INTERNATIONAL RESEARCH AND REVIEWS IN ECONOMICS AND ADMINISTRATIVE SCIENCES

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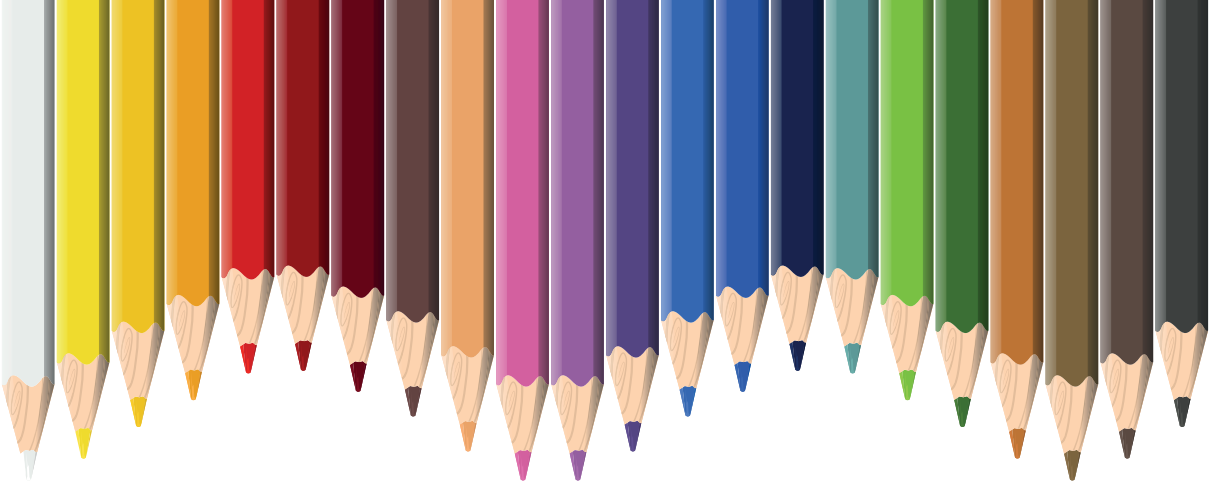

Chapter 1

THE SUSTAINABILITY CONCEPT AND ITS HISTORICAL DEVELOPMENT

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1. Introduction

The industrial revolution, beginning with the use of steam power in industry in Europe, replaced human labor with machines and transitioned to a very rapid production process. One of the areas most affected by the industrial revolution was the destruction of the natural environment. Thus, sustainability began to be considered not just in the environmental dimension but also in the social dimension. Until the economic depression of 1929, air, water and environmental elements, seen as free goods by economists, were not included in economic models and economic development models. In later years, summits, conferences, action plans and protocols were signed, bringing states together. Thus, sustainability gained an international meaning. The 'Common Futures' report created at the Brundtland Conference defined sustainable development in an institutional sense for the first time. Sustainable development is defined as development meeting the needs of today without compromising the ability of future generations to meet their own needs. Thus, sustainability, entering the field of economy, has replaced human capital in several long-term economic growth and development models in the present day. As a result of this process, sustainability is accepted as both an institutional concept and emerges from inseparable environmental, social and economic dimensions. In this situation, there is consensus about the simultaneous realization in these three dimensions for sustainability.

2. Sustainability Concept and Historical Development

1.1. Sustainability Concept

The source of the word sustainability is from the Latin word "*sustinere*". As a word, it is frequently encountered in references as meaning to sustain, to be continuous, to provide, to support, to exist, to continue and to be permanent (Onions, 1964). The Cambridge Dictionary of the Environment defines sustainability as "the situation of natural resources being usable in the future by using methods that do not harm the environment and the quality of causing little or no damage to the environment and therefore able to continue for a long time". The Turkish Language Society does not have a fully equivalent Turkish word. With different dimensions of sustainability emerging in varying conditions at present, not only environmental sustainability but also the concepts of economic sustainability and social sustainability have begun to be commonly used. Currently, the institutional sustainability concept, a marker of competitiveness in terms of companies, is becoming popular.

The aim of the sustainability concept is to concretize the ethical concerns about the need to sustain a suitable ecologic infrastructure for future generations. When examined in more detail, the concept appears to include sometimes contradictory norms and social values. Interpretation of impacts is contextual and linked to varying social values. Functionalization of the

concept should be based on a comprehensive analysis of the perceptions of different users and groups interested in natural resources, and balance these opinions with political discussions. In spite of the concept being formulated as a universal principle, in practice it should be specific and flexible to social, cultural, political and at the same time ecologic conditions (Wiersum, 1995). For this reason, many international conferences, action plans and reports have been prepared as sustainability carries global meaning and is a global criterion.

1.2. **Historical Development of the Sustainability Concept**

The interaction of living organisms with the environment is a process that begins before birth and continues after death. Gaining importance in the present century, the history of sustainability dates back to very ancient times, contrary to what is known. As is known, before beginning a settled life, the basic source of livelihood for societies was based on hunting and gathering. In this period, people were afraid of nature and attempted to live in harmony with it. Transitioning to settled life in the Neolithic period, humans learned to plant and harvest and attempted to dominate nature. With the industrial revolution, human dominance of nature reached higher levels and gained the dimension of exploiting and even destroying it (Ergün & Çobanoğlu, 2017).

From the first days, nature's provision of the needs of living things and their continuation has had irreplaceable importance. The idea of protecting nature, which is not just important for humans but also for all living things, did not just emerge with environmental pollution and consumption of natural resources experienced in the last century, contrary to what is known. For example, the Tamil Nadu Sacred Groves in south India were stated to witness the Paleolithic and Neolithic periods (8000-6000 BC) (Krishna & Sanklar, 1997). In Europe in the Middle Ages, some privileged individuals created private hunting reserves and this included protected parks and forest areas. In these areas, animal husbandry or agricultural activities were prohibited. This situation ensured some areas remained untouched. Areas outside of these reserves were unprotected due to reasons such as housing needs due to unplanned growth, processing of soil to obtain highest yield, and continuous hunting, and many wild animal species became extinct and forestry areas were destroyed (Coolidge, 1965). As can be seen from evidence from the past to the present day, though different to the sense it is used today, humanity's first examples of sustainability were protection of areas first counted as sacred and of some animals.

The topic of sustainability first began to be used conceptually in the fields of agriculture, forestry and fishery. In Arthur Young's book "General View of Agriculture of Hertfordshire", published by during travels in the British Isles, he stated the continuous increase in agricultural product amounts and yields occurred with the transition from a communal system to an individual system

and thus, agricultural sustainability transitioned from the dimension of an idea to the conceptual dimension (Young, 1804). H.S. Gordon, A.D. Scott and M.D. Schaefer proposed the need for fishing to be performed in planned and regulated manner with the concept of "minimum sustainable product" in the 1950s in order to sustain fishing activities (Kula, 1997). To prevent the destruction of the Black Forest in Germany and to ensure continuity in meeting the needs of society for wood, water and rest areas and their transferal to later generations, forest protection laws were passed in the 18th and 19th centuries (Hill, 1993).

International works written in the 19th and 20th centuries contributed to the conversion of sustainability from idea to concept. Arrival as a global concept was affected by reports, papers, commissions and conferences at international level. The most important reason why sustainability did not gain universal dimensions until this time was the determination of economic growth and development policies for countries that did not count the environmental impacts. Growth and development began to be debated intensely by many economists with the effect of D. Ricardo and Keynes within economic history. Economists like Smith, Ricardo and Malthus, pioneers of the classic school of economics (accepted as the process beginning with Adam Smith's book The Wealth of Nations and lasting until the Great Depression in 1929), did not calculate the impact of the environment and natural resources in their growth models because natural resources like air and water were free goods according to their theories. As is known, there is a strong correlation between the developmental level of countries and the investment in human capital in the present day. Works published in recent periods about economic resources debate sustainable development models as long-term growth models using human capital and the environment at the most appropriate levels for long-term development (Alagöz, 2004).

While this was being experienced in Europe, the Ottomans performed work to protect the environment and ensure sustainability. Mehmet the Conqueror prohibited grazing of animals, agriculture and construction to protect the Golden Horn in the 15th century (Kurdoğlu, 1999). Before 1870, forests were accepted as unique places for the benefit of all, the Forest Regulations were implemented to ensure preservation of forests with the increase in environmental destruction (Akıncı, 1996).

1.2.1. Club of Rome (1968)

In April 1968, a 30-person group comprising scientists, educators, economists, humanists, industrialists and national and international public servants from ten countries met at the Academia dei Lincei in Rome to discuss the topic "man's present and future predicament". The club of Rome researched trends of global concern under five headings. These were accelerating

industrialization, rapid population increase, widespread malnutrition, consumption of non-renewable resources and degradation of the natural environment. Club members proposed that annual increase amounts were like an exponential growth model in mathematics and explained the interactions between each under these five headings. According to this explanation, population cannot grow without food, as the growth of food production increased, it would require more capital and more resources, that discarded resources would become pollutants, and pollution negatively impacts both population and growth of food.

According to club members, if world population, industrialization, pollution, food production and resource consumption continue along the current growth trends without change in the future century, the upper limits of growth on the planet would be reached within the next century. There were two probable outcomes of this approach: the first probable outcome would be a very sudden and uncontrollable fall in both population and industrial capacity. The second probable outcome was to change growth trends to continue into the future sustainably and create a global equilibrium between environment and economy. Global equilibrium was explained as design to meet the basic needs of every person on the earth and for every person to have the opportunity to realize their own individual potential. If people decided to make efforts towards this second outcome instead of the first and worked rapidly, the chance of success was equally high (Meadows et al., 1972).

In 1974, club of Rome members published a second report called 'Mankind at the Turning Point". This report proposed that rather than different national or political structures, in the century ahead of us the world would create nations or regions dependent on each other and affecting each other; in other words, a new system would be created with no country free from the impacts of events occurring in other countries (Mesarovic et al., 1974). Another topic in this report was the growth model based on organic growth or differentiation proposed for countries. The differentiation-based growth model stated that if less developed countries attempted to grow like developed countries, the world would not be able to sustain this; in other words, resources would be inadequate. In this situation, they proposed the need to slow growth. The idea of injustice between rich and poor in society of Malthus was adapted to the level of developed and less developed countries by club of Rome members, classified as new Malthusians.

1.2.2. Stockholm Conference on the Environment (1972)

Consideration of modern environment and development is accepted as beginning with the Stockholm Conference on the Environment in 1972. This conference has the feature of being the first environmental conference held by the United Nations. Representatives from many countries around the

world (1200 delegates from 114 countries participated; however, Soviet block countries boycotted the meeting due to the exclusion of East Germany), and formed the first international arena to discuss environmental problems in the long and short term. The conference ensured that environmental problems gained a universal dimension. The conference focused on determining a common perspective and common principles to inspire and guide the protection and development of the human environment. Documents created during the conference affected international environmental law. The conference also prepared an "Environmental Action Plan" including 109 special recommendations related to the educational and social aspects of human settlement, natural resource management, environmental pollution, development of the environment and international organizations.

Northern countries at the conference wanted to consider industrial pollution, protecting nature and population increase first. Southern countries stated concerns related to growth and did not want rich conservatives to embrace the benefits of the growth and industrialization of poor countries. They saw global capitalism as the basic reason for poverty in many southern countries. Developing countries had to import existing raw materials due to global economic institutions. The statement "pollution of poverty" was considered to represent the idea that the largest global environmental threat was poverty. Southern countries stated that global economic reforms were required to solve this problem (Dauvergne, 2005).

Another notable event at the conference was that countries separated themselves into developed and less developed countries. This distinction resulted in them criticizing each other as parties. As more than half of environmental problems experienced in less developed countries are due to the growth of developed countries, they proposed neglect and destruction during growth. Again, less developed countries suggested the solution needed to be realized by developed countries. Contrary to this, developed countries proposed that the lack of social and economic development experienced in less developed countries caused their environmental problems (Aksu, 2011). Both sides reached consensus about these problems and created a 26-item declaration for the solution of environmental problems at the end of the conference and announced them to the world. In summary these principles stated that:

- Policies encouraging or sustaining racism, discrimination, exploitation and other forms of oppression were condemned and should be abolished.
- The need to preserve nature including wildlife when planning economic development.
- States should take all steps necessary to avoid pollution of the seas from substances that may harm human health and harm marine life or to

interfere with other legitimate uses at sea.

- The earth's non-renewable resources should be protected against the danger of exhaustion in the future and benefits obtained from this work should be employed in a way that will ensure they are shared by all humanity.

- Planning coordinated at international level should be developed for environmental problems.

- The need to encourage scientific research and development in the context of national and multinational environmental problems in all countries, led by developing countries especially. In this context, support for the free flow of current scientific knowledge, transfer of experience and facilitating solutions to environmental problems was recommended.

- The need for development of international law related to environmental pollution and damage.

- The need to protect humans and the environment from the effects of nuclear weapons and other weapons of mass destruction, and the need to make efforts to reach an agreement related to the removal and full destruction of these types of weapons by nations and other international organs.

1.2.3. Mediterranean Action Plan (1974)

One of the most important outcomes of the Stockholm Conference on the Environment (1972) was the United Nations Environmental Programme (UNEP), which founded the "Regional Seas Programme" abiding by decisions taken at the first management council meeting in 1973. The first priority topic of the program was the Mediterranean. In 1974, the "Regional Seas Action Centre" was founded and the draft Mediterranean Action Plan (MAP) was prepared (Algan, 1998). The program was accepted by countries with Mediterranean coastlines and the European Union in 1976 in Barcelona and was implemented in 1978. Today, it is run by 21 countries surrounding the Mediterranean and the European Union.

The Mediterranean Action Plan was prepared with the aim of assessing environmental problems experienced in the Mediterranean as a whole and to ensure cooperation between regional countries. At the Rio Conference (UN Environment and Development Conference 1992), the "Mediterranean Action Plan" became a plan with the aim of sustainable development for countries along the Mediterranean coast based on solution ideas for environmental problems. In accordance with decisions taken at the conference, in 1995, the name of the Barcelona Convention encompassing sustainable development targets, public participation, environmental impact and coastal areas was changed to the "Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean" and was implemented in 2004.

Turkey approved the revised Barcelona Convention in 2002. There are 7 protocols included in the Barcelona Convention:

- Protocol about preventing and removing pollution due to dumping from ships and planes or at sea, without incineration, in the Mediterranean.
- Protocol about preventing pollution due to trans-border movements and disposal of dangerous wastes in the Mediterranean (accepted after making a statement reflecting Turkey's views on the UN Convention on the Law of the Sea).
- Protocol about protecting against pollution due to land-based sources and activities in the Mediterranean.
- Protocol about intervention and cooperation for pollution by petrol and other harmful material in the Mediterranean in emergency circumstances.
- Protocol about special preservation areas and biological diversity in the Mediterranean.
- Protocol about management of integrated coastal areas in the Mediterranean.
- Protocol about preventing pollution due to discovery and operation of the continental shelf and the seabed in the Mediterranean.

1.2.4. Brundtland Report and Sustainable Development Concept (1987)

In 1983, the Norwegian prime minister Go Harlem Brundtland chaired the World Commission on Environment And Development (WCED) comprising participants from 20 different countries on the request of the United Nations General Secretary. A report entitled "Our Common Future" was prepared and presented to the United Nations General Council in 1987 (Bozlağan, 2005).

The "Our Common Future" report created by the Brundtland conference defined sustainable development in an institutional sense for the first time. In the second section of the report sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". This definition includes two key constructs. The concept of need is stated to be the need to give priority dominantly to the basic needs of the poor in the world, additionally, the power of technology and social organization on the environment was emphasized. Here, the idea of limiting the ability to meet the needs of the present and the future is dominant. The basic aim of sustainable development is stated to be satisfying the needs and desires of humanity (Keeble, 1988). With this report, the sustainable development concept was used in all international organizations.

In addition to increasing environmental awareness, different to other reports, the Brundtland report proposed a sustainable environmental

development strategy providing long-term economic and social benefits instead of short-term economic and environmental benefits (Han and Kaya, 2013). The report included the idea of seeing the environment and economy as a whole when making decisions about changing the quality of growth in the long term (sustainable growth), meeting basic human needs (overcoming poverty), ensuring sustainable population levels (population control), protecting and developing resources (ensuring justice between generations), and reorganizing technology and risk management (use of environmentally-friendly technologies).

1.2.5. Rio Conference (1992)

On 16 June 1972 in Stockholm, the announcement of the United Nations Human Environment Conference was accepted and the Rio Conference aimed to build on this. This conference, attended by the leaders of 178 countries, prepared a report comprising four sections known as "Agenda 21" determining 24 items comprising basic principles and sustainable development principles in many different areas. The message send by the conference to the world was 'the earth is our home and has an inseparable interconnected nature'. Additionally, the principles included in the 24 items collected around two main ideas of the need to work towards international agreements that protect the integrity of the global environment and a development system that respects the interests of all, and to create new levels of cooperation between states with societies and people as key sectors while the goal of this cooperation was to create a fair global partnership (Declaration R. 1992).

"Agenda 21" created by world leaders included all areas of sustainable development in addition to creating a broad-scope working program for the 21st century representing more than 98% of the world's population. A comprehensive plan for global cooperation, "Agenda 21" made efforts to reach consensus about the twin conditions of a high-quality environment for every person on the earth and a healthy economy. When determining the main areas of responsibility, at the same time, preliminary cost estimations were presented for success. Comprising four sections, the first section of Agenda 21 explained the social and economic dimensions of sustainability, the second section explain preserving and managing resources, the third section was about strengthening the roles of important groups and the final section explained the subheadings and costs of applied sustainability areas (Declaration, R, 1992). In spite of Agenda 21 being a global agreement document, an attempt was made to create it in line with global interests, not in a way that will solve all disputes or in the best interests of each participant. Additionally, Agenda 21 was an unequaled step for progressing on the road to sustainability and offered a courageous plan to motivate local, national and global actions (Keating, 1992).

1.2.6. Kyoto Protocol (1997)

The "United Nations Framework Convention On Climate Change" accepted in Rio de Janeiro in 1992 was the first international agreement dealing with climate change with the aim of preventing dangerous human impacts of climate change. The convention accepted three principles of the prevention principle, common but differentiated responsibility principle and the right to development principle (Protocol K, 1997).

The Kyoto Protocol accepted in 1997 formed the targets and mechanisms required to implement the 'United Nations Framework Convention On Climate Change'. Accordingly, the emission target was to reduce emissions in the 40 most industrialized countries by at least 5% compared to 1990 levels between 2008 and 2012. The targets differed according to country (the United States of America did not ratify the Protocol and as a result was not held to fixed reduction targets by 2008-2012). Considering the protocol and extensions, it appears the protocol had relatively little correlation with temperature drops and sea level rise. However, it is important in terms of being the first step taken with the aim of stabilizing the climate system (Wigley, 1998).

1.2.7. United Nations Millennium Summit (2000)

The United Nations hosted the 'Millennium Summit' in September 2000 with participation from 149 heads of state and upper level officials from more than 40 countries (Millennium Summit, 2000). At the end of the summit, the 'United Nations Millennium Declaration" was announced. The declaration comprised a total of 8 sections and 32 items. In the first section, world leaders announced their determination to establish a just and lasting peace in all parts of the world in accordance with aims and principles (Assembly U. G, 2000).

The "Millennium Development Goals" collected around eight targets of reducing hunger, achieving universal basic education, removing gender inequality, reducing maternal and infant deaths, reversing the spread of HIV/AIDS, tuberculosis and malaria, reversing the loss of natural resources and biodiversity, improving access to water and good housing, and creating effective global partnerships. The Millennium Development Goals represented a previously unseen global agreement about precautions to be taken to reduce poverty (Waage et al., 2010).

Progression to the eight main goals was monitored by international agencies. In 2004, these agencies concluded that many countries (especially in Africa) remained behind in these goals at the current progression rates (Millennium Development Goal Indicators Database, 2006). Again, considering that these goals would be reachable with collective action from the world's societies and national governments, the additional financial resources required to reach the 'Millennium Development Goals' identified at the Millennium Summit

were predicted to be 135 billion dollars in 2006 and 195 billion dollars in 2015 (Robert, Parris and Leiserowitz, 2005). However, aid sent by industrialized countries to developing countries comprised 0.7% of the Gross National Product of developed countries, which was below the United Nations targets (Sachs and Director, 2005). In 2015, the Sustainable Development Conference organized by the United Nations discussed the outcomes of the Millennium Development Goals and concluded that they would not provide a solution to the environmental, social and economic problems facing the world (Fırat et al., 2017).

1.2.8. World Summit on Sustainable Development (2002)

At the World Summit on Sustainable Development organized from 2-4 September 2002 in Johannesburg in South Africa, the gathered representatives of world leaders reaffirmed their commitment to sustainable development. They stated their commitment to building a humane, just and benevolent global society that is aware of the need for human dignity for all. In the opening speech of the summit, they stated in clear and simple language that the future belongs to the children and the challenge was to not leave an inadequate world heritage caused by poverty, degraded environment and unsustainable development (Assembly, U. G. 2002). At the summit, important decisions were made in five areas of water projects, energy, health, agriculture, biological diversity and ecosystem management (Karabıçak & Armağan, 2004).

The summit, called Rio+10, discussed what had been done since the 'Rio Earth Summit' and determined two basic outputs in line with this aim. One of these was the 'Political Declaration' reflecting political will and the other was the 'Implementation Plan' (Sezer, Ö. 2007). The Political Declaration focused on responsibilities and obligations to be able to ensure global, regional and local sustainability in countries (Akgül, 2010).

The Implementation Plan (Action Plan) was the result of meetings at ministry level about topics like renewable energy, chemicals, natural resources and climate generally and was accepted by the General Council on 4 September 2002. 'Renewability' was the topic where agreement was most difficult in the Implementation Plan. European countries and Canada defended the need to bring renewability to 15% levels by 2010. The targets of the Implementation Plan are summarized as follows (MFA, 2002):

- Numbers without access to clean water and waste water services should be reduced by 50% by 2015.
- Loss of biological diversity should be reduced by 2010.
- Highest yield possible should be obtained from fishing grounds by 2015.

- In addition to other elements to ensure improvements in living conditions for at least 100 million people living in unsuitable circumstances in accordance with the 'no cities with slums' view by 2020, access to land, soil and adequate shelter should be developed and implementation of programs with this aim by local authorities should be ensured.

- Energy should be provided to 2 billion people without access to energy with the aim of increasing the share of energy resources.

- The impacts created by the production and use of chemicals with negative effects on human health and the environment should be reduced by 2020.

- The main resources for the Convention to Combat Desertification should be determined from the Global Environment Fund.

- Development of agreements to reduce air pollution at international, regional and national level and ratification of the Kyoto Protocol should be encouraged.

- Innovative mechanisms broadly encompassing debt problems in developing countries should be supported.

Turkey participated in the summit with a delegation headed by the President. Turkey prepared a report for the summit at national level within a participatory process with contributions from all sections of society like public institutions, non-government organizations, local administrations, academic circles, the private sector and the press. The most important feature separating the Johannesburg Conference from other sustainability conferences is that it was a conference discussing concrete projects prepared by participants instead of abstract promises (Bozlağan, 2005).

1.2.9. Earth Summit (2012)

The Brazilian minister of state recommended an Earth Summit to discuss sustainable development problems on the 20th anniversary of the "Rio Conference' to the UN general council in 2007. This proposal was accepted by the UN general council in 2009 (Karabıçak & Özdemir, 2015).

In 2012, world leaders came together at the "Rio+20" meeting to advance sustainable development 20 years after the 'World Summit on Sustainable Development' and reached agreements about important principles. However, the decided actions remained inadequate. Many development goals were partly provided as they were not considered in an integrated way with social (including health), economic and environmental priorities. Many negative significant environmental trends were reported since the World Summit on Sustainable Development. According to reports, significant economic growth occurred in many regions; however, again the lack of benefit for many low-

income populations led to increasing inequality. Variability was recorded in health and it was stated that inequality was permanent. It was stated that a stable ecosystem and equal economic progression should be provided to contribute to improved health progression. The urgent need to implement policies encouraging sustainable development and promoting health was emphasized (Haines et al., 2012).

1.2.10. Sustainable Development Summit (2015)

Decisions to be taken at this summit, organized with leaders from member countries in New York from 25-27 September 2015 by the United Nations, aimed to build on the Millennium Development goals taken at the previous Millennium Summit and to achieve the unmet goals. The basic aim of the summit was to save the human race from the tyranny of poverty, and protect and heal our planet.

The summit identified 17 sustainable development goals and targets comprising 169 sub-indicators (United Nations Sustainable Development Summit, 2015). These goals were accepted by the Union of Municipalities of Turkey and were included in the 2nd National Review of Sustainable Development Goals in Turkey published by the Presidency in 2019.

