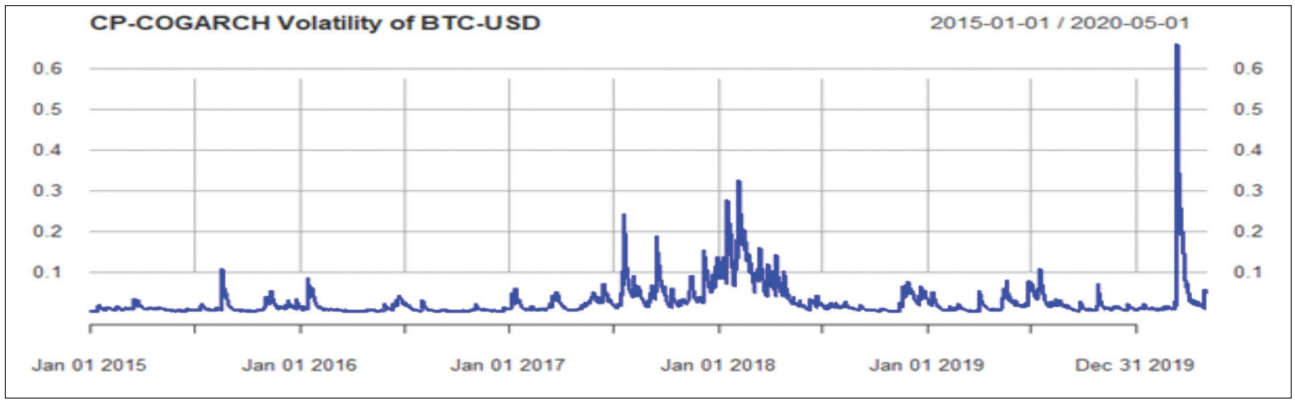

Figure 3. Time-series Plot of the COGARCH Volatility

a time lag. Findings obtained by the mentioned test are given in Appendix B in the tables Table B1, Table B2 and Table B3 respectively. According to the results, there is no autocorrelation by the weighted Ljung-Box test on standard residuals. Further, the Ljung-Box test and the ARCH-LM test on standardized squared residuals are supporting each other by concluding that there is no autocorrelation and ARCH effect on standardized squared residuals.

The Sign Bias Test proposed by Engle and Ng (1993) to verify whether previous positive and negative shocks have a different impact on heteroscedasticity The Sign-Bias Test that is designed for detecting asymmetry in the conditional variance (leverage effect) requires a finite fourth moment.. Specifically, it examines whether the standardized squared residual is predictable using (dummy) variables indicative of certain information. Three dummy variables are used in the Sign Bias Test to test for the impact of positive & negative shocks on volatility not predicted by the model, the effect of large and small negative shocks.The null hypothesis for these tests is those additional parameters corresponding to the additional (dummy) variables are zero. The most important point of these tests is that in the case of the null hypotheses are rejected, the coefficients of the additional parameters are non-zero indicating misspecification of the model. The result of the test given in Appendix B in Table B4 shows that there is no misspecification in the model and there are no leverage effects remained in the residuals.

The adjusted Pearson goodness-of-fit test for the GARCH diagnostics compares the empirical distribution of the standardized residuals with the selected theoretical distribution. The null hypothesis is that the empirical and theoretical distribution is identical, in other words, the conditional distribution is chosen appropriately. The test results in Appendix B in Table B5 indicates that the conditional distribution of the innovations is proper.

The Nyblom Stability Test that is used to determine the structural break in time series examines the constancy of all parameters in the model. However, Nyblom Stability Test does not give any information about the type and the date of structural change. The structural break/change means that the relationship between variables changes over time. The null hypothesis of the test is that the parameter values are constant and have zero variance. The test results in Appendix B in Table B6 indicate that some parameters are constant over time individually but there is a structural change in time series.

After this point, the outputs of the COGARCH process are discussed. As in the work of Klüpellberg et al. (2004), the Gaussian white noise process of the discrete model GARCH (1,1) is replaced by the compound Poisson Lévy increments to obtain a continuous process. The parameter estimation of the discrete-time GARCH model, in which innovations have a normal distribution, is used as the initial values of the COGARCH parameters. COGARCH parameter values and initial values found by the PML estimation method are given in Table 3. The plot of volatility obtained from COGARCH process is given in Figure 3.

Table 4. The Descriptive Statistics of the Lévy Increments

n	Min.	1st Q	Median	Mean	3rd Q	Max.	Std. Dev.
1947	-5.5499	-0.18091	0.003318	-0.00052	0.196352	3.480641	0.463035

Table 5. The Prediction Comparison of The Volatility Models

Model	MSE	RMSE	MAE
JSU-ALLGARCH	0.00204	0.045165	0.040054
CP-COGARCH	0.000596	0.024409	0.012804

The Lévy increments of the COGARCH process are derived from the Compound Poisson distribution and the statistics for these increments can be found in Table 8. One can obtain these increments also using distributions such as normal, variance gamma, and normal inverse Gaussian. This application is done by using the R-based software "yuimagui" developed by Iacus and Yoshida (2018).

The delta value shows the difference between the observations while estimating the parameters of the continuous process. Usually, the delta value is used as in daily data sets. The reason for this is that there is an average of 252 working days a year. However, was chosen since the larger delta value gave better prediction results in this study. The descriptive statistics of the increments is given at the following table.

The diagnostics test shows that the process is strictly stationary and the unconditional first moment of the Variance process exists. Moreover, the variance is a positive process with pseudo-log-likelihood value -3710.498.

Finally, the predictions of the discrete and continuous models are compared according to the mean square error (MSE), root mean square error (RMSE) and mean absolute error (MAE) measures, and it is concluded that the CP-COGARCH (1,1) model performs better. The comparison measures are given in Table 5.

CONCLUSION

In this study, Bitcoin volatility, which is accepted as the origin of crypto coins, has been examined. Volatility is modeled on BTC-USD exchange rate data. In volatility modeling, ten different discrete-time GARCH models with eight different innovation distributions and compound Poisson COGARCH models were used. The structure and properties of these models are given in detail. Among the discrete-time GARCH models, the most appropriate model was selected according to the information criteria and the JSU-ALLGARCH model was found to be the best-fitting model. The order of all compared models is determined to be one for convenience and simplicity. Parameter estimation of the models was made by pseudo maximum likelihood method. In the study, the most widely used models in the "rugarch" package and in the literature were preferred. Anyone can include more extensions of the GARCH model in the analysis. In the COGARCH model, innovations are derived only with compound Poisson increments. While Lévy increments derived from Variance Gamma and normal-inverse Gaussian distributions can be used, parameter estimates can also be made by the method of moments and other Bayesian methods. In future studies, Exponential COGARCH and GJR-COGARCH models, which are the derivatives of the COGARCH model, can also be used.

In the comparison of predictions made according to various measurements, it has been revealed that the continuous model has lower error values and performs better than the discrete model. It is an expected result that continuous models can make better predictions with their flexibility in high-frequency data. However, to reach this inference, a simulation study must be done. It can also be compared using value-at-risk and option pricing calculations. All R codes used in this study can be downloaded from the website https://math-stat.net/garch-and-cogarch-modelling.htm (Arı, 2020).

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Appendix A. Model Comparison