Goal 1: End poverty everywhere and in every form.

Goal 2: End hunger, ensure food safety, improve nutrition and encourage sustainable agriculture.

Goal 3: Ensure good health and increase human welfare at every age.

Goal 4: Ensure inclusive and equitable quality education and encourage lifelong learning opportunities for all.

Goal 5: Ensure gender equality and strengthen all women and girls.

Goal 6: Ensure availability and sustainable management of water and sanitation for all.

Goal 7: Ensure access to reliable, sustainable and modern energy with appropriate cost for all.

Goal 8: Encourage sustainable, inclusive economic growth and full and productive employment with the aim of providing decent work for all.

Goal 9: Create flexible infrastructure, encourage inclusive and sustainable industrialization and innovation.

Goal 10: Reduce inequality within countries and between countries.

Goal 11: Make cities and human settlements inclusive, safe, flexible and sustainable.

Goal 12: Ensure sustainable consumption and production patterns.

Goal 13: Take urgent precautions in the struggle against climate change and impacts.

Goal 14: Preserve oceans, seas and marine resources for sustainable development and use the sustainably.

Goal 15: Protect terrestrial ecosystems and biological diversity and ensure sustainable management.

Goal 16: Encourage peaceful and inclusive societies for sustainable development, ensure access to justice for all and construct effective, accountable, inclusive institutions at every level.

Goal 17: Strengthen implementation tools and revitalize the Global Partnership for Sustainable Development.

2. **Conclusion**

The aim of the study was to provide an overview of the process and basic changes in the sustainability concept and definitions from its time of first use to the present day. The study shows that the evolutionary process of the sustainability concept is not just connected to international associations but at the same time is connected to social movements and events reflecting institutional behavior expectations in communities.

Agenda 21, known as the most important outcome of the Rio Conference, was an important plan to motivate local, national and global actions for sustainability. Previous international meetings had only dealt with the global dimensions of sustainability. However, Agenda 21 presented brave plans for sustainability at local dimensions. In other words, while a macro perspective on the topic of sustainability was dominant before Agenda 21, a micro perspective developed with Agenda 21.

With the sustainability concept, companies or institutions saw that short-term and profit-focused approaches were unsustainable in the long term; instead they accepted the idea of the need for adopting long-term approaches. Additionally, from a financial perspective, sustainability alone is not sufficient, the need to pay attention to the environmental and social dimensions for sustainable development emerged. Currently, companies, institutions or international organizations attempt to use sustainability effectively especially in the fields of finance, marketing and brands.

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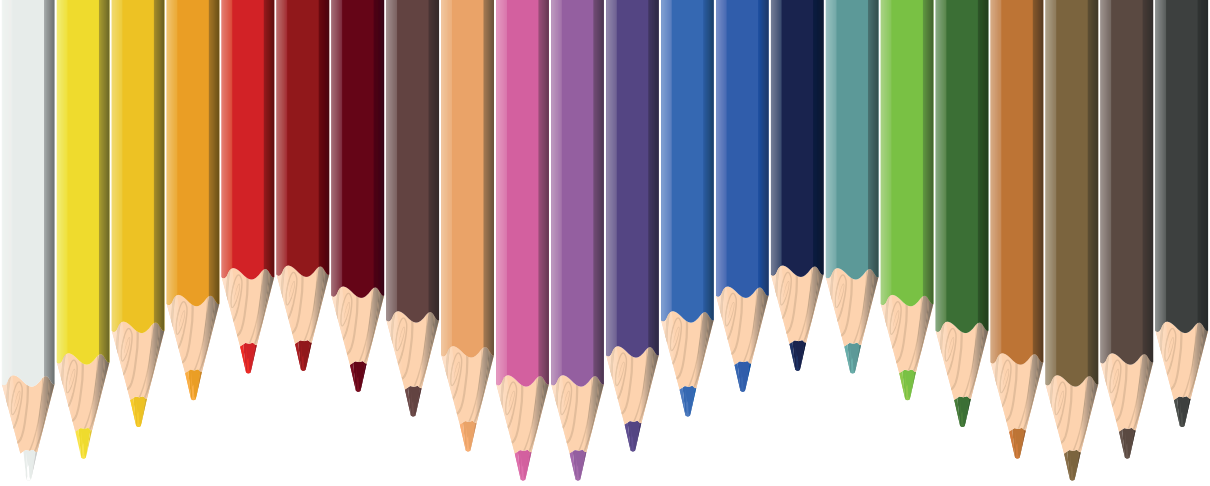

Chapter 2

MARKET EFFICIENCY IN THE WEAK FORM: ANALYSIS OF BORSA ISTANBUL TRANSPORTATION INDEX

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INTRODUCTION

Stock markets have gained significant prominence in recent years, mostly due to their role in providing capital, particularly for companies based in developing nations. These stock exchanges possess substantial financial resources in the form of various corporations and also regarded as a viable investment instrument for individuals seeking to optimize their savings. It is inherent for investors to seek higher returns on their assets. From this perspective, accurately determining asset prices is of utmost importance in calculating gains. The substantial growth in financial flows directed towards developing nations has prompted questions regarding the efficiency of these markets. Researchers in fields of finance and economics are particularly interested in the interaction amongst capital markets and economic growth. Numerous studies have established a positive correlation between the advancement of financial markets and economic growth. Carp (2012) asserts that stock markets are vital to the world economy and that their influence on economic growth can be transferred to the real sector through a number of channels, such as the generation of liquidity, market capitalization, risk allocation, and distribution. The stock markets play a crucial role in the economy by facilitating market liquidity, generating funds through promoting saving, diversifying the ownership of capital to foster societal expansion, and serving as an economic indicator. Due to transportation industry being one of the most crucial drivers of economic growth (Şahan and Tuna, 2021), it is essential for companies in this sector to benefit from the tools of capital markets. Transportation sector has witnessed advancements due to the expansion of global economies, the adoption of performance-driven strategies by firms, and advancements in communication and information technologies (Baygül, 2020). To sustain these advancements and stay competitive in the market, transport firms require attracting investments and generating funds now more than ever. Therefore, it is vital for their stock prices to exhibit market efficiency to encourage individuals to invest in their stocks without the fear of being consistently out-played.

Before diving into market efficiency in more detail, we have to clarify the notion of random walk, and the random walk theory. The phrase "random walk" is first coined by Pearson (1905) to characterize the trajectory followed by an intoxicated individual, who moves in an erratic and unexpected manner. The random walk theory claims that fluctuations in asset prices occur in a random manner. Stock prices exhibit inherent volatility, rendering historical

prices unreliable for conducting future price predictions. The random walk hypothesis also suggests that the stock market is efficient and accurately incorporates all accessible information. Malkiel (1973) popularized the concept of random walk theory. As per the theory attempting to time or outperform the market, or employing fundamental or technical research to forecast stock prices is a futile endeavor that can result in subpar performance. Conversely, it is contended that investors would be more advantageous by purchasing and retaining a diversified index fund. Which became the key assumption of Efficient Market Hypothesis (EMH).

Despite facing criticism from proponents of alternative methods for predicting stock prices and achieving superior performance, random walk theory continues to be extensively embraced in the field of financial economics. By acknowledging the inherent unpredictability and efficiency of stock prices, investors can prioritize long-term strategic planning and refrain from impulsive decision-making driven by short-term market fluctuations. Random walk theory serves as a reminder to investors about the significance of maintaining discipline, patience, and concentration on their long-term investing objectives.

The notion of market efficiency has garnered significant interest from policymakers, investors, academicians, and financial professionals. The efficient market concept is derived from the EMH, which asserts that the present prices of assets completely include all the accessible information regarding the true worth of the asset (Fama, 1970). Essentially, this indicates that the returns on assets cannot be predicted, and as a result, investors cannot consistently gain higher returns from their investing plans. Conversely, in markets with inefficiency, it is possible to forecast the returns on assets by analyzing past fluctuations in prices. This implies that investors have the potential to achieve better performance than the whole market. Regulators and policymakers face a constant challenge in improving the speed of price discovery by enhancing the flow of market information. This requires focusing on frameworks for laws, regulations, and transparency. Scholars find the pursuit of inefficient marketplaces and strategies to capitalize on them to be a fertile and enticing area of research. The study of market efficiency has deep roots in the literature, stretching all the way through the works of Gibson (1889), Bachelier (1900), Mandelbrot (1963), Alexander (1964), Steiger (1964) and, among others (Sewell, 2011).

Fama (1965a) discovered the initial market efficiency and conducted the first empirical study on stock prices which exhibited characteristics of a random walk. Then, Fama (1965b) addressed the generalized version of random walk, while Samuelson (1965) contributed the notion of fair play to the field of financial economics. Samuelson (1965) also examined the concept of martingale, which is closely connected to random walk in the general form. After that, Roberts (1967) improved this concept and differentiated between weak and strong efficiency forms. Lastly, Fama (1970) categorized the EMH into three distinct types: strong form efficiency, semi-strong form efficiency, and weak form efficiency. Efficiency in the strong form refers to the condition when market prices effectively incorporate all available information, including insider knowledge, that is accessible to both the public and private individuals. Investors should not possess the ability to regularly surpass the performance of the market or earn returns that above the average in this particular situation. Both the efficiencies in the forms of semi-strong and weak are encompassed by the strong form efficiency. Prices are considered to be in semi-strong form when they accurately incorporate information that is readily accessible to the public, including dividend announcements, dividend/yield ratios, political and economic events, book value/market value ratios, and stock splits. Efficiency in the weak form indicates that prices accurately reflect information of all historical prices. Therefore, employing weak form efficiency to forecast future price fluctuations provides limited advantage. Put simply, previous fluctuations in price have no influence on current or future fluctuations in price. The utility of technical analysis is rendered ineffective when the weak form efficiency is upheld. Insufficient historical evidence exists for forecasting future price fluctuations under the weak form.

Based on Lo's (2005) adaptive markets hypothesis, recent research has shown that market efficiency is influenced by specific circumstances and is constantly changing. This means that abnormal returns can occur occasionally in response to shifts in market conditions. This has been supported by empirical evidence from studies conducted by Neely et al. (2009), Kim et al. (2011), and Lim and Brooks (2011). Therefore, rather than testing EMH on overall time period, this study aims to test the market efficiency of the BIST Transportation Index in the weak form during COVID-19 period to determine if investors in this area could predict the future values via technical analysis during this period and use the historical prices to outplay the market.

LITERATURE REVIEW

In essence, the investigations conducted on market efficiency have examined whether the prices of securities display a random walk or in other words are their patterns predictable or not. As discussed in the above section, the asset prices in a market has to exhibit a random walk in order to be considered in any form of efficiency. Since this theory is one of the cornerstones of the study of finance, one can find its application on almost any market around the world.

Although the market efficiency concept has been extensively researched in various financial markets including bond markets (Hall and Miles, 1992; Hotchkiss and Ronen, 2002), credit default swaps markets (Imbierowicz and Cserna, 2008; Kiesel et al., 2016), exchange rates (Frankel and Mussa, 1980; Charles et al., 2012), and commodities (Kaminsky and Kumar, 1990; Smith, 2002; Charles and Darné, 2009; Kristoufek and Vosvrda, 2013; Bouri, 2014; Memon et al., 2022) main focus on the reviewed literature will be studies testing EMH on stock markets.

Market Efficiency in International Stock Markets

International stock markets have been extensively tested for EMH since the inception of this concept. The literature on this subject is perhaps most established on United States (US) stock markets followed second by European markets. Early researchers such as Granger and Morgenstern (1963) discovered that the price series of New York Stock Exchange (NYSE) stocks exhibit random-walk behavior in the short run, as confirmed by spectral analysis. However, they observed that this theory does not hold for long-term movements. Narayan (2006) tested the EMH on NYSE between 1964 and 2003 and concluded that the weak form efficiency upholds on the market. Lim (2007) tested various stock markets and ranked them in terms of whether they possess market efficiency or not. The study concluded that the US stock market possessed market efficiency and ranked number one amongst other countries in terms of the market efficiency scale developed by the author. Anagnostidis et al. (2016) tested the impact of 2008 global financial crisis upon the efficiencies of stock markets in the Eurozone consisting of stock exchanges of twelve European nations. Their findings suggest that from 2004 to 2008 the Eurozone stock markets followed random walk and sustained market

efficiency in the weak form. However, during the 2008 -2014 period (post-crisis era) they concluded that due to the adverse effects of crisis such as herding behavior and financial panic the EMH is disrupted where the markets turned to inefficiency. Similarly in terms of post crisis results, Younas and Mehmood (2018) conducted market efficiency tests on another major US stock market, National Association of Securities Dealers Automated Quotations (NASDAQ). Their study encompassed the period between 2007 and 2017, which concluded in rejection of the EMH.

Regarding the emerging markets, in Squalli's (2006) study, the weak form efficiency of the Dubai Financial Market (DFM) and the Abu Dhabi Securities Market (ADSM) in the United Arab Emirates is analyzed. Both exchanges are relatively recent, having been established around the year 2000. The findings from their testing regularly demonstrate that a majority of the economic sectors in the DFM and ADSM exhibit inefficiency. Kim et al. (2014) examine the stock markets in Asia and Australasia, specifically Australia, China, Bangladesh, India, Japan, South Korea, New Zealand, Pakistan, Indonesia, Singapore, Malaysia, Sri Lanka, Taiwan, Hong Kong, and Thailand with meta analysis of variance ratio tests. This cluster of stock markets has heterogeneous attributes, demonstrating fluctuating levels of advancement and sophistication over the course of time. They discover a breach of the EMH in Asian and Australasian stock markets. In general, stock market inefficiency is more pronounced in nations with less established and heavily regulated stock markets. Significantly, they have also discovered that the efficiency of the stock market has increased with time.

For testing the EMH in China, researches mainly focused on the country's primary stock markets of Shanghai Stock Exchange and Shenzhen Stock Exchange. Laurence et al. (1997), Liu et al. (1997), Long et al. (1999), and Lima and Tabak (2004) have together concluded that the stock markets of Chinese demonstrate weak form efficiency. This is evidenced by the absence of linear serial correlations in their stock returns. These efficiency findings are unexpected considering the commonly held belief that the Chinese stock markets are predominantly speculative, influenced primarily by market rumors and individual investor attitudes. On the opposite side of the fence, Ma (2004), and Mookerjee and Yu (1999) have both concluded that the primary stock markets of China were inefficient due to the rejection of the existence of random walk in their autocorrelation based investigations. While

Groenewold et al. (2004) discover substantial linear serial correlations and, they warn that the observed predictability may be false due to thin trading causing return autocorrelations.

Market Efficiency in Borsa İstanbul (BIST)

Depending on the employed methods and sample periods the literature on market efficiency of BIST, which was named İstanbul Stock Exchange (ISE) historically, exhibit differing results. On one hand, Smith and Ryoo (2003) tested the EMH using variance ratio analysis on ISE between 1991 – 1998. Their results suggested that the marked exhibited a random walk, which resulted in weak efficiency. Buguk and Brorsen (2003) tested the composite index of ISE as well as its finance and industry sub-indices with unit root approach. Their study also confirmed the efficiency in the weak form both for the composite and industry specific indices. Özdemir (2008) also conducted market efficiency on ISE 100 Index with a combination of unit root and variance ratio analysis. The study concluded that between 1990 and 2005 ISE exhibited weak form market efficiency. Based on their analysis of the ISE 30 with random walk and hypersensitivity hypothesis, Karan and Kapusuzoglu (2010) concluded that the Turkish stock market fulfilled market efficiency in the weak form during 2003-2007 period. After analyzing the BIST 100 Index regarding the EMH, Gozbasi et al. (2014) suggest that BIST was weak form efficient during 2002-2012. Çağlı (2018) contributed to the subject by testing the efficiency of BIST with a sectoral approach. He employed unit root tests to analyze random walk properties of BIST 100, BIST Financial Index, BIST Service Index, and BIST Technology Index during 1988-2018. This study resulted in confirmation of market efficiency in the weak form for BIST and its three sector based sub-indices.

On the other hand, Balaban (1995) conducted one of the very first examinations of Turkish stock market by testing EMH on ISE composite index between 1988-1994 with regression approach. Findings of this study resulted in rejection of EMH for the market. Balaban and Kunter (1997) tested the Turkish stock market efficiency in the semi strong form via causality approach and incorporated the intrabank money market and foreigh exchange market data in their model. Their findings stated that stock market in Türkiye was interdependent with the above mentioned two other markets

and did not hold efficiency in the semi strong form. Demirer and Karan (2002) used three way variance analysis method to prove the existence of market anomaly for rejecting EMH on ISE. Ozer and Ertokatli (2010) employed unit root tests in conjunction with chaos theory to test the behavior of ISE 100 during 1997-2009. Their results stated that stock market of Türkiye was an inefficient one. There are two possible explanations for the lack of consensus: either different periods were used for different markets with different levels of development, or different methodologies with different degrees of restrictive assumptions were applied.

METHODOLOGY

Following the examples of studies discussed in previous section, this study employs unit root approach, which is one of the most widely used parametric method of determining whether a series is a random walk or not, on testing the market efficiency of BIST Transportation Index. One of the primary properties of a random walk process is that it must possess a unit root, in other words to be at the order of I(1). To this end, both Augmented Dickey-Fuller (ADF) unit root test and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) stationarity tests were employed on this study. These two tests complement each other due to ADF testing for a unit root and KPSS testing for its exact opposite, stationarity (Kwiatkowski et al. 1992). The analysis of this study is conducted on Eviews 13 econometrical and statistical analysis software.

Augmented Dickey Fuller Test

The acquired test value in the ADF Unit Root Test is compared to its model using a constant and a trend formed out of;

$$\Delta y_t = \mu + \phi y_{t-1} + \sum_{j=1}^{p} \psi_i \Delta y_{t-j} + \varepsilon_t$$

Where μ is a vector of terms that are deterministic such as constant and trend. The autoregressive structure of the errors is approximated by the p-lagged

difference terms, $\Delta yt-j$, and the value of p is set such that the error term, εt, is serially uncorrelated. The null hypothesis assumes the series have unit root, in other words H_0 is $\phi \neq 0$. For determining the order of p lag selection Akaike Information Criterion (AIC) formulated by Akaike (1974) is employed. The AIC formulation is defined as:

$$AIC = 2k - 2\log(\hat{L})$$

Where $\hat{L}$ the maximized value of the likelihood function and k is the number of parameters estimated by the model.

Kwiatkowski Phillips Schmidt Shin Test

The null hypothesis of this test assumes stationarity and proposes H_0 is $\phi = 0$. This is due to the fact that KPSS uses a reverse hypothesis in its interpretation. Moreover, the bandwidth is automatically included in the KPSS computation using the Newey-West covariance estimator, so the lag time for the regression is not necessary (Newey and West, 1987). On its application the test statistic is computed by the formula below:

$$KPSS = \frac{\sum_{t=1}^{T} S_t^2}{s^2 T^2}$$

$$S_t = \sum_{i=1}^{T} \varepsilon_i$$

Where T is the effective sample size, s^2 is the Newey-West estimate of the long run variance and ε_i is the error term (Kwiatkowski et al. 1992).

Data

The data used on analysis consists of daily BIST Transportation Index closing prices published by BIST. Due to transportation, being one of the main sectors that directly contribute to Türkiye's economy, BIST created this sub index as

one of its 11 sector indices. Currently, the most important financial indicator of the transportation sector in Türkiye is the BIST Transportation Index (Akdağ et al., 2022). Index data has been gathered from Investing.com. The index has 10 firms as its components which have been given in Table 1.

Table 1. Components of BIST Transportation Index

Code	**Company**	**Operation Area**
BEYAZ	Beyaz Auto Fleet	Automotive Trading and After Sales Services
CLEBI	Çelebi Air Services	Airport Ground Services
DOCO	DO & CO	Airport Catering Services, International Catering Services, Restaurants
GSDDE	GSD Maritime	Maritime Transportation
GRSEL	GÜR-SEL Tourism	Land Transportation
PGSUS	Pegasus	Airline Transportation
RYSAS	Reysaş	Transportation and Logistics
TLMAN	Trabzon Port	Port Operations
TUREX	TUREKS	Automotive Rental, Personnel Transport, Construction Vehicles Rental
THYAO	Turkish Airlines	Transport, Communications, Storage, and Airline Transportation

Source: KAP, 2023

In order to test the EMH on BIST Transportation index during COVID-19 pandemic, the analyzed sample period is from 11 March 2020 to 1 December 2023. The starting point of the pandemic period is determined based on World Health Organization's (WHO) announcement of COVID-19 as a global pandemic on 11 March 2020. The line graph of BIST Transportation Index since the beginning of the pandemic is given at Figure 1.

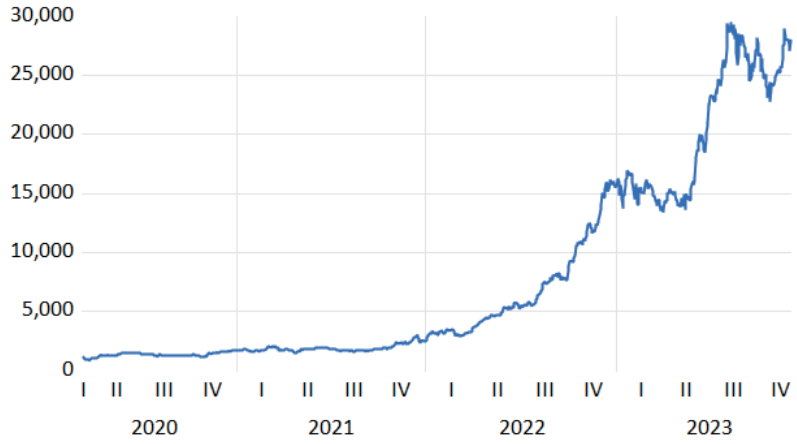

Figure 1. BIST Transportation Index

Source: Investing, 2023

Upon visual inspection of Figure 1, although staying relatively stable at the first two years of the pandemic, the increasing trend of the index can be easily identified for the COVID-19 period. Especially in the last two years, this upwards trend has reached exponential proportions. Perhaps one of the main reason for this could be the increasing inflation while having negative real interest rates in Türkiye during this period. In an economy where high inflation and negative real interest rate, investors could increase their demand for stock markets in order to protect their savings. In turn, this could cause the prices in the stock market to have an upwards trend. To start the analysis process firstly the index data has been converted into their natural logarithmic form. Then to acquire a better perspective on returns during that period, the series were converted into returns by the equation below:

$$R_t = log\left(\frac{P_t}{P_{t-1}}\right)$$

Where R_t is the index returns, while P_t represents the index price. Descriptive statistics for raw index prices and their returns are given at Table 2.

Table 2. Descriptive Statistics of BIST Transportation Index

	BIST TRAN	RETURNS(BIST TRAN)
Mean	7716.333	0.003435
Median	3008.250	0.001599
Maximum	29479.30	0.094503
Minimum	864.6100	-0.128430
Std. Dev.	8371.253	0.027474
Skewness	1.208850	0.000926
Kurtosis	3.143479	5.308609
Jarque-Bera	228.0352	206.9691
Probability	0.000000	0.000000
Observations	933	932

When Table 2 is inspected one of the first element which catches ones eye is the colossal discrepancy between maximum and minimum index values, where highest price point of the index were more than 34 times larger than its highest price point. This is also evident when we calculate the mean/standard deviation ratio of 92%. Also when the skewness and kurtosis values are inspected, we can state that the index series possess excess kurtosis and skewed to the right. When the statistics for returns are inspected, the index provided 0,01% daily returns on average to its investors during the pandemic. While it saw highest daily return at 9,45% while resulted in highest daily loss for 12,84%. The relative stability of index returns can be seen when we calculate its the mean/standard deviation ratio as 12,5%. Also when the skewness and kurtosis values of returns are inspected, we can state that the returns are not skewed while possessing excess kurtosis.

Findings and Discussion

Firstly, ADF unit root and KPSS stationarity tests have been conducted on the series natural logarithmic form in order to determine the unit root property of the random walk hypothesis of BIST Transportation Index. Lag length for ADF test is selected 0 based on AIC. Results of these tests are given at Table 3.

Table 4. ADF Unit Root and KPSS Stationarity Test Results

	ADF	**KPSS**
Test Statistics at level	−1.910321 (p: 0.64)	0.740222***
Test Statistics at 1st Difference	−30.67615^^^ (p: 0.00)	0.080581
1% critical value	−3.967926	0.216000
5% critical value	−3.414643	0.146000
10% critical value	−3.129473	0.119000

Note: *** indicates the KPSS null hypothesis of stationarity is rejected at the 1% level and ^^^ indicates the ADF null hypothesis of unit root is rejected at 1% level.