Table A1. The Comparison of GARCH-type Models with Order 1

#	Model	AIC	BIC	SIC	HQC	
1	jsu ALLGARCH11	-4.1874	-4.1645	-4.1874	-4.1789	4084.39
2	jsu AVGARCH11	-4.1873	-4.1673	-4.1873	-4.1800	4083.36
3	std ALLGARCH11	-4.1858	-4.1657	-4.1858	-4.1784	4081.85
4	sstd ALLGARCH11	-4.1858	-4.1657	-4.1858	-4.1784	4081.85
5	std AVGARCH11	-4.1855	-4.1683	-4.1855	-4.1792	4080.58
6	sstd AVGARCH11	-4.1855	-4.1683	-4.1855	-4.1792	4080.58
7	nig AVGARCH11	-4.1835	-4.1635	-4.1835	-4.1761	4079.63
8	nig ALLGARCH11	-4.1832	-4.1603	-4.1832	-4.1748	4080.34
9	jsu TGARCH11	-4.1831	-4.1660	-4.1832	-4.1768	4078.28
10	jsu APARCH11	-4.1821	-4.1621	-4.1821	-4.1747	4078.28
11	jsu EGARCH11	-4.1813	-4.1641	-4.1813	-4.1749	4076.46
12	jsu NGARCH11	-4.1811	-4.1639	-4.1811	-4.1748	4076.28
13	std TGARCH11	-4.1808	-4.1665	-4.1808	-4.1756	4075.03
14	sstd TGARCH11	-4.1808	-4.1665	-4.1808	-4.1756	4075.03
15	nig TGARCH11	-4.1800	-4.1628	-4.1800	-4.1737	4075.21
16	std APARCH11	-4.1798	-4.1626	-4.1798	-4.1735	4075.05
17	sstd APARCH11	-4.1798	-4.1626	-4.1798	-4.1735	4075.05
18	nig APARCH11	-4.1790	-4.1589	-4.1790	-4.1716	4075.23
19	nig NGARCH11	-4.1786	-4.1614	-4.1786	-4.1723	4073.84
20	std NGARCH11	-4.1785	-4.1642	-4.1785	-4.1732	4072.78
21	sstd NGARCH11	-4.1785	-4.1642	-4.1785	-4.1732	4072.78
22	std EGARCH11	-4.1785	-4.1642	-4.1785	-4.1732	4072.76
23	sstd EGARCH11	-4.1785	-4.1642	-4.1785	-4.1732	4072.76
24	nig EGARCH11	-4.1784	-4.1612	-4.1784	-4.1721	4073.69
25	ged ALLGARCH11	-4.1691	-4.1491	-4.1691	-4.1617	4065.63
26	nig NAGARCH11	-4.1684	-4.1513	-4.1685	-4.1621	4063.98
27	jsu NAGARCH11	-4.1682	-4.1510	-4.1682	-4.1619	4063.71
28	nig IGARCH11	-4.1675	-4.1560	-4.1675	-4.1633	4061.06
29	nig GJRGARCH11	-4.1675	-4.1503	-4.1675	-4.1612	4063.05
30	ged EGARCH11	-4.1673	-4.1530	-4.1673	-4.1620	4061.85
31	ged NGARCH11	-4.1671	-4.1528	-4.1671	-4.1618	4061.65
32	jsu GJRGARCH11	-4.1669	-4.1498	-4.1670	-4.1606	4062.52
33	sged EGARCH11	-4.1666	-4.1494	-4.1666	-4.1603	4062.18
34	sged NGARCH11	-4.1664	-4.1492	-4.1664	-4.1601	4062.01
35	nig GARCH11	-4.1662	-4.1519	-4.1663	-4.1610	4060.84
36	jsu IGARCH11	-4.1662	-4.1548	-4.1662	-4.1620	4059.83
37	jsu GARCH11	-4.1649	-4.1506	-4.1649	-4.1597	4059.56
38	ged IGARCH11	-4.1611	-4.1525	-4.1611	-4.1580	4053.87
39	sged IGARCH11	-4.1604	-4.1490	-4.1604	-4.1562	4054.16
40	ged NAGARCH11	-4.1603	-4.1460	-4.1603	-4.1550	4055.03
41	ged GARCH11	-4.1600	-4.1486	-4.1600	-4.1558	4053.77
42	ged GJRGARCH11	-4.1599	-4.1455	-4.1599	-4.1546	4054.62