According to the ADF unit root test results, the provided test statistics is greater than critical values with the p-value of 0.64, we cannot reject the null hypothesis of H_0 is $\phi \neq 0$. Therefore conclude that the series have a unit root. Meanwhile according to the KPSS stationarity test results, the provided test statistics is greater than critical values, resulting in the rejection of null hypothesis H_0 is $\phi = 0$. Meaning the series are not stationary. After running the tests on the first differentiation of the series, this time ADF test rejects the existence of unit root while stationarity of the series cannot be rejected according to KPSS test. Meaning unit root can be removed by differentiating the series once, therefore the series possess one unit root. With results of both tests are in line with each other it is safe to state that BIST Transportation Index series possess unit root and are not stationarity. Meaning past shocks in the series are permanent and reflected in the current prices.

Existence of unit root or non-stationarity of series is a prerequisite of random walk hypothesis, however it is not enough on its own to prove the series actually follow a random walk process. It is possible that a series has a unit root, yet it is not a random walk. For example an ARIMA(p, d, q) process is a random walk with $d = 1$ and $p > 0$ or $q > 0$ or both (Campbell et. al, 1997). With the ADF and KPSS tests we determined BIST Transportation Index fulfills the $d = 1$ assumption of unit root. However, we must make sure the series possess autoregressive or moving average or both properties to affirm it follows a random walk process. To reject nonzero autocorrelations the first-

differenced process of Δx_t is estimated on different orders of (p, q). The estimation that minimizes the AIC is the selection for the Δx_t process. Model comparison of the top 20 estimations with different (p, q) orders are given in Figure 2.

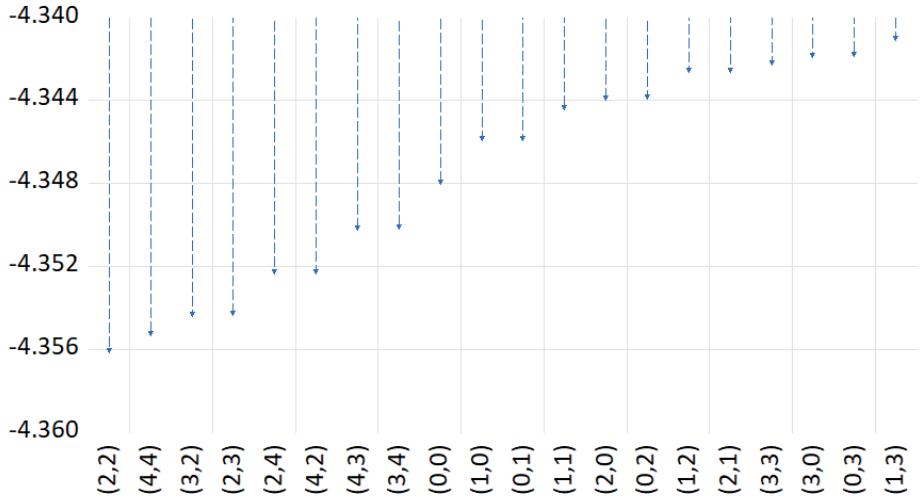

Figure 2. AIC Model Comparisons

According to AIC, the Δx_t process possesses the orders of $p = 2$ and $q = 2$. These findings point out to the existence of autoregressive and moving average properties of the series and affirm the $p > 0$ or $q > 0$ or both assumption of random walk.

CONCLUSION

The purpose of this study is analyzing the weak form efficiency of BIST Transportation Index, which is the primary indicator for stock prices of transportation companies in Türkiye, during COVID-19 pandemic. To assess the weak form of BIST Transportation sector efficiency, the daily closing prices of the index have been collected from investing.com. The sample period is selected from 11.03.2020 to 01.12.2023, consisting a total of 933 observations, in line with the announcement of COVID-19 as a global

pandemic by WHO. The analysis process includes ADF unit root test, KPSS stationarity test, and auto regressive moving average detection process.

The results of ADF unit root and KPSS stationarity tests suggested that BIST Transportation Index possesses a unit root and it is not stationary. These findings satisfied the non-stationarity aspect of the random walk hypothesis. However, in addition to not being stationary, a series has to possess autoregressive property or moving average property or both properties. To this end (p, d, q) order fitting process has been conducted based on AIC. The results indicated that best fit for Δx_t process of BIST Transportation Index has the order of ARIMA$(2,1,2)$, fulfilling the autoregressive assumption of random walk hypothesis.

Therefore, the tests employed in this study suggests that BIST Transportation Index has been moving as a random walk since the beginning of the COVID-19 pandemic, affirming the market efficiency in the weak form. In addition, individuals can safely invest in stocks of transportation sector in Türkiye without the fear of being consistently out-played. Meaning, current prices of BIST Transportation sector fully reflect its historical prices. In light of these findings, performing technical analysis for forecasting the prices to beat the market is a fruitless endeavor since the inception of COVID-19. Decision makers should direct their efforts into fundamental analysis when investing in stocks of transportation companies in Türkiye. Further studies could test the EMH on BIST Transportation Index before COVID-19 pandemic to compare their findings on our results to test the adaptive market hypothesis on this sector.

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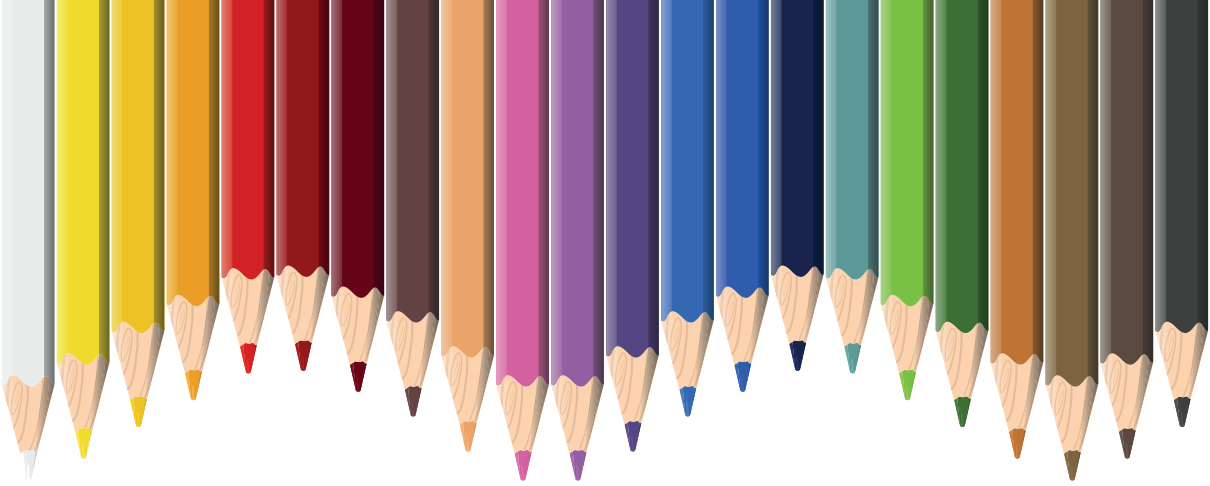

Chapter 3

A STUDY ON THE ECONOMIC DISCONTENT INDEX: THE CASE OF CIVETS COUNTRIES

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1. Introduction

The increase in inflation and unemployment rates in many countries has been detrimental to macroeconomic stability. Many studies have been conducted on these variables to measure the macroeconomic performance of national economies. Arthur Okun developed the Economic Discontent Index, which consists of the unweighted sum of annual inflation and unemployment rates in the 1970s when both recession and inflation were experienced. Later, Robert Barro created an economic discontent index in the late 1990s that reflected economic discontent and economic and social performance. Barro created a new economic discontent index by adding long-term interest rates and growth indicators to this index, which consists of inflation and unemployment rates developed by Okun (Kolaneci et al., 2016). In this index, economic discontent will increase if inflation, unemployment, and interest rates rise or growth rates decrease. However, when the rates of these first three variables drop or growth rates increase, economic satisfaction will increase. This index subtracted the growth variable from the other three variables after adding them. Because economic growth will positively increase economic satisfaction, it is calculated with a negative sign in the equation.

If unemployment and inflation rates decrease and economic growth rates increase in a country, the purchasing power of individuals is expected to increase. Economic discontent, which is expressed as the sum of inflation and unemployment rates, which are especially important for developing and developed countries, is significant for sustainable economic growth and income distribution (Şentürk & Akbaş, 2014).

CIVETS is used as an acronym for Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa, which are considered to be the new generation of tiger economies that share some common characteristics such as rapid economic growth, a young and large population, and a relatively good financial system and are often overlooked in the literature (Bentes, 2023). The abbreviation CIVETS was created in 2010 by Robert Ward of the Economist Intelligence Unit. This concept was outlined by Michael Geoghegan, CEO of HSBC Group, in a speech he delivered at the Hong Kong Chamber of Commerce in April 2010. CIVETS countries have a large, young population,

a dynamic and diverse economy, and a certain level of political stability (Akdere, 2016). In addition, CIVETS countries are considered "hot markets," "investment miracles," and "new stars" with the potential for rapid development and large-scale returns in the future, even though they are geographically very remote and shaped by very different cultural, religious and political structures (Knowledge at Wharton, 2011).

This study aims to evaluate the basic macroeconomic performance of the CIVETS countries on the path of development within the framework of the Barro Misery Index and to make an inter-country comparison.

2. Economic Discontent Index

Economic decision-makers and policymakers pay great attention to the changes in inflation, unemployment, interest, and growth rates, which are the leading macroeconomic indicators. However, it may be misleading to say that decision-makers decisions are based only on indicators. Studies show that macroeconomic decisions are also significantly affected by abstract concepts such as culture and belief systems (Kumar et al., 2011; Baxamusa & Jalal, 2014; Aggarwal & Goodell, 2014; Karakoç & Arcagök, 2023). On the other hand, while indices are derived from time-series data in the form of figures showing percentage changes over a given year (base year-base) or the previous year (Orhunbilge, 1999; Arcagök & Çilan, 2022), the misery index, also known as the economic discontent index, was one of the first attempts to develop a comprehensive index consisting of a set of indicators to monitor macroeconomic conditions over business cycles. This index was first developed by an economist, Arthur Okun, in 1966, including inflation and unemployment rates for a given economy. Over the years, other indexes, such as Barro's misery index, have been developed, including interest rates and GDP. Barro's work has also been updated and applied to countries outside the United States. The index has become an essential measure of economic livelihood in many countries (Tule, 2017).

2.1. Okun Misery Index

The Okun misery index (OMI) is the unweighted sum of inflation and unemployment rates (Das et al., 2023). This index was developed by Arthur Okun in the early 1970s, when the United States began to experience a combination of both rising unemployment and rising inflation (so-called

"stagflation") (Cohen et al., 2016). The original misery index developed by Arthur Okun is calculated as follows:

$$OMI=u+\pi$$

u: Total unemployment rate

π: Annual inflation rate

However, since it ignores deflationary effects and deflation has severe costs such as economic contraction and unemployment, the misery index is calculated as follows:

$$OMI = u+|\pi|$$

"Expressing "π" in absolute terms recognizes the fact that deflation can be as costly as inflation (Lovell & Tien, 2000).

Among macroeconomic indicators, the severe impact of high unemployment and inflation rates on a society cannot be overstated, affecting us both economically and socially. High unemployment rates not only lead to economic costs, such as the output gap but also give rise to significant social problems. Similarly, inflation issues in an economy do more than erode the purchasing power of households; they breed uncertainties and cause savings to dwindle. In this context, according to this index developed by Okun, it is clear that economic discontent intensifies with the rise of inflation and unemployment rates. At the same time, it eases when these rates decrease.

2.2. Barro Misery Index

Arthur Okun's index was revised by Robert Barro in 1999 by adding economic growth and the long-term interest rate (10-year bond interest rate). After this change, the index started to be used as Barro Misery Index (BMI) (Barro, 1999).

Barro's reformulated index is now expressed by the following equation (Eğilmez, 2018).

BMI = (Inflation Rate + Unemployment Rate + Interest Rate) - Growth Rate

On the other hand, Barro suggests using changes in variables in successive periods instead of their level values (Ewa, 2009).

$$BMI = \Delta\pi + \Delta u - \Delta Y + \Delta i$$

$$\Delta\pi = \pi_t - \pi_{t-1}$$

$$\Delta u = u_t - u_{t-1}$$

$$\Delta Y = Y_t - Y_{t-1}$$

$$\Delta i = i_t - i_{t-1}$$

In Barro's misery index, π represents the annual inflation rate, u the total unemployment rate, Y the annual GDP growth rate, and i the nominal long-term interest rate.

Since an increase in the interest rate increases misery and growth decreases misery, the interest rate is positively included in the index, and the growth rate is negative. The index is calculated by adding the unemployment, inflation, and interest rates and then subtracting the growth rate from this total. As a matter of fact, in this study, BMI is analyzed in the context of these variables.

It is important to note that the misery index has evolved since its inception by Robert Barro in 1999. Steve Hanke revised it in 2011, making a significant change. Unlike Barro, who used the economic growth rate in the index calculation, Hanke opted for the rate of increase in the Real Gross Domestic Product per Capita (RGDP). This change led to a new formula for the index: HAMI = (Unemployment rate + Inflation rate + Interest rate) - RGDP. This evolution in the index calculation reflects the ongoing refinement of economic indicators (Hanke, 2021).

3. Literature

Since the 1970s, the relationship between the economic discontent index and macroeconomic variables has started to be investigated. When the related literature is analyzed, it is observed that the relationship between the variables in the economic discontent index and economic growth has been investigated more. However, the relationship between the economic discontent index and other economic, social, and political variables has also been investigated.

Cavanaugh et al. (1988) tested the relationship between crude oil prices and Okun's Misery Index for the USA for 1979-1988 using regression analysis on multiple time series. They found a significant and positive effect between the two parameters.

Lee et al. (2007) analyzed the relationship between the Economic Discontent Index and the Economic Performance Index for 1967-2001 for S. Korea, Japan, and the USA with VAR Analysis. They stated that low economic discontent is associated with high economic performance.

Hufbauer et al. (2008) associated the misery index with presidential approval and consumer confidence index in their study using 1986-2008 data for the USA. They found that a one-point increase in the misery index leads to a decrease in the presidential approval and consumer confidence index.

Grabia (2011) calculated the Okun misery index for the European Union countries from 2000-2004 and 2005-2009. He compared the index values with the national income per capita according to purchasing power parity. Accordingly, the countries with the best index values are the Netherlands, the United Kingdom, Luxembourg, Austria, Sweden, and Denmark. The countries with the worst index values are Romania, Slovakia, Bulgaria, Lithuania, Hungary, Poland, Latvia and Estonia. He also concluded that there is a remarkable similarity between index values and national income per capita according to purchasing power parity.

Çondur (2016) analyzed the relationship between Turkey's misery index and social indicators. Although social parameters differ from region to region, he concluded that increases in the poverty index negatively affect social parameters.

Tule et al. (2017) analyze the relationship between the Okun Misery Index calculated for the Nigerian economy and oil prices and other macroeconomic parameters and provide policy recommendations.

Dadgar & Nazari (2018), in their study on the relationship between economic growth, good governance, and the misery index in the case of Iran, emphasized that there is a negative relationship between the misery index and economic growth.

Işık and Öztürk Çetanak (2018) calculated the Okun Index for the period 2000–2017 and the Barro Index for the period 2006–2017 of BRICS countries and Turkey. In the study, the country with the highest Okun index average is South Africa, while China has the lowest and best average. According to the Barro Index (1), whose index indicators are included in the calculation according to the percentage change of the previous year, the country with the highest average is South Africa. In contrast, the country with the lowest and best average is Turkey. According to the Barro Index (2), calculated by the percentage change of the index indicators, South Africa is the country with the highest average. In contrast, the country with the lowest and best average is China.

Adrangi & Marci (2019) analyzed the relationship between the rate of public support for presidential policies in the USA and the misery index using logarithmic regression and found a significant relationship between them.

Wang et al. (2019) examined the relationship between economic growth, financial development index, and poverty index in the case of Pakistan. They found that the direction of the relationship between poverty index and economic growth is negative.

Akay & Oskonbaeva (2020) analyzed the relationship between economic growth and poverty index for 16 selected developing countries between 1996 and 2017 using the Panel ARDL method. A long-term relationship was found between the index and growth. In addition, it was observed that the increase in the misery index negatively affected economic growth.

Aishwarya et al. (2021) analyzed the effect of the poverty index on health indicators and the human development index for the world. According to the results of the analysis, it was concluded that there is a strong link between the poverty index and both health indicators and the human development index.

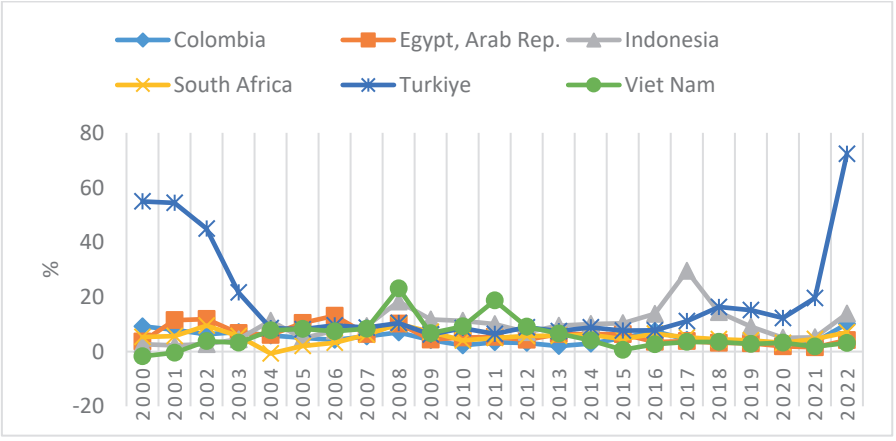
Büyüksarıkulak and Suluk (2022) calculated the misery index of the Fragile Five (Brazil, India, Indonesia, South Africa and Turkey) countries for

the period 2010-2021. The study concluded that Indonesia performed the best while Turkey and South Africa shared the last place.

4. Evaluation of Macroeconomic Performance of CIVETS Countries within the Framework of Barro Misery Index

In this study, the BMIs of Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa, called CIVETS, are calculated, and the countries are compared. The study covers the period 2010-2022. The inflation, unemployment, and growth data used in the analysis are obtained from the World Bank database, while the ten-year bond yield data are obtained from the Fred St. Louis Fed database and Investing.com. The reason for starting the analysis in 2010 is that Egypt and Turkey started to issue ten-year bonds at this date, representing long-term interest rates.

Graph 1: Inflation Rates of CIVETS Countries

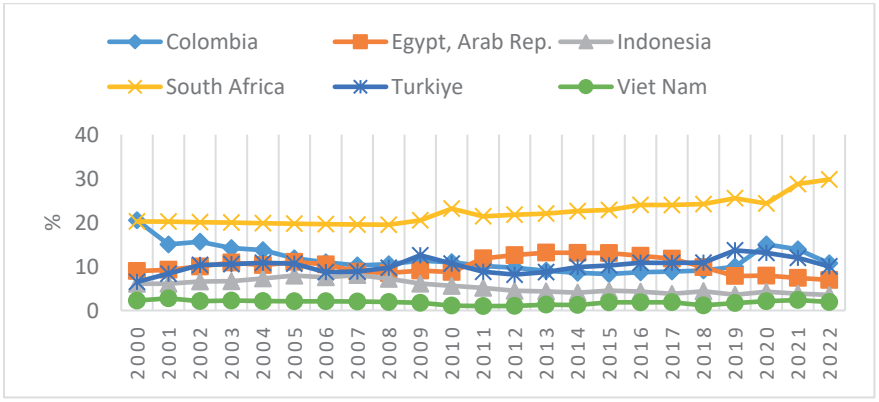


Source: World Bank

Inflation refers to a continuous increase in the general price level. Inflation can affect all aspects of a country, affecting economic growth, employment, investment, income and wealth distribution, and even social and political conditions (Mohsenia & Jouzaryan, 2016). The trend of inflation rates, one of the main variables taken into account when evaluating the macroeconomic performance of CIVETS countries and used in calculating the

economic discontent index for the period 2000-2022, is shown in Figure 1. Notably, in the years under consideration, inflation rates in CIVETS countries other than Turkey were moderate, i.e., single-digit rates, but inflation rates have increased in all countries in recent years. In Turkey, where high inflation rates were observed until the mid-2000s, inflation was single-digit until 2016, except for 2011, and it has been observed to be increasing since this year. In 2022, it exceeded 70%, a significant increase compared to the previous year, and became the country with the highest inflation rate among CIVETS countries. While Vietnam experienced negative inflation, i.e., deflation, in the early 2000s, it is observed that inflation was generally realized at single-digit and low rates throughout the years under consideration, except for 2008 and 2011. Turkey has the worst inflation performance among the CIVETS countries, and Vietnam has the best.

Graph 2: Unemployment Rates of CIVETS Countries

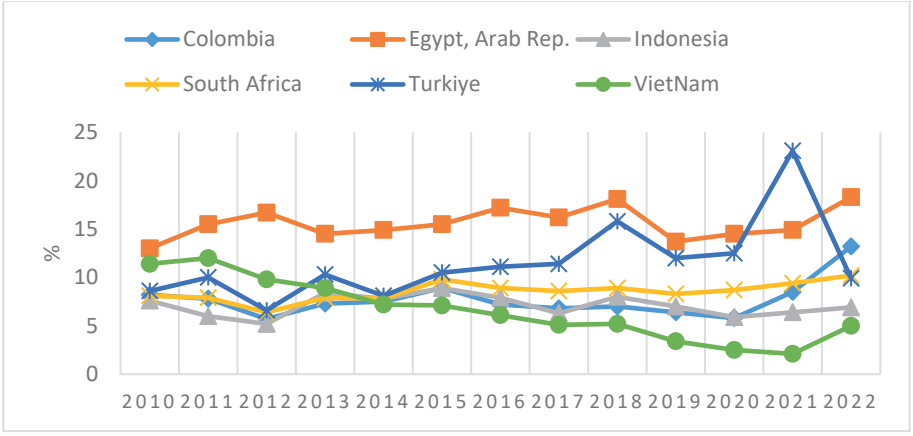


Source: World Bank

The trend of unemployment rates, one of the main variables used in calculating the economic discontent index of CIVETS countries for the period 2000-2022, is shown in Figure 2. Notably, the country with the highest unemployment rates among the CIVETS countries is S. Africa. While the unemployment rate in South Africa has been consistently above 20 percent, this rate has increased further in recent years, reaching around 30 percent. Although Egypt, Colombia, and Turkey also have double-digit and relatively high unemployment rates, unemployment rates in these countries have been

on a downward trend in recent years. In these three countries, unemployment averages were around 10-11 percent during the years under review. It is noteworthy that Vietnam has the lowest unemployment rate in CIVETS, with an average of 1.8 percent. On the other hand, the average unemployment rate in Indonesia is around 5-6 percent, and unemployment rates have generally decreased further after 2011, when unemployment rates have been less than 5 percent.

Graph 3: Long Term Interest Rates of CIVETS Countries

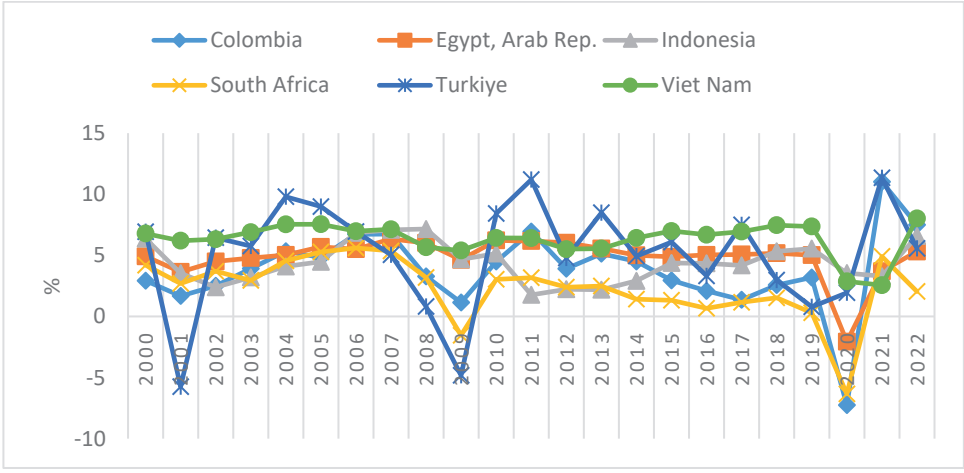


Source: Fred St. Louis FED, https://www.investing.com (Access Date: 18.09.2023).

The course of long-term interest rates, the 10-year bond interest rate, one of the main variables used in calculating the economic discontent index of CIVETS countries, for the period 2010-2022 is shown in Figure 3. It is noteworthy that Egypt has the highest interest rates among the CIVETS countries in general, while Vietnam has the lowest interest rates. It is also observed that long-term interest rates in Vietnam decreased until 2021 and realized around 2%. While the average 10-year interest rate in Egypt was around 15.6%, it has increased to around 18% in recent years. In Indonesia, interest rates have decreased significantly since 2015 and have been realized around 6-7%. In 2022, interest rates on ten-year bonds increased in all CIVETS countries except Turkey, while in Turkey, this rate decreased from

23% to around 9% compared to the previous year. On the other hand, long-term interest rates in Turkey generally increased from 2013 to 2021. In general, Turkey, together with Egypt, has the highest long-term interest rates among these countries.

Graph 4: Growth Rates of CIVETS Countries



Source: World Bank

The trend of growth rates, one of the main variables used in calculating the economic discontent index of CIVETS countries for the period 2010-2022, is shown in Figure 4. During these years, Colombia had average growth rates of 3.8%, Egypt 4.8%, Indonesia 4.4%, South Africa 2.3%, Turkey 5.1% and Vietnam 6.3%. Among these countries, Turkey had negative growth rates in 2001 and 2009, and the reason for this is thought to be the 2001 economic crisis and the 2008 global financial crisis. On the other hand, another country that had negative growth rates together with Turkey in 2009 was S. Africa. In addition, when Figure 4 is analyzed, it is seen that three countries experienced an economic contraction in 2020. Colombia, Egypt, and S. Africa were the countries whose economies shrank in this period due to the shrinking global trade due to the COVID-19 pandemic. On the other hand, among the countries whose economies recovered in 2021, Turkey's growth rate reached 11% from 1.9%, while Colombia, whose economy contracted by 7%, reached a similar growth rate the following year. Likewise, Egypt, which contracted by

2%, reached a growth rate of 3% in 2021, while S. Africa, whose economy contracted by around 6%, achieved a growth rate of around 5% the following year. However, it is also noteworthy that Vietnam has the most stable growth performance among CIVETS countries.

Table 1: Barro Misery Index Values of CIVETS Countries

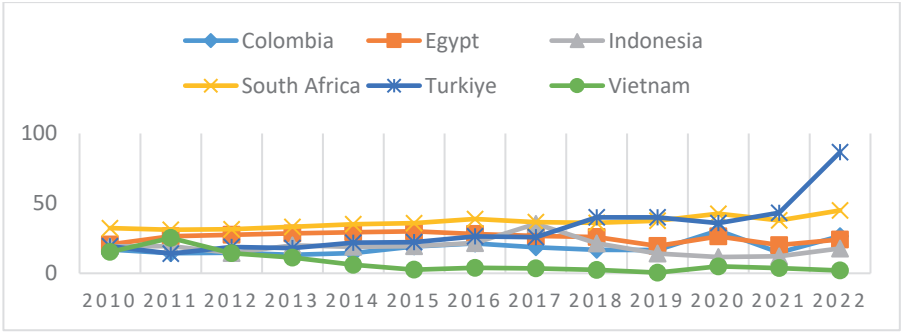
Year	Colombia	Egypt	Indonesia	South Africa	Turkiye	Vietnam
2010	16,96	20,67	19,33	32,33	19,40	15,29
2011	14,38	26,54	19,45	31,15	14,07	25,26
2012	14,70	27,55	14,56	31,52	18,85	14,42
2013	13,23	28,51	20,02	33,24	18,04	11,26
2014	14,47	29,39	19,00	35,13	21,89	6,12
2015	19,23	30,04	19,41	35,89	22,33	2,59
2016	21,32	28,14	21,67	38,83	26,39	3,93
2017	18,62	26,71	35,41	36,62	25,86	3,55
2018	16,79	25,98	21,46	36,11	40,04	2,43
2019	16,70	19,56	14,19	37,66	40,06	0,52
2020	30,62	26,43	11,64	42,59	35,95	4,96
2021	14,88	20,16	12,15	37,87	43,32	3,75
2022	26,61	24,16	17,76	45,00	86,67	2,06

Source: Calculated by author

While calculating the Barro Misery Index of CIVETS countries, the variables' ratios were considered instead of the percentage change of inflation, unemployment, long-term interest rate, and growth rate in the index compared to the previous year. Using Table 1, which shows the Barro Misery Index values of CIVETS countries, the trend of BMI values of CIVETS countries is shown in Figure 5. Considering the years taken into consideration, according to the calculated index, the country with the highest average economic discontent is S. Africa, and the country with the lowest average economic discontent is Vietnam. The reason for the high index value of S. Africa, which averages around 36.6 and has reached 45 in recent years, can be said to have high unemployment rates. Conversely, Vietnam performs better than other CIVETS countries in all variables and is the least economically discontented country. When the index values of Turkey are analyzed, we see that the index score has been on an increasing trend since 2011 and has reached 86 by 2022 from 14s. The reason for such an increase in economic

discontent in Turkey, which has diverged negatively in recent years, has been the poor inflation performance. When we look at the index value of Colombia, we see that it has increased from 16 to 26 in recent years. This situation is due to rising inflation and unemployment rates in recent years. Considering the index values of Egypt, it has relatively stable scores in the years considered. The most significant share in the index value, which averages around 25, can be attributed to the relatively higher 10-year interest rate. In Indonesia, the country with the most favorable economic discontent after Vietnam in recent years, the macroeconomic variable affecting the index value, which is around 18 on average, is inflation.

Graph 5: Barro Misery Index Values of CIVETS Countries



Source: Calculated by author

Işık and Öztürk Çetanak (2018) took the average of the macroeconomic indicators of the BRICS countries. Büyüksarıkulak and Suluk (2022) took the average of the Okun misery index and Barro misery index values of the countries called the Fragile Five and then ranked the countries by giving the highest score to the country with the highest average. In this study, a similar analysis was applied for CIVETS countries only for BMI values, and the results are shown in Table 2. Among the macroeconomic indicators for 2010-2022, Colombia and Egypt have the best performance in terms of inflation rates, while Turkey and Indonesia have the worst performance. Regarding another variable, the unemployment rate, the best-performing country is Vietnam, and the worst-performing country is South Africa. Regarding long-term interest rates, the country with the best performance is Vietnam, and the

country with the worst performance is Egypt. When the growth variable, one of the index's important indicators, is analyzed, it is seen that the country with the best growth performance in the periods considered is Vietnam, and the country with the lowest growth performance is South Africa. When the average values of the Barro index are analyzed, Vietnam has the best score, while South Africa has the lowest score.

Table 2: Index Indicators and Average of Indices

	Colombia	Egypt	Indonesia	South Africa	Turkiye	Vietnam
Inflation	4,12	4,25	11,49	5,12	15,58	5,31
Unemployment	10,23	10,52	4,29	24,2	10,6	1,58
Long Term Interest Rate	7,72	15,62	7,1	8,53	11,53	6,6
Growth Rate	3,72	4,7	3,96	1,39	5,95	6,09
Barro	18,35	25,69	18,92	36,46	31,76	7,4

Source: Calculated by author

5. Conclusion

When its components are considered, the economic discontent index can affect the economy as a whole. An increase in economic dissatisfaction may cause consumers and producers to have negative expectations about the future and impact investment, consumption, or saving decisions. An increase in the index will mean that unemployment, inflation, and interest rates will likely increase and that these macroeconomic variables will cause adverse consequences for the whole economy. An increase in the unemployment rate may lead to more challenging conditions for job seekers and cause social and economic costs. An increase in the inflation rate would reduce the purchasing power of consumers and lead to a higher cost of living. The irrationality of interest rates will also be decisive in investment, consumption, and saving decisions and may lead to the deterioration of both external and internal balance. In this study, macroeconomic indicators such as unemployment, inflation, interest rates, and growth in CIVETS countries are calculated and evaluated within the framework of BMI. While calculating the index, unemployment, inflation, and long-term interest rates are summed for each

country. Then, the index scores are calculated by subtracting the growth rate from the resulting value.

For the period 2010-2022, the country with the best performance in terms of inflation rates is Colombia, while the country with the worst performance is Turkey. The country with the best performance in terms of unemployment rate is Vietnam and the country with the worst performance is South Africa. The country with the best performance in terms of long-term interest rates is Vietnam, while Egypt has the worst performance. In the growth variable, which expresses the percentage increase in real gross domestic product, the country with the best performance is Vietnam, while the country with the lowest growth performance is S. Africa. According to the index calculated in the years analysed, on average, the country with the highest economic discontent is S. Africa and the country with the lowest economic discontent is Vietnam.

When the index findings are evaluated as a whole, it is seen that some countries have inflation problems, some have large unemployment problems, and some countries do not exhibit stable growth performances. It is important for these countries to increase economic and social welfare and achieve sustainable growth performances by focusing more on policies to eliminate such macroeconomic problems. On the other hand, it is considered that this index, which is calculated by giving equal weight to these variables such as unemployment, inflation, interest rate and growth, which are the biggest indicators of macroeconomic performance, is not sufficient to explain economic dissatisfaction. In addition, taking into account certain social and environmental indicators such as level of education, access to health services and housing conditions would help to evaluate economic dissatisfaction from a broader perspective.

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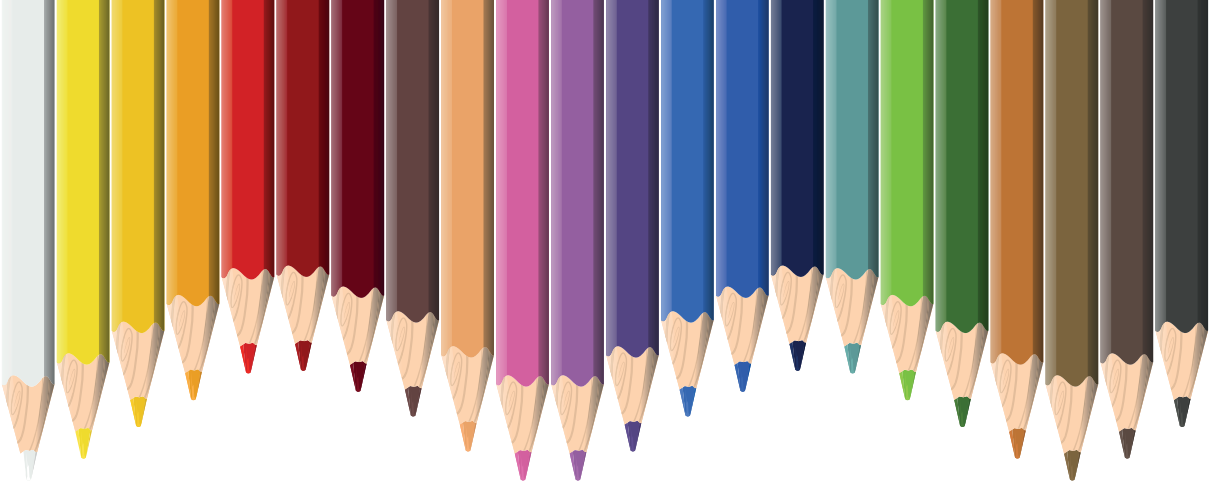

Chapter 4

INVESTIGATING THE TECHNICAL CHARACTERISTICS OF INSURANCE COMPANIES MARKETING CAR INSURANCE WITH INTUITIONISTIC FUZZY QUALITY FUNCTION DEPLOYMENT*

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* Bu çalışma "Kalite fonksiyon göçerimi ile kasko poliçesi pazarlayan sigorta şirketlerinin teknik özelliklerinin incelenmesi üzerine bir çalışma" adlı yüksek lisans tez çalışmasının geliştirilmesiyle üretilmiştir. İlgili tez "Mert Ersen" tarafından Dr.Öğretim Üyesi Banu Özgürel'in danışmanlığında yapılmıştır.

1. INTRODUCTION

With the developing technology, the competitive environment among businesses has increased and businesses have had to be open to changes in order to gain a place in the current competitive environment.

In this environment, new management models have emerged in order to have a more effective say in the market. One of the new management models is Total Quality Management (TQM) (Şahin, 2007).

TQM does not only aim to achieve higher efficiency in the goods and services produced. It also aims to achieve better efficiency in management quality. In short, it aims to fulfill customer requests respectively with the help of all employees. According to Total Quality Management, the degree of customer satisfaction and quality are directly related and when total quality will be achieved is determined by the customers.
The Quality Function Deployment (QFD) method has emerged with the aim of systematizing the understanding of "Quality Control" in a way to include the total in achieving the TQM approach (Mizuno and Akao, 1994). The philosophy of Quality Function Deployment (QFD) first emerged in Japan in 1966 (Akao,1990). Here, customer satisfaction was considered as the output with a fishbone diagram. When QFD was later used for the design of oil tanks in Mitsubishi Heavy Industry's loading facilities, it was concluded that the number of fishbones increased and some of the results were due to the same causes (Ersen, 2015). In Turkey, QFD was applied on a dishwasher by Arçelik. (Akbaba, 2005) QFD is still being discussed and debated with new studies. It helps in the development of products and services by understanding customer wants and needs and is thus used to transfer them to product/service characteristics.

Although automobile insurance attracts a lot of attention in the sector, it is shown as a source of loss every year by insurance companies. Currently, there is no adequate study on the reasons for this problem. For this reason, this study will compare the motor insurance offered by the sector as a product with customer demands and needs. This study, which will be carried out with QFD, is aimed to offer solutions to the problems of the sector on this loss-making product.

In the sector, it is observed that there are studies on the change in product structure and pricing in automobile insurance. At this point, the sector has concluded that it cannot know to what extent customer expectations are met with the existing studies. In this sense, this study will make significant contributions to the sector.

QFD will seek answers to the questions of how insurance companies, which are in a competitive environment with each other in the sector, meet or fail to meet customer demands and needs at what level, and what is the status of the sector in terms of technical features, where the voice of customers benefiting from existing motor insurance and the technical features of automobile insurance are compared.

In the second part of the study; TQM characteristics literature study was conducted.

In the third part, the focus is on investigating how effective the QFD application is in the selection of this product.

The main objectives of the study were to collect the voice of the customer, to determine the technical characteristics of the insurance companies, to determine the relationship between the technical characteristics and customer expectations, and to prioritize the technical characteristics.

In addition, competitive benchmarking, examining the relationship between technical characteristics, and the contribution of characteristics to sales at the point of sale are also included. In the fourth section, Intuitionistic Fuzzy AHP and in the fifth section Intuitionistic Fuzzy Vikor methods are analyzed. All calculations related to these methods were obtained through a long labor process using MS Excel. In the last section, the quality house is analyzed in detail and comments and suggestions are presented.

2. TOTAL QUALİTY MANAGEMENT

The definition of TQM, which prioritizes customer satisfaction, envisages the participation of all employees in common purpose and consensus, requires a long-term perspective and a broad vision, and envisages a continuous improvement in quality, can be made as follows.

TQM is a management approach that aims to develop a continuous quality with the participation of all employees, to ensure customer satisfaction with long-term goals and to be beneficial and serve the whole society (Özdemir, 2004).

It is seen that studies on total quality accelerated especially after World War II. The Japanese, who emerged from the war devastated, tried to recover, especially by making use of American scientists. For this purpose, scientists such as Deming, Feigenbaum and Juran were invited to Japan and studies on total quality were accelerated. In the light of their suggestions, they restructured their organizations and tried to spread quality to all institutions. Ishikawa, who made significant contributions to the concept of total quality, carried out his studies in this direction based on the revolution of thought in management (Garvin, 1998).

Total quality is a holistic approach of management science and is a form of management applied in all kinds of relationships and processes at all levels of the organization. An American concept, total quality management was developed by Deming and Juran, two statisticians working in the Japanese manufacturing industry. Later, total quality management was rediscovered in the US in the 1970s, and from there it moved to the UK in the 1980s (Özdemir, 2004).

As it is known, American quality experts Deming, Juran and Japanese Ishıkawa played a major role in the systematization and implementation of the TQM concept in the years following World War II. Deming's 14 basic rules of TQM, Juran's "Quality is Management's Responsibility" principle, Ishıkawa's "Quality is everyone's business" and Crosby's "Zero Defect in Production" approach laid the ground for the emergence of the ideas that form the foundations of TQM philosophy. Today, the techniques and elements used in TQM, which has been shaped as an effective and efficient management approach, are the sum of the techniques and elements put forward by these quality experts (Çetin, 2002).

In fact, the concept of TQM is a management system that has emerged as a result or a synthesis of all the work done to improve all the processes in the organization, that is, the management of quality and the improvement of the management quality of the organization (Taş, 2001).

When national structural development efforts are examined within the framework of historical evaluations, it is seen that they have been ongoing since the Ottomans, but the universal understanding of globalization, which has changed and developed in recent years, has added a separate dimension and importance to the issue in terms of access to quality life (Özdemir, 2004).

Juran emphasized that senior managers have important roles in quality management and stated that they should have certain characteristics. Deming focused on process control and argued that this should be done by the employees of the organization. Feigenbaum stated that quality control can be achieved by ensuring mutual cooperation between all units in the organization and summarized the nine important concepts of quality as follows: Market, money, management, people, motivation, material, machinery, modern information methods, increased products and rules (Cafoğlu, 1996).

There are some principles for the development and progress of TQM. Some of them are: leadership, connection, total customer satisfaction, continuous improvement, education and training, interest and ownership, trust and correction of mistakes, unity and teamwork (Gavcar, 2001).

In the development process of quality, in a period of nearly a century, the concept of quality management has been developed from the concept of control to quality control, and from there to quality assurance and its reflection on the whole organization. Crosby, Feigenbaum, Ishikawa, Deming, Feigenbaum, Ishikawa, Crosby, Feigenbaum, Ishikawa, Deming and many other scientists have made definitions that can be the basis of TQM, but in a narrower scope. The concept, which is explained with the terms quality control or total quality control at the company scale, is then defined as a management element, a new way of thinking in the management of organizations and a systematic management approach that requires change in many issues from the behavior and attitudes of individuals in the organization to strategies. According to some management scientists, the concept, which is expressed as a management philosophy, is a business understanding that aims to determine customer expectations, to realize them fully and economically, and to anticipate continuous improvement (Özdemir, 2004).

Looking at "what TQM is not" can lead us to a different approach: "TQM is not the implementation of a series of programs" (Price and Chen, 1993). Total Quality Management is both a management idea and a philosophy of "change"

in the organizational climate. The TQM philosophy: creates an environment that enables continuous improvement in an organization. TQM is a management idea that focuses on customer satisfaction by utilizing people-oriented measurement, structuring and disciplining production. In simple terms, TQM is "doing the right thing at the right time and using all the time correctly. TQM is a management system based on competition by creating an organizational climate that directs employees towards a common goal and rewards those who are successful (Tekin, 2002).

3. QUALITY FUCTION DEPLOYMENT

QFD has been defined by scholars in different ways according to themselves. Some of these definitions are given below (Yenginol, 2008; Ardıç et al., 2008).

- "QFD is not just a tool, but a planning process that assists a business in the effective use of other technical tools to support and complement each other and to identify priority issues" (DAY, 1998).

- "QFD is a method that aims to improve design quality in order to satisfy the customer and to translate the customers' demands into design goals and key quality assurance points to be used during production" (Akao, 1990).

- QFD is a way of listening to customers and finding out what they want, then determining how to meet those needs" (Guinta and Praizler, 1993).

If we try to make our own definitions based on these definitions; QFD is a service development method that is not too difficult to understand, although it has a detailed and specific structure to ensure customer satisfaction (Akbaba, 2000). While some management scientists define it as a management philosophy, others define it as a business approach that aims to continuously improve customer wants and needs by identifying them in advance (Meriç, 2003).

QFD is not only about the products produced, but also about quality throughout the entire organization. It aims to improve design quality in order to satisfy the customer and at the same time to translate their demands into

design goals and key quality assurance points to be used in the production process. It uses methods such as surveys, focus groups and interviews to achieve this goal.

The data obtained should be systematically organized and transformed into technical data to guide the planning and development phase. QFD is an efficient method that can be applied to realize this transformation by providing numerous benefits. Yenginol defines QFD as "transforming the qualities that customers want and need in the product or service into functions that will fulfill or realize these qualities and transferring the task of doing the work related to the realization of these functions to the appropriate units within the organization" (Yenginol, 2000). Based on the definitions, QFD adopts a customer-based production and service approach. Most tourism businesses conduct market research to understand the expectations of their customers and evaluate the production process and product portfolio in this context. Although the effect of the services offered within the scope of the data found as a result of market research in the service sector on the satisfaction level of customers is lower than in production enterprises, most of the enterprises in the sector strive to achieve a certain position with this method (Yenginol, 2000).

In addition, the correct interpretation of market research by managers in many businesses in the sector significantly affects the position of the business in the market. In these enterprises, only the opinions of managers are not sufficient in determining customer expectations and needs (Ersen, 2015). Only small businesses can adopt such an understanding. In institutionalized large-scale enterprises, the data of market research is carried out by the marketing department. The main point here is to ensure that the data is analyzed reliably and accurately. The QFD method enables good communication between the customer and the manufacturer. In this way, the voice of the customer is influential in all decisions to be taken, starting from the design of the product. Giving importance to the voice of the customer in company policies allows us to conclude that the company is a customer-based company. Today, due to the intense competition environment, the companies that are one step ahead in success are the companies that follow customer-based policies, listen to the voice of the customers and aim to offer products that will satisfy them in the best way. If we briefly redefine QFD, we can express it as an important method that allows us to compare ourselves with

other businesses that we see as competitors in the sector that prioritize customer requests and thus enable us to gain a competitive advantage in the market itself (Ersen, 2015).

QFD aims to achieve the level of quality desired by the customer in all the design, production and planning steps of the products that consumers want to have. It focuses on skills in the organization to achieve these goals.

3.1 Quality Function Deployment Process

The main goal of Quality Function Migration is to bring the customer and the company to a common point. QFD is based on the transformation of customer needs (WHATs) into appropriate technical specifications (HOWs) at each stage of new product development and production. In other words, QFD first determines what the customer wants and expectations are, and then systematically explains how these wants and expectations can be met (Dinçer, 2017).

A Quality Function Deployment system is usually set up in 4 phases (Delice & Güngör, 2008).

Phase 0: Planning

Phase 1: Collecting Customer Voice (Identifying Customer Needs)

Phase 2: Creating the Quality House

Phase 3: Analysis and Interpretation of Results

3.1.1 Planning Phase (Phase 0)

In order for the QFD project to be carried out successfully, its organization and planning must be done well. The project plan should be prepared well in order to avoid negative results and success (Çinpolat, 2007).

The planning phase includes securing organizational support, setting objectives, deciding on the customer group, determining the time horizon, deciding on the product concept, establishing the team, designing the QFD process and providing the necessary materials and facilities (Akbaba, 2000).

3.1.2 Identifying Customer Needs (Phase 1)

The founders of businesses think that they can meet the wants and needs of customers in a way that is superior to their competitors. Being more advantageous than the products of competitors is very important when the product is first introduced to the market. Therefore, the wishes of the customers need to be understood correctly. In order for businesses to make themselves successful, they need to have processes that can continuously follow customer demands and expectations and constantly update them. If customers' expectations cannot be constantly monitored, new products will be disadvantageous compared to other products at the beginning of the business. QFD is a design concept that provides businesses with up-to-date customer expectations and the voice of the customer is the first stage of QFD (Eymen, 2006).

3.1.3 Creation and Analysis of the Quality House (Stages 2 and 3)

The second and third stages in the QFD process are steps that complement each other and are in the same place. While the quality house is constructed in the second stage, the quality house is evaluated and interpreted in the third stage. In this section, which constitutes the last two stages of the QFD process, the information gained throughout the process is brought together in the quality house, which is an integrated matrix (Dinçer, 2017).

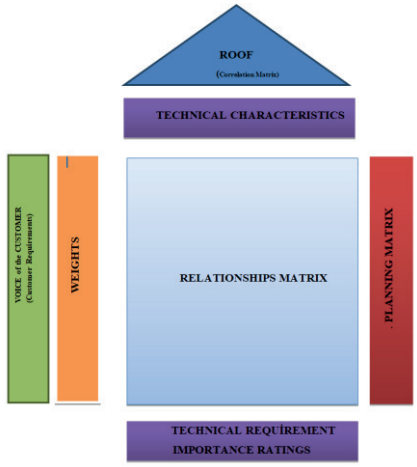
There are two important parts of the quality house to be created in the QFD application created according to customer expectations. The horizontal part of the quality house consists of the customer part, which contains information about customers, and the vertical axis consists of the technical part that responds to customer information (Delice & Güngör, 2008).

Customer section: This is the section created with information received from customers. Customer opinions are the basic input required for the start of the QFD project. Customers try to express their expectations in their own way. These expressions need to be expressed in terms that companies can understand and with measurable data (Ersen, 2015).

Technical part: The technical part of the matrix includes how businesses will respond to the expectations that customers want to describe in their own way (Ersen, 2015).