43	std NAGARCH11	-4.1597	-4.1454	-4.1597	-4.1544	4054.46
44	sstd NAGARCH11	-4.1597	-4.1454	-4.1597	-4.1544	4054.46
45	sged NAGARCH11	-4.1596	-4.1424	-4.1596	-4.1533	4055.37
46	sged GARCH11	-4.1593	-4.1450	-4.1593	-4.1540	4054.06
47	sged GJRGARCH11	-4.1592	-4.1420	-4.1592	-4.1529	4054.97
48	std GJRGARCH11	-4.1581	-4.1438	-4.1581	-4.1529	4052.93
49	sstd GJRGARCH11	-4.1581	-4.1438	-4.1581	-4.1529	4052.93
50	std IGARCH11	-4.1574	-4.1488	-4.1574	-4.1542	4050.23
51	sstd IGARCH11	-4.1574	-4.1488	-4.1574	-4.1542	4050.23
52	std GARCH11	-4.1561	-4.1446	-4.1561	-4.1519	4049.93
53	sstd GARCH11	-4.1561	-4.1446	-4.1561	-4.1519	4049.93
54	snorm EGARCH11	-3.8211	-3.8068	-3.8211	-3.8158	3724.84
55	snorm APARCH11	-3.8160	-3.7988	-3.8160	-3.8097	3720.88
56	snorm GJRGARCH11	-3.8159	-3.8016	-3.8159	-3.8107	3719.81
57	snorm ALLGARCH11	-3.8157	-3.7956	-3.8157	-3.8083	3721.56
58	snorm GARCH11	-3.8151	-3.8036	-3.8151	-3.8109	3717.99
59	snorm NAGARCH11	-3.8150	-3.8007	-3.8150	-3.8098	3718.92
60	snorm NGARCH11	-3.8146	-3.8003	-3.8146	-3.8093	3718.48
61	norm EGARCH11	-3.8145	-3.8031	-3.8145	-3.8103	3717.44
62	snorm IGARCH11	-3.8136	-3.8050	-3.8136	-3.8105	3715.55
63	snorm TGARCH11	-3.8112	-3.7969	-3.8112	-3.8060	3715.22
64	snorm AVGARCH11	-3.8104	-3.7933	-3.8105	-3.8041	3715.47
65	norm GJRGARCH11	-3.8088	-3.7974	-3.8088	-3.8046	3711.90
66	norm APARCH11	-3.8085	-3.7942	-3.8086	-3.8033	3712.61
67	norm NAGARCH11	-3.8081	-3.7966	-3.8081	-3.8039	3711.17
68	norm ALLGARCH11	-3.8076	-3.7904	-3.8076	-3.8013	3712.70
69	norm GARCH11	-3.8048	-3.7962	-3.8048	-3.8017	3706.99
70	norm AVGARCH11	-3.8047	-3.7904	-3.8047	-3.7994	3708.89
71	norm IGARCH11	-3.8043	-3.7986	-3.8043	-3.8022	3705.47
72	norm NGARCH11	-3.8038	-3.7924	-3.8038	-3.7996	3707.03
73	norm TGARCH11	-3.8032	-3.7917	-3.8032	-3.7989	3706.38
74	sged AVGARCH11	3.9718	3.9919	3.9718	3.9792	-3859.57
75	sged TGARCH11	3.9939	4.0111	3.9939	4.0002	-3882.08
76	sged APARCH11	3.9949	4.0150	3.9949	4.0023	-3882.08
77	ged TGARCH11	3.9952	4.0095	3.9952	4.0005	-3884.36
78	ged AVGARCH11	4.8044	4.8215	4.8043	4.8107	-4671.04
79	ged APARCH11	5.2909	5.3081	5.2909	5.2973	-5144.74
80	sged ALLGARCH11	na	na	na	na	na

Table B1. Weighted Ljung-Box Test on Standardized Residuals

Weighted Ljung-Box Test on Standardized Residuals		
	statistic	p-value
Lag[1]	3.09	0.07878
Lag[2*(p+q)+(p+q)-1][2]	3.464	0.10511
Lag[4*(p+q)+(p+q)-1][5]	6.241	0.0789
df=0		

Table B2. Weighted Ljung-Box Test on Standardized Squared Residuals

Weighted Ljung-Box Test on Standardized Squared Residuals			
	statistic	p-value	df
Lag[1]	0.02735	0.8686	2
Lag[2*(p+q)+(p+q)-1][5]	1.01777	0.8556	
Lag[4*(p+q)+(p+q)-1][9]	2.16508	0.8844	

Table B3. Weighted ARCH LM Tests

Weighted ARCH LM Tests					
		Statistic	Shape	Scale	P-Value
ARCH	Lag[3]	0.2575	0.5	2	0.6118
ARCH	Lag[5]	2.1955	1.44	1.667	0.4296
ARCH	Lag[7]	2.5342	2.315	1.543	0.6054

Table B4. Sign Bias Test

Sign Bias Test		
	t-value	prob sig
Sign Bias	1.2971	0.1947
Negative Sign Bias	1.0711	0.2843
Positive Sign Bias	0.6655	0.5058
Joint Effect	3.8822	0.2745

Table B5. Adjusted Pearson Goodness-of-Fit Test

Adjusted Pearson Goodness-of-Fit Test			
	group	statistic	p-value(g-1)
1	20	17.22	0.5748
2	30	27.68	0.5348
3	40	35.97	0.6089
4	50	49.33	0.46

Table B6. Nyblom stability test

	Nyblom stability test
Parameters	Individual Stats:
omega	0.24151
alpha1	0.2009
beta1	0.26743
eta11	0.02601
eta21	0.11419
lambda	0.17937
skew	0.36294
shape	0.24832
Joint Stat:	1.9578
Asymptotic Critical Values	10% 5%
Joint Stat:	1.89 2.11
Individual Stat:	0.35 0.47

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