Here, the information in the customer section is evaluated. At the top of the matrix are the technical and design requirements that companies must use to identify and measure customer needs. Here, the transformation of customer needs into technical requirements constitutes the business effort. Figure 1 shows an example quality house.

Figure 1. Sample Quality House



It has been observed that the traditional quality function determines the weight of customer requirements without making a pairwise comparison, which may lead to incorrect ranking of technical requirements, the preference states of decision makers are not taken into account due to the use of linear aggregation model in prioritizing technical requirements (Huang et al., 2019), and recently, studies that integrate fuzzy multi-criteria decision-making methods have gained importance in order to provide solutions for uncertain situations that occur in human decisions (Bulut & Sakallı, 2021).

In this study, intuitionistic fuzzy set theory is utilized to deal with the hesitancy in the imprecise statements of customer expressions and expert opinions. While prioritizing customer requirements, Intuitionistic Fuzzy AHP method is used to cope with the errors and inconsistencies that occur when translating customer requirements expressed in ordinal scales in the traditional quality function into a numerical scale. In order to take into account the preference states of decision makers, which are not taken into account by the traditional quality function propagation when transforming customer requests into

technical requirements, the Intuitionistic Fuzzy VIKOR method was used to obtain the most important technical requirement.

4.INTUITIVE FUZZY AHP

The Analytic Hierarchy Process (AHP) was first used by two scientists, Myers and Alpert, in 1968. Later, in 1977, it was used by Saaty on a model to make it useful in decision-making problems. In 1980, Saaty defined the Analytic Hierarchy Process (AHP) as a decision method that transforms a complex multi-criteria decision problem into a hierarchy (Saaty, 1980; Yaralıoğlu, 2001).

In order to define the decision hierarchy, it is necessary to use AHP. We can briefly define AHP as a decision-making and estimation method that allows us to find the percentage distributions of decision points. AHP uses a predetermined comparison matrix on the defined decision hierarchy and is based on pairwise comparisons in terms of factors affecting the decision (Demirer, 2017). The differences in importance on the decision points are converted into percentage distributions (Tektaş and Hortaçsu, 2003). The main advantage of using quality function propagation and AHP is that it is a technique applied in decision-making problems to prioritize evaluation criteria. In the AHP method, there is a one-way relationship between the objective, criteria, sub-criteria and alternatives (Mayyas et al., 2011). The AHP method does not fully express the functioning of the human thought system. Therefore, fuzzy AHP method was developed to solve hierarchical fuzzy problems (Bulut and Sakallı, 2021). In their 1983 study, Laarhoven and Pedrycz developed a new method that is an extension of the AHP method proposed by Saaty and compared fuzzy ratios expressed in triangular fuzzy numbers (Laarhoven and Pedrycz, 1983).

In their 1985 study, Buckley and Uppuluri extended the classical AHP method by using fuzzy comparison ratios and used the geometric mean method to calculate fuzzy weights (Buckley and Uppuluri, 1985). In the literature, it is possible to find studies in which intuitionistic fuzzy AHP method, which is an extension of fuzzy set theory, is used.

Intuitionistic fuzzy AHP was first presented by Silavi et al. in 2006 on earthquake vulnerability mapping (Silavi et al., 2006). Sadiq and Tesfamariam in 2009 examined the ambiguity and dichotomous uncertainty in AHP by

utilizing intuitionistic fuzzy set theory for environmental decision making. (Sadiq and Tesfamariam, 2009). In 2009, Abdullah et al. proposed a new AHP that uses two representations of the intuitionistic fuzzy set membership function and non-member function without considering the values of the degree of hesitation as a component of the intuitionistic fuzzy set preference measurement representation (Abdullah et al., 2009). In 2011, Zhang et al. introduced the heuristic fuzzy AHP method in relation to fuzzy AHP (Zhang et al., 2011). In 2011, Wang et al. proposed an intuitionistic fuzzy AHP that synthesizes the eigenvectors of an intuitionistic fuzzy comparison matrix where all decision information is represented by intuitionistic fuzzy values (Wang et al., 2011). In their 2014 study, Xu and Liao discussed the extension of the classical AHP method to intuitionistic fuzzy AHP with intuitionistic fuzzy set. (Xu and Liao, 2014). In their 2014 study, Abdullah and Najib proposed a new heuristic fuzzy AHP with a new pair matching comparison matrix evaluation preference scale. This new preference scale leads to the proposal of a new consistency test for matrix evaluation using the values of the degree of hesitation. The intuitionistic fuzzy AHP steps presented by Abdullah and Najib in 2014 are as follows (Abdullah and Najib, 2014).

Step1: For the decision-making problem, the objective, criteria, sub-criteria and their related solution alternatives are defined and then the hierarchy of the problem under consideration is created.

Step 2: Design and select the IFS evaluation scale with AHP. The study by Abdullah and Najib was used as the evaluation scale for comparing the relative importance of the criteria. Table 1 shows the linguistic variables and their equivalent expressions in IFS (Abdullah and Najib, 2014).

Table 1. Transformation of Ahp Preference into Intuitive Fuzzy Set and Its Reciprocal Forms

Linguistic Variables	AHP Preference Number	IFS Equivalent	Opposite IFS Equivalent
Equally Important	1	(0.02 0.18 0.8)	(0.02 0.18 0.8)
Middle Value	2	(0.06 0.23 0.7)	(0.23 0.06 0.7)
A Little Important	3	(0.13 0.27 0.6)	(0.27 0.13 0.6)
Middle Value	4	(0.22 0.28 0.5)	(0.28 0.22 0.5)

Strong Important	5	(0.33 0.27 0.4)	(0.27 0.33 0.4)
Middle Value	6	(0,47 0,23 0,3)	(0.23 0.47 0.3)
Very Strong Important	7	(0.62 0.18 0.2)	(0.18 0.62 0.2)
Middle Value	8	(0.8 0.1 0.1)	(0.1 0.8 0.1)
Absolutely Important	9	(1 0 0)	(0 1 0)

Step 3: Determine the weights of the experts. The importance of experts is assessed using IFS language terms, as can be seen in Table 2. In this approach, the importance of decision makers may vary according to their experience and knowledge of the topic. In light of this information, $D_k(\mu_k, v_k, \pi_k)$ is the evaluation of the kth expert in terms of an intuitionistic fuzzy number. Accordingly, the weight of expert k can be calculated by Equation (1):

$$\lambda_k = \frac{(\mu_k + \pi_k(\frac{\mu_k}{\mu_k + v_k}))}{\sum_{k=1}^{l}(\mu_k + \pi_k(\frac{\mu_k}{\mu_k + v_k}))} \text{ and } \sum_{k=1}^{l}\lambda_k = 1, k = (1,2,...,l) \quad (1)$$

If it is assumed that all experts have equal importance, the weight of the kth expert can be calculated by Equation (2):

$$\lambda_k = \frac{1}{l} \text{ and } \sum_{k=1}^{l}\lambda_k = 1, k = (1,2,...,l) \quad (2)$$

For linguistic variables defined triangular intuitonistic fuzzy numbers are given in Table 2.

Table 2. Linguistic Variables for the Importance of Experts

Linguistic Variables	**IFS Equivalent**
Very Important	(0.90,0.05,0.05)
Important	(0.75,0.20,0.05)
A Little Important	(0.50,0.40,0.10)
Unimportant	(0.25,0.60,0.15)
Very Insignificant	(0.10,0.80,0.10)

Step 4: Experts' intuitive preference relations are determined. In this step, first, pairwise comparisons are obtained for each criterion and sub-criteria and then intuitive preference relations are established.

The importance of each criterion is denoted by "W", where $\lambda = (\lambda_1, \lambda_2, ...\lambda_l)$ is the weight of experts and $\sum_{k=1}^{l} \lambda_k = 1, \lambda_k \in [0,1]$.

The group decision-making procedure is used to find the most suitable alternative according to the experts' assessments. Therefore, all individual opinions have to be combined in an aggregated form. Therefore, the IFWA operator is used to aggregate the experts' assessments in order to rank the importance levels for the criteria and alternatives (Xu, 2007).

$W_j^{(k)} = [\mu_j^{(k)}, v_j^{(k)}, \pi_j^{(k)}]$ is an IFS given to criterion X_j by the kth expert. Aggregation is done using Equation (3) and criterion weights are calculated with the IFWA operator as follows (Ünlükal, 2019):

$$
\begin{aligned}
&W_j = IFWA_\lambda(W_j^{(1)}, W_j^{(2)}, ...W_j^{(l)}) = \lambda_1 W_j^1 \oplus \lambda_2 W_j^2 \oplus \lambda_3 W_j^3 \oplus ...\lambda_l W_j^l \\
&W_j = [1 - \prod_{k=1}^{l}(1-\mu_j^{(k)})^{\lambda_k}, \prod_{k=1}^{l}(v_j^k)^{\lambda_k}, \prod_{k=1}^{l}(1-\mu_j^{(k)})^{\lambda_k} - \prod_{k=1}^{l}(v_j^{(k)})^{\lambda_k}] \\
&W = [W_1, W_2, W_3, ...W_j] \\
&W_j = [\mu_j, v_j, \pi_j], (j = 1, 2, ..., n).
\end{aligned}
\tag{3}
$$

Step 5: Construct the combined weighted Intuitionistic Fuzzy (IF) decision matrix. After finding the criteria weights (W) IF decision matrix, the combined weighted IF decision matrix is constructed as indicated in Equation 4, Equation 5, Equation 6 and Equation 7 below.

$$R \otimes W = \{x, \mu_{A_i}(x).\mu_w(x), v_{A_i}(x) + v_w(x) - v_{A_i}(x).v_w(x) \big| x \in X\} \tag{4}$$

$$\pi_{A_i} w(x) = 1 - \mu_{A_i}(x).\mu_w(x) - v_{A_i}(x) - v_w(x) + v_{A_i}(x).v_w(x) \tag{5}$$

$$R^{*}=\begin{bmatrix} \mu_{A_1}w(x_1),v_{A_1}w(x_1),\pi_{A_1}w(x_1) & \mu_{A_1}w(x_2),v_{A_1}w(x_2),\pi_{A_1}w(x_2) & \dots & \mu_{A_1}w(x_n),v_{A_1}w(x_n),\pi_{A_1}w(x_n) \\ \mu_{A_2}w(x_1),v_{A_2}w(x_1),\pi_{A_2}w(x_1) & \mu_{A_2}w(x_2),v_{A_2}w(x_2),\pi_{A_2}w(x_2) & \dots & \mu_{A_2}w(x_n),v_{A_2}w(x_n),\pi_{A_2}w(x_n) \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \cdot & \cdot & & \cdot \\ \mu_{A_m}w(x_1),v_{A_m}w(x_1),\pi_{A_m}w(x_1) & \mu_{A_m}w(x_2),v_{A_m}w(x_2),\pi_{A_m}w(x_2) & \dots & \mu_{A_m}w(x_n),v_{A_m}w(x_n),\pi_{A_m}w(x_n) \end{bmatrix} \quad (6)$$

$$R^{'}=\begin{bmatrix} r_{11}^{'} & r_{12}^{'} & \dots & r_{1m}^{'} \\ r_{21}^{'} & r_{22}^{'} & \dots & r_{2m}^{'} \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot \\ r_{n1}^{'} & r_{n2}^{'} & \dots & r_{nm}^{'} \end{bmatrix} \quad (7)$$

$r_{ij}^{'}=(\mu_{ij}^{*},v_{ij}^{*},\pi_{ij}^{*})=(\mu_{A_i}w(x_j),v_{A_i}w(x_j),\pi_{A_i}w(x_j))$ is an element of the combined weighted IF decision matrix.

Step 6: The consistency of each heuristic preference relation is checked. To do this, the consistency ratio (CR/Consistency Rate) is calculated. The aim here is to determine whether the pairwise comparisons are consistent. If the CR is less than 0.10, the comparisons are considered consistent. If the CR is greater than 0.10, this ratio is unacceptable and the comparisons need to be repeated and the values revised. The consistency ratio formula given in Equation (8) is adapted from Abdullah and Najib (2014) (Abdullah and Najib, 2014).

$$CR=\frac{(\lambda_{\max}-n)/(n-1)}{RI} \quad (8)$$

The values of random indices (RI) are taken from Saaty (Saaty, 1980; Özel and Türkel, 2018). These values are shown in Table 3.

Table 3. Random Indices of Matrix Dimensions

n	1-2	3	4	5	6	7	8	9
RI	0.0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

$(\lambda_{\max} - n)$ is expressed as the arithmetic mean of the values of $\pi_{(X)}$, the combined IF matrix of each criterion. Here it specifies the size of the matrix. Here n, denotes the dimension of the matrix.

Step 7: The IF entropy weights of the combined weighted IF decision matrix are calculated as in Equation (9) (Abdullah and Najib, 2014):

$$\overset{=}{w}_i = -\frac{1}{n\ln 2}[\mu_i \ln\mu_i + v_i \ln v_i - (1-\pi_i)\ln(1-\pi_i) - \pi_i \ln 2] \tag{9}$$

When $\mu_i = 0,\ v_i = 0,\ \pi_i = 1$ in Equation 9; $\mu_i \ln\mu_i = 0,\ v_i \ln v_i = 0,$ $(1-\pi_i)\ln(1-\pi_i) = 0$. If $\mu_i = 1,\ v_i = 0,\ \pi_i = 0$; $\mu_i \ln\mu_i = 0,\ v_i \ln v_i = 0,$ $(1-\pi_i)\ln(1-\pi_i) = 0$.

Finally, the final entropy weight of each IF matrix is defined using Equation (10) below:

$$w_i = \frac{1-\overset{=}{w}_i}{n - \sum_{j=1}^{n} \overset{=}{w}_i}, \sum_{j=1}^{n} w_i = 1 \tag{10}$$

5. INTUITIVE FUZZY VIKOR

The VIKOR method, which is frequently preferred among multi-criteria decision making methods, was developed by Opricovic in 1998 (Opricovic, 1998). The VIKOR method aims to select the most appropriate alternative by ranking alternatives among conflicting criteria. The aim of the method is to find a multi-criteria optimal compromise solution that will provide maximum group benefit (majority rule) and minimum individual regret with a compromise solution. In the classical VIKOR method, the weights of the criteria are known precisely. However, it is difficult to access precise data in solving real-life problems. Therefore, decision makers need to take into account imprecise information. When the decision matrix used in the VIKOR method contains uncertain and imprecise data, a fuzzy extension of the VIKOR method should be used.

In the literature, the ordinary fuzzy VIKOR method was developed by Wang et al. in 2006, the intuitionistic fuzzy VIKOR method by Devi in 2011, and the

hesitation fuzzy VIKOR method by Liao and Xu in 2013 (Wang et al., 2006; Devi, 2011; Liao and Xu, 2013). In this study, the technical requirements in the quality house were ranked using a heuristic fuzzy VIKOR method adapted from Chatterjee et al. 2013 (Chatterjee et al., 2013). The intuitionistic fuzzy VIKOR steps are given below.

Step 1: Combining the individual intuitionistic fuzzy values for the technical requirements into group intuitionistic fuzzy values.

With the help of the experts' statements, an aggregated intuitionistic fuzzy preference relationship matrix is created. While creating the relationship matrix, the linguistic variables given in Table 4 are utilized. Here $R = (r_{ij}^{(k)})_{mxn}$, is defined as the intuitionistic fuzzy decision matrix of the kth expert for the technical requirements. The determination of the weights of the experts and the combined weighted intuitionistic fuzzy (IF) decision matrix is obtained as in the Intuitionistic fuzzy AHP method.

Table 4. Linguistic Variables for the Assessment of Technical Requirements

Linguistic Variables	μ	v	π
Extremely Bad (EB)	0	0,9	0,1
Very Bad (VB)	0,1	0,85	0,05
Bad (B)	0,25	0,6	0,15
Middle Bad (MB)	0,4	0,5	0,1
Middle (M)	0,5	0,45	0,05
Partially Good (PG)	0,6	0,3	0,1
Good (G)	0,75	0,1	0,15
Very good (VG)	0,9	0,05	0,05
Extremely Good (EG)	1	0	0

Step 2: Positive and negative ideal solutions are found. Here (in Equation 11 and Equation 12) A^*, is defined as the positive ideal solution and A^-, is defined as the negative ideal solution. J_1 refers to the set of benefit criteria and J_2 refers to the set of cost criteria. The definitions of μ_j^*, v_j^*, μ_j^- and v_j^- values are given in Equation 13, Equation 14, Equation 15 and Equation 16 respectively.

$$A^* = (\breve{r}_{1^*}, \breve{r}_{2^*}, ..., \breve{r}_{n^*})\breve{r}_{j^*}, = (\mu_j^*, v_j^*, \pi_j^*), j = 1,2,...n \quad (11)$$

$$A^{-} = (\breve{r}_{1^{-}}, \breve{r}_{2^{-}}, ..., \breve{r}_{n^{-}})\breve{r}_{j^{*}}, = (\mu_j^{-}, v_j^{-}, \pi_j^{-}), j = 1,2,...n \tag{12}$$

From here;

$$\mu_j^{*} = (\overset{Max}{i}\{\mu_{ij}\}\Big| j \in j_1), (\overset{Min}{i}\{\mu_{ij}\}\Big| j \in j_2) \tag{13}$$

$$v_j^{*} = (\overset{Max}{i}\{v_{ij}\}\Big| j \in j_1), (\overset{Min}{i}\{v_{ij}\}\Big| j \in j_2) \tag{14}$$

$$\mu_j^{-} = (\overset{Min}{i}\{\mu_{ij}\}\Big| j \in j_1), (\overset{Max}{i}\{\mu_{ij}\}\Big| j \in j_2) \tag{15}$$

$$v_j^{-} = (\overset{Min}{i}\{v_{ij}\}\Big| j \in j_1), (\overset{Max}{i}\{v_{ij}\}\Big| j \in j_2) \tag{16}$$

Step 3: Normalized heuristic fuzzy discrimination is calculated using Euclidean distance (Szmidt and Kacprzyk, 2000). These calculations are given in Equation 17, Equation 18, Equation 19 and Equation 20 respectively.

$$d(\hat{a}_j^{*}, \hat{r}_{ij}) = \sqrt{\frac{1}{2}(\mu_j^{*} - \mu_{ij})^2 + (v_j^{*} - v_{ij})^2 + (\pi_j^{*} - \pi_{ij})^2} \tag{17}$$

$$d(\hat{a}_j^{*}, \hat{a}_j^{-}) = \sqrt{\frac{1}{2}(\mu_j^{*} - \mu_j^{-})^2 + (v_j^{*} - v_j^{-})^2 + (\pi_j^{*} - \pi_j^{-})^2} \tag{18}$$

$$S_i = \sum\nolimits_{j=1}^{n} w_j \frac{d(\hat{a}_j^{*}, \hat{r}_{ij})}{d(\hat{a}_j^{*}, \hat{a}_j^{-})} \tag{19}$$

$$R_i = 1 \le \overset{Max}{j} \le n\{w_j \frac{d(\hat{a}_j^{*}, \hat{r}_{ij})}{d(\hat{a}_j^{*}, \hat{a}_j^{-})}\} \tag{20}$$

Step 4: Calculate the degree of closeness coefficients for each technical requirement. The values of Q_i S^{*} and S^{-} are given in Equation 21, Equation 22 and Equation 23.

$$Q_i = \alpha \frac{s_i - s^*}{s^- - s^*} + (1-\alpha)\frac{R_i - R^*}{R^- - R^*} (i = 1,2,...m) \quad (21)$$

From here;

$$S^* = 1 \le \overset{Min}{j} \le m^{\{S_i\}} \quad R^* = 1 \le \overset{Min}{j} \le m^{\{R_i\}} \quad (22)$$

$$S^- = 1 \le \overset{Max}{j} \le m^{\{S_i\}} \quad R^- = 1 \le \overset{Min}{j} \le m^{\{R_i\}} \quad (23)$$

α , should be the maximum group utility weight. Accordingly, $(1-\alpha)$is the individual regret weight, $\alpha \in [0,1]$.

Step 5: Technical requirements are ranked according to S, R and Q values. At this stage, it is necessary to determine whether the best alternative is a compromise solution. To determine the best compromise solution, the following two conditions are checked. If the two conditions are met, the solution identified using the Q_i index is the compromise solution (Bulut and Sakallı, 2021).

1. Acceptable Advantage:
   $Q_{Technical\ Requirement_{(2)}} - Q_{Technical\ Requirement_{(1)}} \ge \frac{1}{m-1}$,
   $Q_{Technical\ Requirement_{(2)}}$, Q_i is the second technical requirement in the list here.
2. Acceptable Stability: It should be the best when ranked according to $Q_{Technical\ Requirement_{(1)}}$, S_i and/or R_i.

That is, if $Q_{Technical\ Requirement_{(M)}} - Q_{Technical\ Requirement_{(1)}} \le \frac{1}{m-1}$ and condition 1 is not satisfied, $\text{Technical Requirement}_{(M)}$ and $\text{Technical Requirement}_{(1)}$ are the same compromise solution. If condition 2 is not satisfied, although $\text{Technical Requirement}_{(1)}$ has a relative advantage, there is no stability in the decision making. Therefore, the set consisting of $\text{Technical Requirement}_{(1)}$ and $\text{Technical Requirement}_{(2)}$ is recommended, since $\text{Technical Requirement}_{(1)}$ and

$\text{Technical Requirement}_{(2)}$ are identical (Ay-Türkmen and Bildik, 2015; Akyüz, 2012).

6. METHOD

Nowadays, with the developing technology, it is now seen as a necessity for people to own a car. Especially due to the increase in the number of people owning automobiles, the need for car insurance is gradually increasing and therefore the competitive environment in car insurance is constantly heating up.

The most widely used area of insurance in our country car insurance. When we talk about car insurance, we think of securing and covering the damages that occur as a result of accidents caused by vehicles.

The insurance sector in our country has recently undergone rapid growth. For this reason, many new insurance companies have started to operate and have entered into fierce competition with each other. In order to get a higher share of the market, insurance companies offering motor insurance try to offer different services to their customers and try to ensure that customers prefer them when making decisions. With QFD, it is aimed to compare the technical features of insurance companies marketing motor insurance with the voice of customers.

In order to create the voice of the customer part of the quality house, interviews were first conducted with marketing experts from insurance companies offering motor insurance services. Customer requirements were learned through focus group and mutual interviews. The customer requirements obtained are listed below;

- Vehicle Insurance Cost (Customer Requirement 1=CR1)
- Policy Price (Customer Requirement 2=CR2)
- Brand Awareness (Customer Requirement 3=CR3)
- Reliability of the Company (Customer Requirement 4=CR4)
- Damage Payment Speed (Customer Requirement 5=CR5)
- Whether Indexed to Inflation (Customer Requirement 6=CR6)
- Service Agreements (Customer Requirement 7=CR7)

- Additional Guarantees (Customer Requirement 8=CR8)
- After Sales Service Quality (Customer Requirement 9=CR9)
- After Damage Service Quality (Customer Requirement 10=CR10)
- Special Conditions (Customer Requirement 11=CR11)
- General Conditions (Customer Requirement 12=CR12)

In the technical requirements section at the top of the quality house, at least one technical requirement was identified for each customer requirement. The technical requirements were created as a result of interviews with marketing experts of insurance companies operating in the sector. The identified technical requirements are listed as follows;

- Education Level of Employees in the Company (Technical Requirement 1=TR1)
- Experience in Insurance (Technical Requirement 2=TR2)
- Number of Employees (Technical Requirement 3=TR3)
- Number of Branches (Technical Requirement 4=TR4)
- Fund Performance (Technical Requirement 5=TR5)
- Portfolio Volume (Technical Requirement 6=TR6)
- Number of Customers (Technical Requirement 7=TR7)
- Foreign Capital Assets (Technical Requirement 8=TR8)
- Information Technologies (Technical Requirement 9=TR9)
- Payment (Technical Requirement 10=TR10)
- Reliability (Technical Requirement 11=TR11)
- Customer Relations (Technical Requirement 12=TR12)
- Brand Image (Technical Requirement 13=TR13)
- Price (Technical Requirement 14=TR14)

6.1 Obtaining the Weights of Customer Requests with Intuitive Fuzzy AHP

Step1: For the decision-making problem, the objective, criteria, and the associated solution alternatives are defined and then the hierarchy of the problem under consideration is first determined.

Step 2: Design and select the IFS evaluation scale with AHP. The study by Abdullah and Najib (2014) was used as an evaluation scale for comparing the

relative importance of criteria (Table 1).

Step 3: The weights of the experts were calculated with Equation (1) using the linguistic variables in Table 2. Since the answers given by the marketing experts of the insurance companies operating in the sector are of equal importance, they are evaluated as "very important". The sample calculation for Expert 1 is given in Equation 24.

$$\lambda_1 = \frac{0.90 + 0.05\left(\frac{0.90}{0.90 + 0.05}\right)}{10 * \left[0.90 + 0.05\left(\frac{0.90}{0.90 + 0.05}\right)\right]} = \frac{0.94736842105}{9.4736842105} = 0.1 \tag{24}$$

Step 4: Experts' intuitive preference relations were determined. The experts were asked to assign weights to compare each customer request according to the linguistic variables in Table 1. Table 5 and Table 6 show the pairwise comparisons of the first expert for customer requests as an example.

Table 5. Intuitionistic Fuzzy Number Representation of Pairwise Comparisons of Customer Requests for Expert 1

Expert 1	CR1			CR2			CR3			CR4			CR5			CR6		
	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ
CR1	0.02	0.18	0.8	0.62	0.18	0.2	0.33	0.27	0.4	0.13	0.27	0.6	0.13	0.27	0.6	0.33	0.27	0.4
CR2	0.18	0.62	0.2	0.02	0.18	0.8	0.13	0.27	0.6	0.33	0.27	0.4	0.33	0.27	0.4	0.13	0.27	0.6
CR3	0.27	0.33	0.4	0.27	0.13	0.6	0.02	0.18	0.8	0.33	0.27	0.4	0.33	0.27	0.4	0.62	0.18	0.2
CR4	0.27	0.13	0.6	0.27	0.33	0.4	0.27	0.33	0.4	0.02	0.18	0.8	0.33	0.27	0.4	0.62	0.18	0.2
CR5	0.27	0.13	0.6	0.27	0.33	0.4	0.27	0.33	0.4	0.27	0.33	0.4	0.02	0.18	0.8	0.13	0.27	0.6
CR6	0.27	0.33	0.4	0.27	0.13	0.6	0.18	0.62	0.2	0.18	0.62	0.2	0.27	0.13	0.6	0.02	0.18	0.8
CR7	0.27	0.13	0.6	0.27	0.33	0.4	0.18	0.62	0.2	0.27	0.33	0.4	0.27	0.33	0.4	0.27	0.13	0.6
CR8	0.18	0.62	0.2	0.18	0.62	0.2	0.27	0.13	0.6	0.27	0.13	0.6	0.27	0.33	0.4	0.27	0.33	0.4
CR9	0.27	0.33	0.4	0.27	0.13	0.6	0.27	0.33	0.4	0.27	0.13	0.6	0.18	0.62	0.2	0.27	0.33	0.4
CR10	0.27	0.33	0.4	0.27	0.13	0.6	0.27	0.13	0.6	0.18	0.62	0.2	0.27	0.13	0.6	0.27	0.13	0.6
CR11	0.27	0.33	0.4	0.27	0.13	0.6	0.18	0.62	0.2	0.27	0.33	0.4	0.27	0.33	0.4	0.18	0.62	0.2
CR12	0.27	0.13	0.6	0.18	0.62	0.2	0.18	0.62	0.2	0.27	0.33	0.4	0.27	0.13	0.6	0.18	0.62	0.2

Table 6. Intuitionistic Fuzzy Number Representation of Pairwise Comparisons of Customer Requests for Expert 1 (continued)

Expert 1	CR7			CR8			CR9			CR10			CR11			CR12		
	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ
CR1	0.13	0.27	0.6	0.62	0.18	0.2	0.33	0.27	0.4	0.33	0.27	0.4	0.33	0.27	0.4	0.13	0.27	0.6
CR2	0.33	0.27	0.4	0.62	0.18	0.2	0.13	0.27	0.6	0.13	0.27	0.6	0.13	0.27	0.6	0.62	0.18	0.2
CR3	0.62	0.18	0.2	0.13	0.27	0.6	0.33	0.27	0.4	0.13	0.27	0.6	0.62	0.18	0.2	0.62	0.18	0.2
CR4	0.33	0.27	0.4	0.13	0.27	0.6	0.13	0.27	0.6	0.62	0.18	0.2	0.33	0.27	0.4	0.33	0.27	0.4
CR5	0.33	0.27	0.4	0.33	0.27	0.4	0.62	0.18	0.2	0.13	0.27	0.6	0.33	0.27	0.4	0.13	0.27	0.6
CR6	0.13	0.27	0.6	0.33	0.27	0.4	0.33	0.27	0.4	0.13	0.27	0.6	0.62	0.18	0.2	0.62	0.18	0.2
CR7	0.02	0.18	0.8	0.13	0.27	0.6	0.13	0.27	0.6	0.33	0.27	0.4	0.62	0.18	0.2	0.62	0.18	0.2
CR8	0.27	0.13	0.6	0.02	0.18	0.8	0.13	0.27	0.6	0.33	0.27	0.4	0.13	0.27	0.6	0.62	0.18	0.2
CR9	0.27	0.13	0.6	0.27	0.13	0.6	0.02	0.18	0.8	0.13	0.27	0.6	0.62	0.18	0.2	0.62	0.18	0.2
CR10	0.27	0.33	0.4	0.27	0.33	0.4	0.27	0.13	0.6	0.02	0.18	0.8	0.62	0.18	0.2	0.33	0.27	0.4
CR11	0.18	0.62	0.2	0.27	0.13	0.6	0.18	0.62	0.2	0.18	0.62	0.2	0.02	0.18	0.8	0.62	0.18	0.2
CR12	0.18	0.62	0.2	0.18	0.62	0.2	0.18	0.62	0.2	0.27	0.33	0.4	0.18	0.62	0.2	0.02	0.18	0.8

Step 5: The experts' opinions are aggregated using Equation 4, Equation 5, Equation 6 and Equation 7. The aggregated intuitionistic fuzzy decision matrix is given in Table 7 and Table 8 and Table 9.

Table 7. Aggregated Heuristic Fuzzy Decision Matrices of 10 Experts' Assessments of Customer Requirements

Expert All	CR1			CR2			CR3			CR4			CR5			CR6		
	M	V	Pi	M	V	Pi	M	V	Pi	M	V	Pi	M	V	Pi	M	V	Pi
CR1	0.02	0.18	0.8	0.315	0.259	0.426	0.256	0.27	0.474	0.373	0.239	0.388	0.260	0.259	0.481	0.370	0.249	0.381
CR2	0.261	0.266	0.473	0.02	0.18	0.8	0.237	0.27	0.493	0.256	0.27	0.474	0.422	0.230	0.348	0.373	0.239	0.388
CR3	0.27	0.227	0.503	0.27	0.207	0.523	0.02	0.18	0.8	0.275	0.27	0.455	0.315	0.259	0.426	0.389	0.239	0.372
CR4	0.244	0.275	0.481	0.27	0.227	0.503	0.27	0.25	0.48	0.02	0.18	0.8	0.279	0.259	0.462	0.297	0.259	0.444
CR5	0.261	0.201	0.538	0.235	0.321	0.444	0.261	0.266	0.473	0.261	0.221	0.518	0.02	0.18	0.8	0.237	0.27	0.493
CR6	0.253	0.311	0.436	0.244	0.275	0.481	0.244	0.302	0.454	0.261	0.242	0.497	0.27	0.207	0.523	0.02	0.18	0.8
CR7	0.244	0.331	0.425	0.244	0.331	0.425	0.226	0.375	0.399	0.261	0.266	0.473	0.253	0.258	0.489	0.261	0.201	0.538
CR8	0.244	0.302	0.454	0.244	0.302	0.454	0.261	0.221	0.518	0.27	0.207	0.523	0.253	0.283	0.464	0.244	0.331	0.425
CR9	0.261	0.221	0.518	0.244	0.275	0.481	0.27	0.172	0.558	0.27	0.207	0.523	0.261	0.183	0.556	0.261	0.221	0.518
CR10	0.27	0.227	0.503	0.261	0.242	0.497	0.244	0.331	0.425	0.244	0.275	0.481	0.253	0.311	0.436	0.27	0.25	0.48
CR11	0.235	0.425	0.34	0.235	0.352	0.413	0.226	0.375	0.399	0.27	0.227	0.503	0.27	0.25	0.48	0.235	0.352	0.413
CR12	0.261	0.266	0.473	0.244	0.275	0.481	0.253	0.311	0.436	0.27	0.274	0.456	0.244	0.302	0.454	0.253	0.341	0.406

Table 8. Aggregated Heuristic Fuzzy Decision Matrices of 10 Experts' Assessments of Customer Requirements (continued)

Expert All	CR7			CR8			CR9			CR10			CR11			CR12		
	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ
CR1	0.405	0.239	0.356	0.389	0.239	0.372	0.279	0.259	0.462	0.256	0.27	0.474	0.466	0.230	0.304	0.315	0.259	0.426
CR2	0.405	0.239	0.356	0.389	0.239	0.372	0.373	0.239	0.388	0.297	0.259	0.444	0.437	0.230	0.333	0.373	0.239	0.388
CR3	0.468	0.22	0.312	0.279	0.259	0.462	0.196	0.27	0.534	0.405	0.239	0.356	0.468	0.22	0.312	0.370	0.249	0.381
CR4	0.315	0.259	0.426	0.237	0.27	0.493	0.237	0.27	0.493	0.373	0.239	0.388	0.256	0.27	0.474	0.294	0.27	0.436
CR5	0.336	0.249	0.415	0.353	0.249	0.398	0.24	0.26	0.5	0.37	0.249	0.381	0.275	0.27	0.455	0.389	0.239	0.372
CR6	0.26	0.259	0.481	0.405	0.239	0.356	0.279	0.259	0.462	0.275	0.27	0.455	0.437	0.23	0.333	0.386	0.249	0.365
CR7	0.02	0.18	0.8	0.237	0.27	0.493	0.279	0.259	0.462	0.216	0.27	0.514	0.422	0.23	0.348	0.389	0.239	0.372
CR8	0.27	0.207	0.523	0.02	0.18	0.8	0.216	0.27	0.514	0.256	0.27	0.474	0.454	0.221	0.325	0.452	0.23	0.318
CR9	0.261	0.221	0.518	0.27	0.189	0.541	0.02	0.18	0.8	0.256	0.27	0.474	0.318	0.249	0.433	0.405	0.239	0.356
CR10	0.27	0.189	0.541	0.27	0.227	0.503	0.27	0.227	0.503	0.02	0.18	0.8	0.482	0.22	0.298	0.523	0.212	0.265
CR11	0.235	0.321	0.444	0.226	0.342	0.432	0.253	0.235	0.512	0.226	0.412	0.362	0.02	0.18	0.8	0.279	0.259	0.462
CR12	0.244	0.302	0.454	0.235	0.387	0.378	0.244	0.331	0.425	0.217	0.482	0.301	0.261	0.221	0.518	0.02	0.18	0.8

Table 9. Batch Heuristic Fuzzy Matrix

Expert All			
	M	V	Pİ
CR1	0.36635	0.184744	0.448906
CR2	0.379659	0.180752	0.439589
CR3	0.370646	0.176128	0.453226
CR4	0.304946	0.190248	0.504806
CR5	0.320422	0.185214	0.494365
CR6	0.330986	0.188825	0.48019
CR7	0.303403	0.200652	0.495945
CR8	0.318206	0.18744	0.494355
CR9	0.306092	0.159259	0.534649
CR10	0.339436	0.177923	0.48264
CR11	0.267303	0.236948	0.495748
CR12	0.270685	0.233018	0.496297

Step 6: The consistency ratio of the aggregated heuristic fuzzy decision matrix was checked.

$$UG = \frac{\frac{(0.448906+0.439589+0.453226+0.504806+0.494365+0.48019+0.495945+0.494355+0.534649+0.48264+0.495748+0.496297)}{12}/11}{1,54} = 0.028634$$

(25)

The consistency ratio is obtained by using Equation (8) for the aggregated heuristic fuzzy matrix given in Table 27. The consistency ratio is given in Equation (25). Since the number of customer requests is 12, the RI value is 1.54 according to Table 3. The consistency ratio is 0.028634. Since it is less than 0.1, it can be said that the experts' evaluations are consistent.

Step 7: In the combined weighted heuristic fuzzy decision matrix given in Table 7 and Table 8, customer requirements assessments for 10 experts are given in Table 10 by calculating entropy weights with Equation (9) and total final entropy weights with Equation (10).

Table 10. Final Entropy Weights of Customer Requests

Expert All		
	Entropy Weight	Final Entropy
CR1	0.079668	0.083454
CR2	0.078996	0.083515
CR3	0.079081	0.083508
CR4	0.081722	0.083268
CR5	0.081133	0.083322
CR6	0.080966	0.083337
CR7	0.082065	0.083237
CR8	0.081277	0.083309
CR9	0.0805	0.083379
CR10	0.080251	0.083402
CR11	0.083223	0.083132
CR12	0.083164	0.083137

Table 10 shows the final entropy weights of customer requests. As a result of the evaluations made by the experts, it is seen that the top three customer requests that customers attach the most importance to are "Policy Price", " Brand Awareness " and " Vehicle Insurance Cost ". These are followed by "After Damage Service Quality" and "After Sales Service Quality".

6.2 Determining the Ranking of Technical Requirements According to Their Importance Using Intuitive Fuzzy VIKOR

For the relationships between customer requirements and technical requirements, the opinions of selected experts are used. The linguistic variables given in Table 4 are used to examine the relationships. The relationship matrix between customer requirements and technical requirements under expert opinion is obtained as shown in Table 11 and Table 12.

Table 11. Relationship Matrix Between Customer Requirements and Technical Requirements

	TR1	TR2	TR3	TR4	TR5	TR6	TR7
CR1							MB, PG, M, M, PG, B, MB, MB, M, PG
CR2					M, B, PG, G, B G, MB, B, PG, PG		M, MB, MB, B, G VB, MB, PG, PG, MB
CR3	G, G, PG, PG, M VG, G, VG, PG, M	PG, M, M, VG, G M, M, VG, PG, PG		M, M, B, VB, G MB, MB, M, B, G	PG, M, PG, MB, M B, M, M, G, PG	MB, B, M, M, MB G, MB, B, B, MB	G, PG, G, M, MB MB, M, M, G, PG
CR4	G, G, VG, PG, PG PG, VG, M, M, G	PG, M, G, G, MB, PG, PG, VG, G, M	MB, M, PG, PG, B M, M, MB, B, PG	M, M, G, VB, PG MB, MB, G, B, PG	M, PG, PG, MB, B G, PG, B, M, M	G, PG, PG, VG, M VG, MB, G, G, PG	M, PG, MB. MB. B G, PG, M, MB, PG
CR5	VG, VG, G, M, G MB, M, G, VG, G	MB, MB, PG, B, PG VB, PG, B, M, M			G, VG, G, VG, PG G, PG, VG, VG, G	MB, B, M, M, B VB, M, MB, MB, B	G, PG, PG, M, M G, M, MB, M, PG
CR6							
CR7					G, G, PG, VG, PG M, G, PG, VG, G		
CR8	G, PG, PG, M, M VG, MB, M, M, G	M, MB, G, G, MB G, PG, PG, M, M			VG, G, PG, PG, G M, M, PG, G, PG		
CR9	G, VG, VG, PG, M MB, G, G, VG, PG	G, MB, PG, PG, MB M, VG, G, VG, M	G, PG, VG, G, G M, PG, PG, G, M		G, PG, VG, VG, G PG, M, VG, G, G		VG, G, M, G, PG G, PG, PG, VG, G
CR10	G, M, G, PG, PG MB, VG, G, G, M	PG, M, M, VG, G G, PG, G, PG, M	G, G, M, VG, VG MB, G, PG, G, G		VG, G, VG, M, G PG, G, VG, G, PG		PG, VG, G, VG, G M, G, G, VG, PG
CR11	B, M, MB, MB, M G, B, M, MB, PG	PG, M, MB, MB, B G, B, M, M, PG			G, M, M, PG, MB M, MB, MB, G, PG		
CR12	G, G, PG, M, PG VG, G, G, M, PG	M, MB, PG, VB, B B, MB, MB, M, PG			PG, M, B, B, MB VB, B, MB, M, M		

Table 12. Relationship Matrix Between Customer Requirements and Technical Requirements (continued)

	TR8	TR9	TR10	TR11	TR12	TR13	TR14
CR1			M, PG, G, B, M M, MB, B, PG, M				
CR2			VG, G, G, PG, PG G, G, PG, VG, G	M, M, MB, PG PG G, PG, MB, MB, B	PG, M, M, MB, G G, PG, MB, B, M		G, G, VG, VG, PG VG, PG, PG, G, M
CR3			M, PG, PG, B, MB MB, M, M, G, G	VG, G, VG, VG, PG PG, PG, VG, G, M	PG, PG, G, M, VG VG, G, G, M, M	G, G, PG, PG, MB VG, G, MB, MB, M	MB, M, M, MB, VB G, PG, B, B, M
CR4		M, M, MB, PG, G PG, MB, MB, B, M	G, PG, PG, M, G VG, PG, MB, PG, G	G, G, PG, VG, VG PG, G, M, G, VG	VG, G, G, PG, G VG, G, G, PG, M	G, PG, G, VG, VG M, PG, M, G, PG	VG, G, G, M, M G, PG, VG, M, G
CR5		MB, MB, PG, PG, G G, M, M, MB, PG	PG, G, MB, M, M B, MB, MB, PG, M	PG, PG, M, M, G MB, G, G, B, PG	M, MB, MB, G, PG G, PG, PG, MB, M		MB, G, M, M, PG PG, MB, MB, G, PG
CR6			M, PG, G, M, MB PG, PG, M, G, MB				M, MB, MB, PG, B M, G, PG, MB, M
CR7			M, PG, PG, MB, M G, PG, PG, MB, M	MB, PG, PG, M, G M, M, PG, G, MB	PG, G, M, MB, PG G, M, M, MB, PG		
CR8		M, VB, MB, MB, G B, PG, MB, B, M	G, G, VG, VG, M PG, M, PG, M, G	G, M, M, VG, G PG, MB, PG, G, M	M, PG, PG, MB, M G, MB, MB, G, M		M, MB, MB, VB, PG PG, M, M, B, MB
CR9		M, B, B, MB, MB G, M, M, MB, B	PG, MB, M, M, MB B, G, M, G, MB	G, PG, M, M, G PG, PG, G, M, MB	VG, G, PG, PG, G M, PG, M, G, G	PG, MB, MB, M, G G, M, M, G, MB	
CR10		PG, G, G, M, VG M, PG, VG, PG, G	G, PG, PG, M, G M, VG, G, PG, M	VG, G, PG, EG, G M, PG, VG, G, PG	G, VG, VG, M, G VG, G, G, PG, M		G, M, G, PG, VG VG, M, G, G, VG

CR11			G, M, M, PG, MB PG, VG, G, M, G	PG, M, M, MB, G PG, B, MB, M, MB	PG, G, G, VG, G M, PG, PG, VG, G		MB, M, B, B, VB G, PG, MB, MB, VB
CR12		M, B, VB, M, MB PG, MB, B, B, M	M, MB, B, B, MB VB, M, MB, B, M	M, MB, M, VB, B G, M, B, MB, M	G, M, M, MB, B VB, MB, MB, M, B	PG, M, MB, PG, MB VB, B, M, M, MB	M, MB, B, B, VB MB, PG, M, M, B

Step 1: Combining the separate intuitionistic fuzzy values for the technical requirements into group intuitionistic fuzzy values is done first. Using Equation 4, Equation 5, Equation 6 and Equation 7, the experts' opinions are transformed into the aggregated intuitionistic fuzzy decision matrix shown in Table 13 and Table 14.

Table 13. Aggregated Intuitionistic Fuzzy Decision Matrix

Expert All	CR1			CR2			CR3			CR4			CR5			CR6		
	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ	M	V	Pİ
TR1	0	0.9	0.1	0	0.9	0.1	0.725	0.164	0.111	0.725	0.164	0.111	0.762	0.129	0.109	0	0.9	0.1
TR2	0	0.9	0.1	0	0.9	0.1	0.684	0.221	0.095	0.671	0.206	0.123	0.442	0.46	0.098	0	0.9	0.1
TR3	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0.474	0.431	0.095	0	0.9	0.1	0	0.9	0.1
TR4	0	0.9	0.1	0	0.9	0.1	0.481	0.384	0.135	0.523	0.344	0.133	0	0.9	0.1	0	0.9	0.1
TR5	0	0.9	0.1	0.532	0.325	0.143	0.537	0.357	0.106	0.518	0.367	0.115	0.81	0.094	0.096	0	0.9	0.1
TR6	0	0.9	0.1	0	0.9	0.1	0.433	0.44	0.127	0.72	0.165	0.115	0.367	0.54	0.093	0	0.9	0.1
TR7	0.486	0.423	0.091	0.47	0.408	0.122	0.597	0.27	0.133	0.52	0.364	0.116	0.585	0.298	0.117	0	0.9	0.1
TR8	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1
TR9	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0.509	0.379	0.112	0.57	0.304	0.126	0	0.9	0.1
TR10	0.507	0.382	0.111	0.76	0.121	0.119	0.55	0.323	0.127	0.678	0.198	0.124	0.509	0.379	0.112	0.578	0.301	0.121
TR11	0	0.9	0.1	0.52	0.364	0.116	0.786	0.122	0.092	0.776	0.118	0.106	0.597	0.264	0.139	0	0.9	0.1
TR12	0	0.9	0.1	0.55	0.323	0.127	0.719	0.17	0.111	0.755	0.126	0.119	0.57	0.304	0.126	0	0.9	0.1
TR13	0	0.9	0.1	0	0.9	0.1	0.651	0.219	0.13	0.725	0.164	0.111	0	0.9	0.1	0	0.9	0.1
TR14	0	0.9	0.1	0.766	0.131	0.103	0.456	0.429	0.115	0.731	0.153	0.116	0.57	0.304	0.126	0.509	0.379	0.112

Table 14. Aggregated Intuitionistic Fuzzy Decision Matrix (continued)

Expert All	CR7			CR8			CR9			CR10			CR11			CR12		
	M	V	Pi	M	V	Pi	M	V	Pi	M	V	Pi	M	V	Pi	M	V	Pi
TR1	0	0.9	0.1	0.639	0.249	0.112	0.756	0.138	0.106	0.686	0.184	0.13	0.478	0.406	0.116	0.698	0.175	0.127
TR2	0	0.9	0.1	0.597	0.27	0.133	0.687	0.202	0.111	0.676	0.204	0.12	0.498	0.386	0.116	0.419	0.483	0.098
TR3	0	0.9	0.1	0	0.9	0.1	0.698	0.175	0.127	0.745	0.133	0.122	0	0.9	0.1	0	0.9	0.1
TR4	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1
TR5	0.743	0.141	0.116	0.684	0.196	0.12	0.776	0.118	0.106	0.776	0.118	0.106	0.56	0.317	0.123	0.393	0.513	0.094
TR6	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1
TR7	0	0.9	0.1	0	0.9	0.1	0.743	0.141	0.116	0.776	0.118	0.106	0	0.9	0.1	0	0.9	0.1
TR8	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1	0	0.9	0.1
TR9	0	0.9	0.1	0.446	0.433	0.121	0.443	0.436	0.121	0.725	0.164	0.111	0	0.9	0.1	0.393	0.513	0.094
TR10	0.558	0.336	0.106	0.719	0.17	0.111	0.532	0.34	0.128	0.676	0.204	0.12	0.663	0.214	0.123	0.367	0.54	0.093
TR11	0.578	0.301	0.121	0.663	0.214	0.123	0.613	0.256	0.131	1	0	0	0.509	0.379	0.112	0.444	0.446	0.11
TR12	0.578	0.301	0.121	0.56	0.317	0.123	0.698	0.175	0.127	0.772	0.122	0.106	0.743	0.141	0.116	0.433	0.451	0.116
TR13	0	0.9	0.1	0	0.9	0.1	0.581	0.284	0.135	0	0.9	0.1	0	0.9	0.1	0.442	0.47	0.088
TR14	0	0.9	0.1	0.442	0.47	0.088	0	0.9	0.1	0.772	0.122	0.106	0.412	0.462	0.126	0.393	0.513	0.094

Step 2: Positive and negative ideal solutions are found using Equation (11) and Equation (12) and are shown in Table 15.

Table 15. Positive and Negative Ideal Solutions

	A*			A-		
	M	V	Pİ	M	V	Pİ
CR1	0.507256	0.9	0.110592	0	0.382152	0.091093
CR2	0.765633	0.9	0.143268	0	0.12104	0.1
CR3	0.786153	0.9	0.135214	0	0.122474	0.091372
CR4	0.776393	0.9	0.132773	0	0.117608	0.094912
CR5	0.809635	0.9	0.138893	0	0.094409	0.092964
CR6	0.577791	0.9	0.120982	0	0.301227	0.1
CR7	0.743143	0.9	0.120982	0	0.140686	0.1
CR8	0.718496	0.9	0.132937	0	0.170287	0.088084
CR9	0.776393	0.9	0.135461	0	0.117608	0.1
CR10	1	0.9	0.129751	0	0	0
CR11	0.743143	0.9	0.126193	0	0.140686	0.1
CR12	0.698291	0.9	0.126452	0	0.175257	0.088084

Step 3: S_i group utility and R_i individual regret values need to be calculated for each alternative. These values are calculated by Equation 19 and Equation 20 and shown in Table 16. $\propto = 0.5$ is taken.

TR	S_i (Index)	R_i (Index)
TR1	**0.663898671**	**0.059846925**
TR2	**0.618716296**	**0.05858977**
TR3	**0.673120134**	**0.059386819**
TR4	**0.678356069**	**0.061733213**
TR5	**0.627120311**	**0.059452576**
TR6	**0.669063387**	**0.061733213**
TR7	**0.638362796**	**0.058455676**
TR8	**0.705040989**	**0.061733213**
TR9	**0.618167117**	**0.059386819**
TR10	**0.617550179**	**0.05997318**
TR11	**0.626757671**	**0.059075693**

TR12	**0.629408478**	**0.059375192**
TR13	**0.668966733**	**0.061733213**
TR14	**0.609110876**	**0.058834185**

Table 16. S_i and R_i Values

Step 4: The Q_i index values obtained by evaluating group benefit and regret together are calculated by Equation 21 and given in Table 16.

Table 16. Q_i Values

Q_i **(Index)**
0.497801022
0.070521213
0.475673602
0.86091479
0.245948165
0.812480144
0.152464742
1
0.189251458
0.275487357
0.186563207
0.246069128
0.811976369
0.057743005

Step 5: The ranking of technical requirements according to S, R and Q values is given in Table 17.

Table 17. Rankings of $S(Ai)$, $R(Ai)$ and $Q(Ai)$ Using Technical Requirements

	S_i		R_i		Q_i	
TR	**Index**	**Importance Ranking**	**Index**	**Importance Ranking**	**Index**	**Importance Ranking**
TR1	**0.663898671**	9	**0.059846925**	8	**0.497801022**	10
TR2	**0.618716296**	4	**0.05858977**	2	**0.070521213**	2
TR3	**0.673120134**	12	**0.059386819**	6	**0.475673602**	9
TR4	**0.678356069**	13	**0.061733213**	10	**0.86091479**	13
TR5	**0.627120311**	6	**0.059452576**	7	**0.245948165**	6
TR6	**0.669063387**	11	**0.061733213**	10	**0.812480144**	12
TR7	**0.638362796**	8	**0.058455676**	1	**0.152464742**	3
TR8	**0.705040989**	14	**0.061733213**	10	**1**	14
TR9	**0.618167117**	3	**0.059386819**	6	**0.189251458**	5
TR10	**0.617550179**	2	**0.05997318**	9	**0.275487357**	8
TR11	**0.626757671**	5	**0.059075693**	4	**0.186563207**	4
TR12	**0.629408478**	7	**0.059375192**	5	**0.246069128**	7
TR13	**0.668966733**	10	**0.061733213**	10	**0.811976369**	11
TR14	**0.609110876**	1	**0.058834185**	3	**0.057743005**	1

At the stage of determining the compromise solution, it was investigated whether two conditions were met in the ranking according to the Q_i index.

Condition 1 - Acceptable Advantage: $Q_{Technical\ Requirement_{(2)}} - Q_{Technical\ Requirement_{(1)}} \geq 0.076923077$ condition must be met.

According to Table 17, since (0.070521213-0.057743005) ≤ 0.076923077, the 14th technical requirement coded as TR14 does not meet the acceptable advantage condition. Since condition 1 is not met for TR14, $Q_{Technical\ Requirement_{(M)}} - Q_{Technical\ Requirement_{(1)}} \leq \frac{1}{m-1}$ should be checked and the same compromise solution should be found for $\text{Technical Requirement}_{(M)}$ and $\text{Technical Requirement}_{(1)}$. Accordingly, the difference between TR2 and TR14 technical requirements is smaller than 0.076923077. Therefore, TR14 and TR2 technical requirements are considered as compromise solution alternatives. Table 18 shows the ranking of alternatives according to Q_i, R_i and S_i index values.

Table 18. Ranking of Alternatives according to Q_i , R_i and S_i Index Values

TR	Index
Q_i	TR14>TR2>TR7>TR11>TR9>TR5>TR12>TR10>TR3>TR1>TR13>TR6>TR4>TR8
R_i	TR7>TR2>TR14>TR11>TR12>TR3=TR9>TR5>TR1>TR10>TR4=TR6=TR8=TR13
S_i	TR14>TR10>TR9>TR2>TR11>TR5>TR12>TR7>TR1>TR13>TR6>TR3>TR4>TR8

According to the results of Table 37, it is seen that the TR14 alternative ranks first according to Q_i and S_i evaluations. Therefore, in case a single technical requirement is selected, the TR14 alternative should be selected. On the other hand, since the index values are quite close to each other, it is seen that the TR14 alternative ranks 3rd in the ranking according to the R_i index values. However, it is seen that the R_i index value for all 3 technical requirements (TR7, TR2 and TR14) is 0.058 and its significance is at a tolerable level. It is also seen that TR2 alternative ranks second in the ranking according to both Q_i and R_i index values. Therefore, if a single technical requirement is selected, alternative TR14 should be selected and if two alternatives are selected, both TR14 and TR2 technical requirements should be selected.

6.3 Determining the Correlation Between Technical Requirements

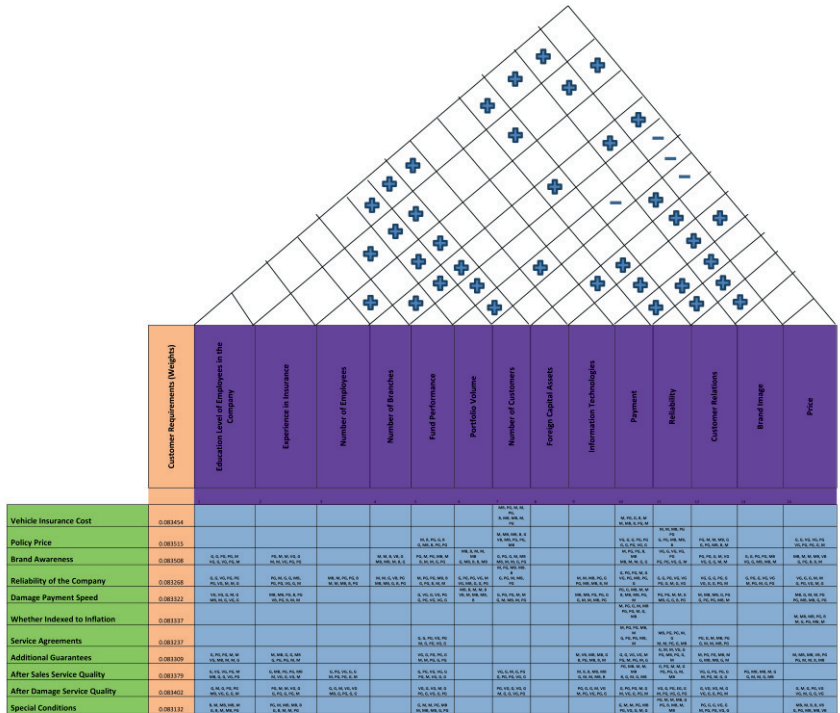
Technical requirements defined by experts to respond to customer requirements can interact positively or negatively with each other. In other words, a positive improvement in one technical requirement may affect another in a positive or negative way. The correlation matrix draws attention to conflicting relationships and allows for quick solutions. It provides a fair answer to the question of which technical requirement we should give up in order to fulfill a technical requirement (Franceschini, 2016). The relationship between the identified technical characteristics may be strong or weak. With the help of the correlation (roof) matrix, it is decided whether this relationship is strong or weak. Table 19 shows the meanings of the symbols in the roof of the quality house (Ersen, 2015).

Table 19. Degree of Correlation

Correlation	Symbol
Strong	+
Weak	-

In Figure 2, the relationships between the technical characteristics in the roof section of the quality house are analyzed. As a result of the evaluations made, those with a strong relationship between them are shown with the symbol "+" and those with a weak relationship are shown with the symbol "-" on the roof of the quality house. All the sections of the quality house are separately tabulated and interpreted separately in the method section.

Figure 2. Quality House



According to the quality house obtained in Figure 2, technical characteristics with strong and weak relationships between them were identified.

Those with a strong relationship are the technical characteristics;

- - Education Level of Employees in the Company and Portfolio Volume
- - Education Level of Employees in the Company and Number of Customers
- - Education Level of Employees in the Company and Foreign Capital Assets
- - Education Level of Employees in the Company and Reliability
- - Education Level of Employees in the Company and Customer Relations
- - Education Level of Employees in the Company and Brand Image
- - Portfolio Volume and Number of Employees
- - Portfolio Volume and Number of Branches
- - Portfolio Volume and Experience in Insurance
- - Portfolio Volume and Number of Customers
- - Portfolio Volume and Information Technologies
- - Number of Employees and Number of Branches
- - Number of Employees and Number of Customers
- - Number of Branches and Fund Performance
- - Number of Branches and Number of Customers
- - Number of Branches and Price
- - Number of Branches and Reliability
- - Number of Branches and Brand Image
- - Experience in Insurance and Fund Performance
- - Experience in Insurance and Number of Customers
- - Experience in Insurance and Price
- - Experience in Insurance and Reliability

- - Experience in Insurance and Brand Image
- - Fund Performance and Number of Customers
- - Number of Customers and Reliability
- - Number of Customers and Brand Image
- - Foreign Capital Assets and Reliability
- - Foreign Capital Assets and Brand Image
- - Foreign Capital Assets and Payment
- - Information Technologies and Price
- - Information Technologies and Reliability
- - Information Technologies and Brand Image
- - Reliability and Customer Relations
- - Reliability and Brand Image
- - Reliability and Payment
- - Customer Relations and Brand Image
- - Customer Relations and Payment
- - Brand Image and Payment

Technical characteristics with a weak relationship between them;

- - Portfolio Volume and Price
- - Portfolio Volume and Customer Relations
- - Fund Performance and Price
- - Number of Customers and Price

was found as.

7. CONCLUSION AND RECOMMENDATIONS

Many of the problems encountered in daily life involve uncertainty and it becomes difficult for decision makers to express their preferences with precise values. Sometimes it is necessary to get opinions from more than one person about a situation or problem. Having more than one opinion and view about a situation leads to disagreement. In addition to having different opinions, these opinions may also be conflicting opinions. Heuristic Fuzzy methods are very successful in solving such problems. These methods incorporate the uncertainty involved in the decision-making process into the solution. It also maximizes the benefit of group decision-making with a conciliatory solution approach (Gürses-Ateş, 2013).

In this study, the technical features that any insurance company should emphasize in order to maximize the expectations of a customer group that is likely to have a motor insurance policy and already has a motor insurance policy are determined. While investigating the expectations of the customer group from the system on the one hand, at the same time, the link between the expectations of the customers and the technical features of the companies was emphasized thanks to the information obtained from the expert personnel in the insurance companies.

Traditional QFD fails to incorporate uncertainty and fuzziness into the solution process by weighting the importance of customer requirements and ranking technical requirements according to their importance. Therefore, decisions need to be expressed qualitatively rather than in precise terms. In this study, intuitionistic fuzzy AHP is used to weight customer requirements and intuitionistic fuzzy VIKOR method is used to examine the relationship between customer requirements and technical requirements. The logic of these methods is that linguistically expressed evaluations are fuzzified and examined in the analysis.

In the proposed heuristic quality function mapping model, interviews were conducted with marketing experts of insurance companies offering motor insurance services. Customer requirements were learned through focus groups and interviews. These customer requirements are ranked in the weights column of the quality house (Figure 2). It was aimed to reveal the product structure requirements for motor insurance, to bring together the ideas of decision makers in their decisions, and to deal with uncertain and imprecise information that may occur in human opinions. In order to obtain the priority of customer requirements, the Intuitive Fuzzy AHP method, which is based on the consensus of decision makers, was used to apply pairwise comparison and to obtain consistent results. On the other hand, in the technical requirements section at the top of the quality house, at least one technical requirement was identified for each customer requirement (Figure 2). Technical requirements were created as a result of interviews with marketing experts of insurance companies operating in the sector. In order to ensure customer satisfaction, customer requests were transformed into technical requirements that should be considered in product improvement and development studies. In order to take into account the preference behaviors of decision makers and to obtain the exact relationships between

customer requests and technical requirements, the Intuitive Fuzzy VIKOR method was used.

Using the Intuitive Fuzzy AHP method, it was concluded that the top three features that customers attach the most importance to are "Policy Price", "Brand Awareness" and "Vehicle Insurance Cost". These are followed by "After Damage Service Quality" and "After Sales Service Quality". The results obtained are shown in Table 10 and Figure 2 in the weights column of the quality house.

Thus, it was found that insurance companies should give importance to these features in order to retain their existing customers and gain new customers. Insurance companies should pay attention to "Policy Price", "Brand Awareness", "Vehicle Insurance Cost", "After Damage Service Quality" and "After Sales Service Quality" features that experts have chosen as criteria for customers when they want to sell their motor insurance policies in the right way.

In the results obtained with the Intuitive Fuzzy VIKOR method, the information obtained is given in Table 17 and Figure 2 in the quality house. As a result of the compromise solution, it is seen that the most important technical characteristic open for improvement is "Price" with 14%. Banks offer high policy prices, agencies offer medium policy prices and insurance companies offer low policy prices. The reason for high policy prices in banks and agencies compared to insurance companies is the commission costs paid to insurance companies. While banks prefer annual premium collection, insurance companies and agencies can collect both monthly and annual premiums. Moreover, since customers believe that the annual premiums they pay to an insurance company are due for recycling, they want the amounts that companies prioritize to be reliable. Therefore, banks and agencies need to attract customers to their side by creating quality service at affordable prices.

The second most important technical characteristic is "Experience in Insurance" with a share of 12%. This situation is closely related to the reliability and professionalism of the company to which customers entrust their fund management with increased experience in motor insurance. Companies should meet customers' expectations for motor insurance with professional consultancy, problem-solving approaches and accurate and timely technical support. In addition, an insurance company with experience

in the sector should be more sensitive about customer relations and increase the number of in-service trainings.
In the relations section of the quality house, marketing experts of insurance companies were asked to evaluate which customer request would be maximized with which technical characteristic and the level of relationship between them. The relationship section of the quality house was created by determining the relationship levels that marketing experts preferred the most in each relationship. In this section, the rows between the customer demand and the technical characteristic, where there was no relationship between them, were left blank by the experts. For example, as can be seen in Table 11, Table 12 and in the quality house in Figure 2, the relationship between the technical characteristic "Policy Price" and "Number of Employees" in the customer requests section was left blank. Thus, it is seen that there is no relationship between policy price and number of employees. All of the identified relationships are shown in Table 11, Table 12 and Figure 2 in the quality house.

Since there is no study in the literature on quality house for motor insurance policies in which AHP and VIKOR methods are used together under intuitionistic fuzzy set theory, this study is a guide for future studies. The proposed model can be applied to service improvement studies as well as product development and can be extended to other stages of QFD.

This study examines the technical characteristics of insurance companies marketing motor insurance policies, taking into account the voice of customers. By looking at the quality house, domestic and foreign-owned companies have the chance to see their shortcomings or the work they have done fully and correctly. This study can also be conducted for other products of insurance companies. It is seen that important results can be obtained by conducting the study on a company basis. In addition, it may be suggested to apply such studies to Bes, Health and Life Insurances.

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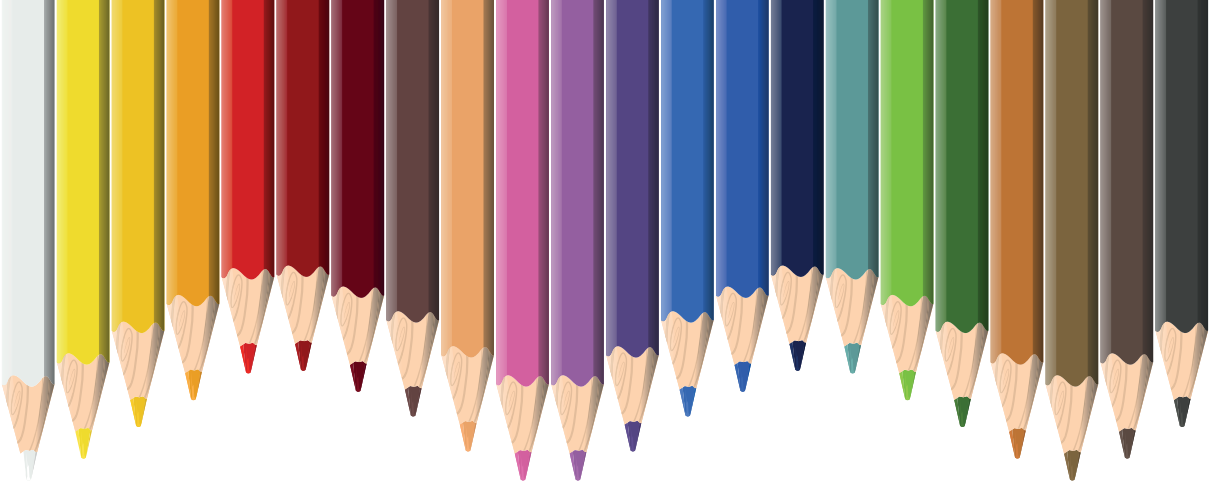

Chapter 5

COMBINING DESCRIPTIVE AND SCIENCE MAPPING ANALYSES TO INVESTIGATE THE CONCEPTS OF A BLUE ECONOMY, BLUE GROWTH, AND SUSTAINABLE BLUE ECONOMY DEVELOPMENT: A RESEARCH ON UP-TO-DATE STUDIES ON WEB OF SCIENCE (2019-2023)

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1. Introduction

In the last decade, the blue economy (BE) has emerged as a concept or strategy to protect the world's oceans and water resources, attracting the attention of researchers and policymakers (Lee et al., 2020). BE, in general, refers to the appropriate use of ocean resources for sustainable economic development, improved livelihoods, and the health of the ocean ecosystem (Michel, 2016).

The concept of the BE was initially introduced by Gunter Pauli (2010) in his book "The Blue Economy" following the global crisis. Since then, various studies have been carried out on BE and sustainable blue economy development (SBED) (Ebarvia, 2016; Ahmed et al., 2022; Phelan et al., 2020; Niner et al., 2022; Fang et al., 2021; Pace et al., 2023; Spalding, 2016; Choudhary et al., 2021; Novaglio et al., 2022). However, prior studies have failed to observe the importance of BE, blue growth, and SBED in the economics context. Additionally, while there are some bibliometric studies on BE, studies that combine the concepts of BE, blue growth, and SBED have been disregarded (Liang et al., 2022; Kabil et al., 2021; Liu et al., 2023).

Addressing this gap, this book chapter aims to present a bibliometric analysis (e.g., descriptive and science mapping analyses) of BE, blue growth, and SBED studies. By doing so, this book chapter will provide a comprehensive overview of the primary developments and trends in the field. The data for this research were acquired from the Web of Science (WoS) database, widely recognized as the most prominent database in academic research due to its inclusion of journals with the highest standards (Merigo and Yang, 2017a; Merigo and Yang, 2017b; Kurtuluş & Bilen, 2021).

The remainder of this book chapter is organized as follows. The following section presents an overview of the literature on the BE, blue growth, and SBED. Following that, the methodology is presented. The results are reported thereafter, followed by a conclusion of the outcomes.

2. An Overview of The Blue Economy and Sustainable Blue Economic Development Concepts

BE refers to optimizing socio-economic activities and development by obtaining the benefits derived from marine resources without causing environmental degradation. The main purpose of BE, blue economic development, and blue growth is to ensure that a country or region achieves long-term prosperity, befitting the welfare of all its citizens and humanity, by protecting the environment, particularly the sea (Bari et al., 2017).

The BE supports economic growth, development, and protection of the livelihoods of those dependent on marine resources to live. Simultaneously, it works to ensure the environmental sustainability of oceans and coastal

areas. This concept gained prominence at the United Nations Conference on Sustainable Development (Rio+20) held in Rio de Janeiro in June 2012, but its roots can be traced back to the Rio Earth Summit in 1992 (Scholaert et al., 2020).

Blue growth aims to achieve sustainable growth in the seas and marine-related sectors. It promises that by ensuring their sustainability, new employment opportunities will emerge, and substantial growth rates can be achieved. Blue growth holds significant importance in generating sustainable jobs and maintaining consistent growth rates in the long term (Smith-Godfrey, 2016).

In essence, BE represents a holistic development process that fosters growth by emphasizing the efficient and effective utilization of marine resources while upholding sustainability requirement (Mohanty, 2019). Several sectors associated with the BE include;

- Fisheries and Aquaculture (Ababouch & Fipi, 2015; Campbell et al., 2021; Pauly, 2018): The seafood industry stands as a pivotal component within BE, providing sustenance and employment for millions worldwide. Ensuring the longevity of this sector relies on sustainable fishing practices, aquaculture, and improved seafood processing techniques.

- Maritime Transport (Niavis et al., 2017; Nikčević & Škurić, 2021): Shipping and marine transport serve as the backbone of global trade, enabling the movement of goods and raw materials. Developing cleaner and more efficient maritime technologies can significantly reduce the environmental impact of this sector.

- Tourism (Tegar & Gurning, 2018; Bhattacharya & Dash, 2021; Praptiwi et al., 2021; Hampton & Jeyacheya, 2020; Karani & Failler, 2020; Jones & Navarro, 2018): Coastal and marine tourism attracts travelers around the world, generating economic opportunities for local people in coastal regions.

- Renewable Energy (Cavagnaro et al., 2020; Young, 2015; Roesch et al., 2020; Pires Manso et al., 2023): The oceans hold vast potential for renewable energy sources, including offshore wind, wave energy, and tidal power. These technologies have the potential to reduce our reliance on fossil fuels and combat climate change.

- Biotechnology (van de Water et al., 2022; Pramanik et al., 2023) The oceans host exceptional biodiversity, with marine organisms providing valuable compounds utilized in pharmaceuticals, cosmetics, and various industries.

3. Research Methodology

This study adopted a bibliometric approach to review the BE, blue growth and SBED research published in the field of economics in general. This study

performed a bibliometric analysis involving descriptive and science mapping analyzes (network analyzes). Moreover, this study was constructed in the following steps:

(1) research design,

(2) collection of bibliometric databases,

(3) analysis,

(4) visualization and,

(5) interpretation (Zupic & Carter, 2015).

3.1. Research design and bibliometric parameters

The research design is the initial and most crucial phase in any bibliometric study. Authors must initially define the research question before selecting the most suitable bibliometric technique. Various bibliometric techniques can be used to address various research questions (Zupic and Carter, 2015). These techniques encompass descriptive analysis examining aspects like the most productive authors, institutions, countries, and annual publication counts (Atsız et al., 2022; Çıkı, 2022), as well as science mapping analysis, which involves the co-occurrence of keywords (Garrigos-Simon et al., 2019; Sigala et al., 2021; Kesici, 2022; Ogretmenoglu et al., 2023).

3.2. Data collection and process

On November 4, 2023, the data for this book chapter were obtained from WoS. The database WoS was selected due to its widespread recognition and frequent use in analyzing scientific papers (Liu & Li, 2020). The term "Blue economy, blue growth, and sustainable blue economic development" were used as a search topic. Quotation marks were included in the search term (Van Nunen et al., 2018; Mavric et al., 2021). This search yielded 99 papers, including articles, conference proceedings, books, and book chapters, within the WoS database (see Table 1).

Table 1. *Data search procedures and obtained amount of data*

Steps	Search Outcome
1. On Web of Science: Search for papers with the keywords " blue economy, blue growth, and sustainable blue economic development" in the title.	5950 documents
2. Refined by Web of Science Categories as Economics	999 documents
3. The year of publication was chosen as 2019-2023	99 documents

4. Results

4.1. Descriptive Results

Between 2019 and 2023, the WoS database contained 99 papers related to BE, blue growth, and SBED studies in economics. Among these, 72 were

research articles, while the remainder comprised conference papers, books, book chapters, and editorial material.

The publications containing the terms BE, blue growth, and SBED show an upward trend over time, as depicted in Figure 1. The count peaked at 48 in 2021; however, there was a slight decline in 2022 and 2023.

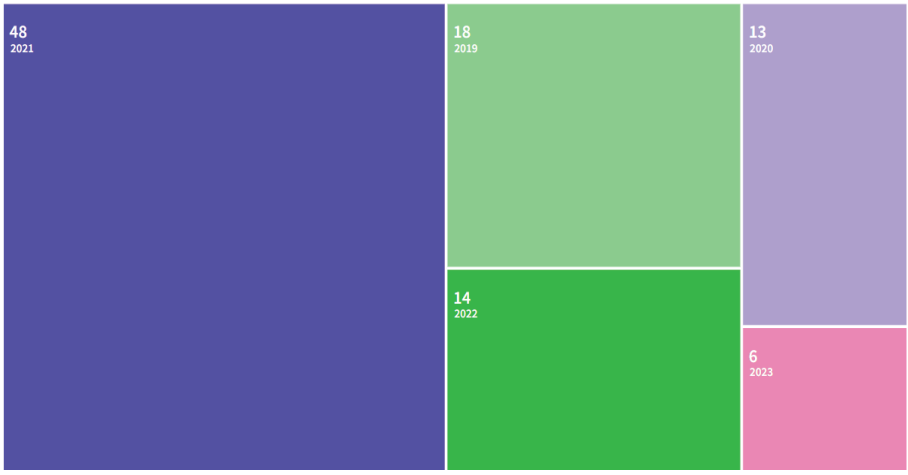

Figure 1. *Annual Number of Papers (Source: WoS)*

Figure 2 demonstrates the most contributed authors on the BE, blue growth, and SBED in economics literature. As the figure shows, the most prolific authors are Robin Mahon (University of the West Indies), H. A. Oxenford (University of the West Indies), and Patrick McConney (University of the West Indies).

Figure 2. *Most Productive Authors (Source: WoS)*

The most productive universities are listed in Figure 3. The most productive organizations can be listed as follows: The University of the West Indies, University of Western Australia, and Shandong University.

Figure 3. *Most Contributing Universities (Source: WoS)*

Figure 4 illustrates the most productive countries in terms of publications. The United States leads with 21 publications, followed by China, England, and Barbados as the next most productive nations. Additionally, Australia recorded 7 publications, while Canada and Germany each contributed 6. India, Jamaica, and Malaysia each produced 4 publications.

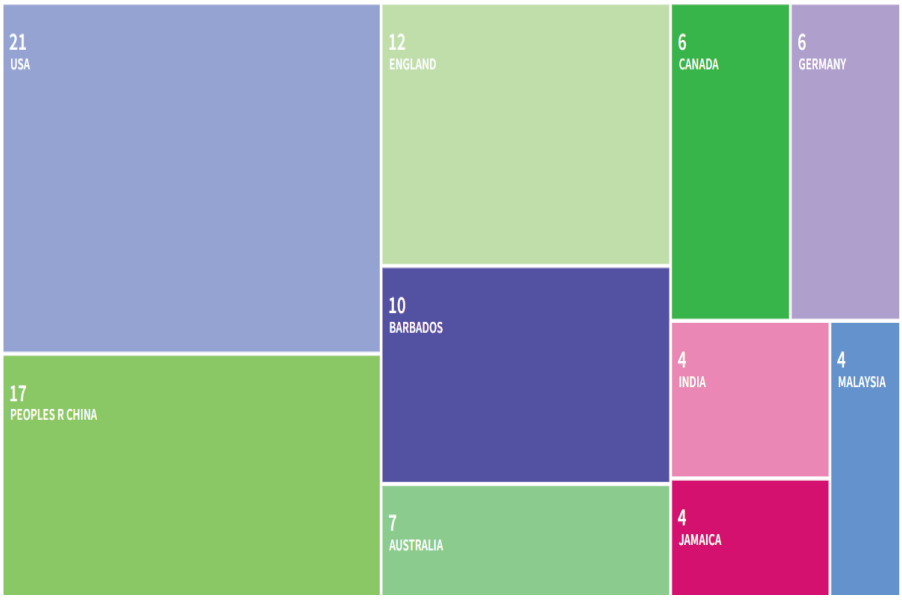

Figure 4. *The most productive countries (Source: WoS)*

4.2. Science mapping analysis results

In this sub-title, it was performed a science mapping analysis of documents and analyzed the co-occurrence of author keywords by VoSviewer.

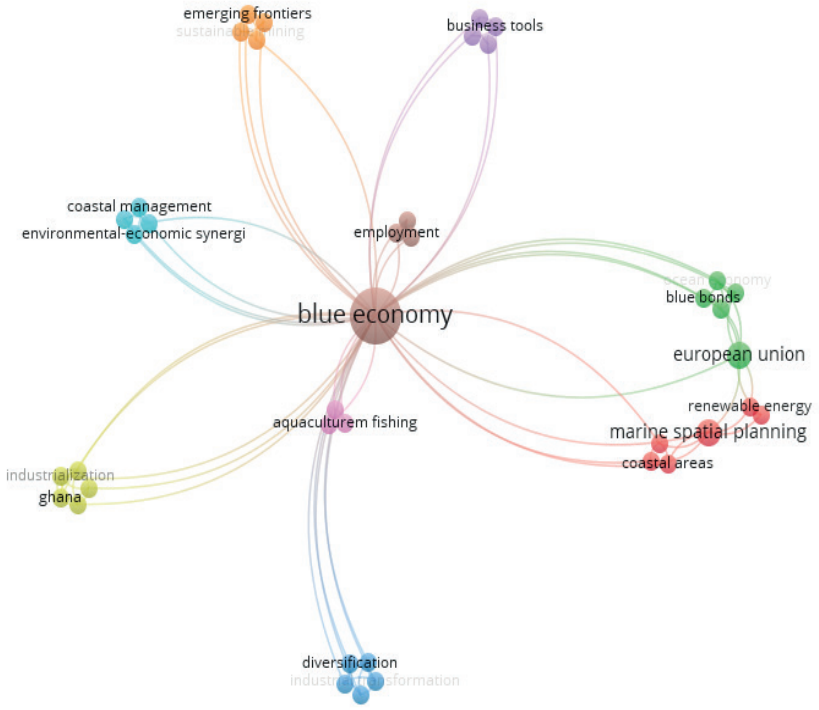

Figure 5. *Co-occurrence of author keywords of documents (Source: WoS)*

As a result of this analysis, 9 clusters were formed (See figure 5). Cluster 1 (red) includes keywords such as coastal areas, marine spatial planning, renewable energy, social-economic factors, sustainable development, and Southern Europe. Cluster 2 (yellow) encompasses keywords such as Ghana, industrializations, land, ocean grabbing and oil-gas. Cluster 3 (green) comprises keywords such as blue bonds, blue invest, climate neutrality, European Union, ocean economy. Cluster 4 (blue) contains the keywords diversification, industrial transformation, inter-industrial relationships, research-innovation projects, and social network analysis. Cluster 5 (purple) consists of keywords such as document analysis, numbers, objectivity, and business tools. Cluster 6 (turquoise) consists of the keywords coastal management, small-scale fishing, perceptions and attitudes, and environmental-economic synergy. Cluster 7 (brown) is associated with keywords such as BE, employment, wages, regional analysis. Cluster 8 (pink) contains keywords such as fish production, economic growth, and aquaculture fishing. Cluster 9 (orange) encompasses keywords such as emerging frontiers, global value chain, sustainable mining and sustainable soil and water.

Conclusion

This book chapter conducted a bibliometric analysis of the BE, blue growth, and SBED concepts from 2019 to 2023 based on the WoS database. In this book chapter, commencing with a descriptive analysis, the following key findings were highlighted: 2021 emerged as the most productive year, Robin Mahon ranked as the most prolific author, The University of the West Indies stood out as the leading institution, and the USA emerged as the most productive country.

This book chapter, which first conducted descriptive analysis, briefly presented the following. It has been determined that the most productive year is 2021, the most productive author is Robin Mahon, the most productive university is The University of the West Indies, and finally, the most productive country is the USA. Furthermore, this chapter yielded various outcomes through science mapping analysis, identifying the most frequently utilized keywords based on the co-occurrence of author keywords within the documents.

In terms of theoretical contribution, in this book chapter, the most studied concepts related to the BE, blue growth, and SBED were discovered. Moreover, it acknowledges the substantial contributions from authors, countries, and universities in these areas. Consequently, the findings presented here may guide researchers aspiring to delve into BE, blue growth, and SBED, offering a platform to explore and develop new perspectives in this field.

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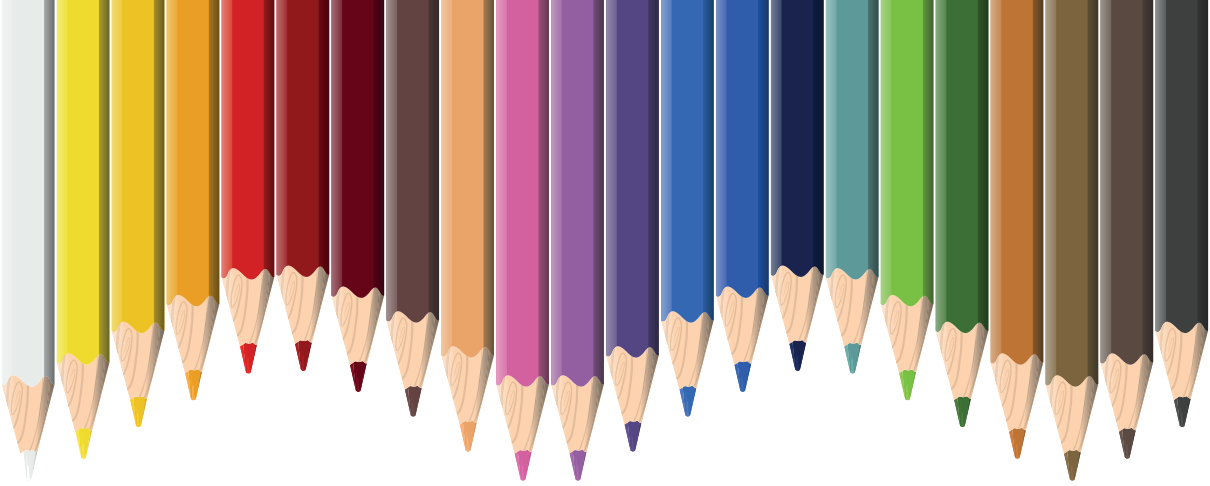

Chapter 6

ANALYSIS OF THE IMPACT OF AGRICULTURAL CREDITS ON AGRICULTURAL GROWTH IN TURKEY: EMPIRICAL EVIDENCE FROM AN AUTOREGRESSIVE DISTRIBUTED LAG BOUNDARY TESTING APPROACH

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1. INTRODUCTION

One of the critical factor in agricultural production is farmers' access to financial resources in the agricultural sector. Agriculture is a sector characterized by uncertainty due to factors such as climatic conditions, market fluctuations, and many others. Thus, providing farmers with appropriate financial tools and support is of paramount importance for the sustainability and efficiency of agriculture. Additionally, the agricultural sector plays a significant role in economic growth and development, particularly in developing countries. Agricultural production requires financial support as all other sectors. Also, agricultural loans serve as financial instruments that play a pivotal role in providing the necessary resources and transitioning to modern farming practices. The structure of agricultural production inherently involves different periods throughout the year, which plays a crucial role in providing the necessary raw materials for the industry. This leads to the dispersion of sectoral expenditures at various times during the year. Furthermore, agricultural production encompasses various inputs such as diesel, fertilizer, seeds, pesticides, and more. To ensure the continuity of agricultural production, it is essential to reduce the costs associated with these inputs. Moreover, with the increasing global population, the continuity of agricultural production has become even more critical.

Tablo 1. Agricultural GDP and Short, Long Term Agricultural Credit (2005-2022)

Year	Rate of Agricultural Gross Domestic Product (%)	Agricultural Gross Domestic Product (Thousand TRY)	Agricultural Credit in Short-Term (Thousand TRY)	Agricultural Credit in Long-Term (Thousand TRY)
2005	7.93	78.370.970	13.345.053	11.926.476
2006	1.55	79.585.310	16.971.775	10.565.003
2007	-6.22	74.636.413	22.489.200	13.678.480
2008	4.53	78.013.732	28.684.751	20.510.076
2009	4.13	81.234.274	35.555.597	21.762.931
2010	7.67	87.464.906	45.450.323	28.317.716
2011	3.44	90.473.489	61.101.026	50.900.927
2012	2.20	92.459.744	67.637.903	57.337.103
2013	2.37	94.649.299	70.759.733	65.026.109
2014	0.55	95.167.987	81.344.668	80.133.310
2015	9.26	103.977.399	73.706.014	145.343.030
2016	-2.59	101.280.685	81.154.539	191.100.358
2017	4.92	106.262.848	91.852.553	231.333.691
2018	2.30	108.708.277	101.701.376	280.794.026

2019	2.99	111.964.074	116.798.413	295.587.729
2020	5.81	118.467.681	137.495.473	333.907.190
2021	-3.04	114.865.702	171.789.987	420.354.689
2022	1.27	116.325.286	365.139.042	624.055.555

(Source: Turkish Statisticsl Institute and The Bank Association of Turkey Statistics, 2023)

When examining the global use of agricultural credits, it is stated that they are predominantly utilized for purposes such as land improvement, machinery acquisition, seed procurement, production stocks, fertilizer, and also frequently for financing labor wages (Chandio et. al., 2017). Therefore, agricultural credits play a crucial role not only in meeting the capital needs for aspects like land improvement, machinery acquisition, seed procurement, production stocks, and fertilizer but also in financing labor wages, aiming to enhance the financial capacity of producers, provide operational capital, support profitable business operations, and achieve income growth through productivity (İnan, 2016). Moreover, the timely and sufficient access to agricultural credits is critically important, particularly for the efficient and sustainable continuation of agricultural production (Saboor et. al., 2009). On the other hand, agricultural activities in Turkey are predominantly carried out on small, fragmented, and scattered lands. Agricultural production continues to rely on limited and low-capacity methods. This situation increases the need for financing for agricultural enterprises lacking sufficient equity capital.

Table 1 denotes the amounts of agricultural GDP and short- and long-term credits extended in the agricultural sector. Despite the decreasing share of agriculture within GDP over the years, the quantity of agricultural credits has been increasing in conjunction with agricultural production, as observed in Table 1. An interesting observation is that, starting from the year 2011, the total of short- and long-term agricultural credits has increased more than the agricultural GDP value. To the best of our knowledge, there is no study that analyzes the mentioned increase in credits by differentiating between short- and long-term agricultural credits. In this context, this research represents the first analysis of the impact of short- and long-term credits provided by banks to the agricultural sector on the agricultural gross domestic product (GDP) in Turkey unlike other studies. This approach allows for the evaluation of Turkey's agricultural credit system within the developing country group, enabling potential comparisons with other countries or country groups.

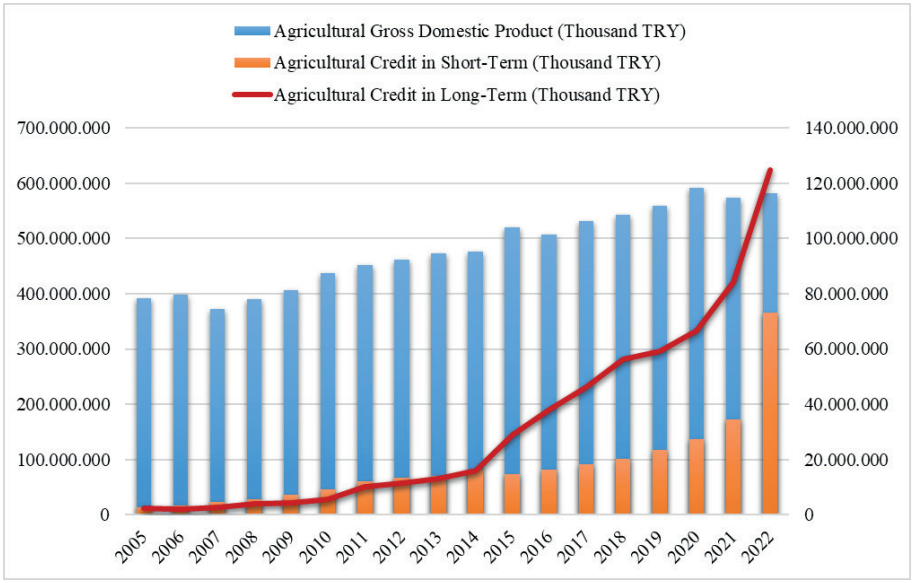

Figure 1. *Short-Term and Long Term Cash Credit Utilizations in the Agricultural Sector in Turkey between 2005-2022 (Source: Turkish Statisticsl Institute; The Bank Association of Turkey Statistics, 2023)*

The Agricultural Gross Domestic Product (GDP) is a significant factor influencing the economic performance of a country's agricultural sector. Figure 1 reveals Turkey's agricultural GDP and agricultural credits from 2005 to 2022. When examining the change in agricultural GDP over the years, a notable increase is observed between 2005 and 2014. Particularly, a rapid continuation of growth in the sector is observed from 2015 to 2022. There is a prevailing trend of increase in short-term credits, which is evident when examining the data on short-term agricultural credit amounts during the same period. Notably, there has been a notable surge in short-term agricultural credits during the Covid-19 pandemic period in the year 2021. However, for the sustainability of economic development in the agricultural sector, the distribution of medium and long-term credits is crucial. As seen figure 1, the increase in medium and long-term credits is more pronounced than that in short-term credits. This situation can be interpreted as evidence that the overall upward trend in medium and long-term credits supports the growth potential in the agricultural sector.

Studies related to the subject in the literature can be categorized into two main groups: those conducted for a single country and those specific to Turkey. Numerous studies investigate the relationship between agricultural credits and agricultural growth and production. In studies focusing on a single country, the impact of agricultural credits on agricultural production or economic

growth is generally explored. Mahmood et. al., (2009) have examined the influence of agricultural credits on the growth of the livestock sector using information obtained from interviews with 50 farmers. The study findings have revealed that the expansive effect of agricultural credits on the livestock sector was more than twice as significant. Anthony (2010) has analyzed the impact of agricultural credits on economic growth in Nigeria using the ordinary least square method. The study, which cover from 1986 to 2007, finds that an augmentation in agricultural credits is associated with the expansion of agricultural GDP, thereby fostering increased exports. Xin & Li (2011) have emphasized the need for agricultural credits in supporting agricultural development, highlighting the central role of finance in the agricultural economy. An error correction model (ECM) based on the least squares method has been constructed to analyze the economic effects of agricultural credits on the agricultural economy and investigate the relationship between them in the Chinese economy. The analyses demonstrate that agricultural credits significantly contribute to the total value of agricultural production, providing empirical evidence that the development of rural finance is crucial for promoting agricultural economic development. Vincent et. al., (2011) have investigated the relationship between loans provided by commercial banks and agricultural production in Nigeria using the Ordinary Least Squares method. The empirical results suggest a positive relationship between agricultural credits and agricultural production, while a negative relationship was observed with interest rates. Asghar & Chughtai (2012) have examined the relationship between agricultural credit usage and wheat production efficiency. A positive correlation was identified among the variables under consideration. Narayanan (2015) has evaluated effect of agricultural credits on agricultural produciton in India, which is cover from 1995-96 to 2011-12. The research findins denoted that an increase in agricultural credits is intensely sensitive to the increase in agricultural production. Agunuwa et. al., (2015) have analyzed the relationship between commercial bank loans and agricultural productivity in Nigeria using the Ordinary Least Squares method for the years 1980-2013. Empirical findings suggest a positive relationship between commercial bank loans and agricultural productivity. Chisasa & Makine (2015) have examined the role of bank loans on agricultural production in South Africa with the Johansen cointegration test and vector error correction method for the period 1970-2011. The study results indicate a positive relationship between bank loans and agricultural production, and a unidirectional causality from bank loans to agricultural outputs was identified. Nnamocha & Eke (2015) have conducted an analysis using the Error Correction Model (ECM) for the years 1970-2013. They found a positive relationship between bank loans and agricultural output in the long run. Udoka et. al., (2015) have examined the impact of commercial bank loans on agricultural production and concluded that an increase in agricultural credit enhances agricultural production in

the long term. Rehman et. al., (2017) have analyzed the relationship between agricultural GDP and agricultural credits in Pakistan from 1960 to 2015 using the Johansen cointegration analysis. The study result denote that a positive and statistically significant relationship between total agricultural credits provided by various institutions and agricultural GDP. On the other hand, there has no been significant relationship found between agricultural credits provided by cooperatives and agricultural GDP.

The relationship between the variables has been consistently identified as positive in studies examining the effects of agricultural credits on agricultural GDP for the Turkish economy using various analysis methods. Yıldız & Oğuzhan (2007) have analyzed the period from 1963 to 2004, utilizing agricultural credit, exchange rates, interest rates, the price index received by farmers, and agricultural production variables. According to Granger causality and VAR analysis results, it has been determined that agricultural credits have been increased agricultural GDP both in the short and long term. Çevik & Zeren (2014) have investigated the relationship between agricultural credits and financial development using positive and negative shocks. As per Hatemi-J's asymmetric causality test results, there has no been found relationship between negative credit shocks and financial development, while a causality relationship has been identified between positive shocks in agricultural credits and financial development. Terin et. al., (2014) have examined the relationship between agricultural credit and agricultural production with Granger causality tests from 1995 to 2012. The study have concluded a unidirectional causality relationship from agricultural production to agricultural credit. Işık et. al., (2015) have evaluated the impact of agricultural credits on agricultural production in 26 regions using panel data analysis from 1995 to 2014. A positive relationship between agricultural credits and agricultural production was determined in both the short and long term. Sever & Han (2015) have utilized quarterly data between 2002 and 2012 to conduct cointegration and causality tests. The study investigates the relationship between credits allocated to the real sector and sectoral GDP. It is been determined that credits allocated to the financial sector are the cause of agricultural GDP, and a unidirectional causality relationship from the financial sector to the agricultural sector is identified. Ünlüer & Güneş (2016) have conducted interviews with 117 selected agricultural enterprises in Eskişehir province. The study result have revealed that 58.27% of agricultural credit usage has been short-term, while 41.73% has been medium to long-term. Duramaz & Taş (2018) have examined the impact of agricultural credits provided by public, private, and foreign-owned banks in the Aegean region on agricultural production. Findings from the panel data analysis have denoted that the increases in credits from public, foreign, and private banks positively have affected agricultural production, contributing to increase of 3.2%, 0.4%, and 0.1% in agricultural output, respectively. Yalçınkaya (2018) has investigated

the effect of credits used in the agricultural sector on agricultural GDP. Granger Causality Analysis results using quarterly data from 2005 to 2015 identified a unidirectional causality relationship from agricultural credits to agricultural GDP. Koç et. al., (2019) have studied the impact of state-provided support and credits on agricultural production from 2004 to 2014 using spatial panel analysis. The results have indicated a positive relationship between agricultural credits and agricultural production. Moreover, it has been determined that a 1% increase in agricultural credits increased agricultural value-added by 0.17%, with direct and spillover effects of 0.05% and 0.12%, respectively. Şit (2019) has evaluated the impact of agricultural credits on the development of the Eastern Anatolia region from 1988 to 2017 using the Dolado-Lütkepohl and Bootstrap causality tests. The findings have revealed a bidirectional causality relationship between regional growth and agricultural credits. Bahşi & Çetin (2020) have investigated the relationship between agricultural credits and agricultural GDP using cointegration and causality tests. It has been determined that agricultural credits have affected agricultural production positively. Semerci (2021) has examined data from 571 agricultural enterprises in the Thrace region, focusing on oilseed sunflower, cotton, rice, canola, and dairy farming. The study results have indicated that as the size of the enterprise increases, the need for agricultural credit also increases. Kaya & Kadanalı (2022) have examined the relationship between agricultural production and agricultural credits provided by investment and development banks from 2008 to 2033 using quarterly data. The study results showed that agricultural credits have a positive impact on agricultural production. Önder (2023) has analyzed the effect of agricultural credits on growth, dividing the geographical regions of Turkey into seven regions using new generation panel data analysis methods from 2004 to 2021. The study findings have revealed that there are regional differences in the long term, but a positive relationship between agricultural credits and economic growth has been identified. Additionally, it has been found that agricultural credits are not the reason of economic growth.

This study consist into four main sections. The first part includes the introduction and literature review. The second section, which has focused on literature studies, has provided detailed information about the econometric method and the dataset. The third section extensively discusses the empirical findings. The final section presents the conclusions of the study along with possible policy recommendations.

2.MATERIALS AND METHODS

Quarterly data cover from 2004 to 2023, which has been adjusted for the effects of seasonality in study.The agricultural gross domestic product data, which have been obtained from the Turkish Statistical Institute (TURKSTAT) database, have been classified according to main activity branches and have been adjusted to real terms using the 2009 base year deflator before being

incorporated into the model. Short and medium-long term loan data have been accessed from the database of the Turkish Banks Association. The natural logarithm of all data is included in the analysis. Definitions related to the variables used in the model have been presented in Table 2

Table 2. Variables and Their Descriptions

VARIABLE NAME	ABBREVIATION	SOURCE
Agricultural Gross Domestic Product (Thousand TRY)	GDPagricultural	The Turkish Statistical Institute
Agricultural Credit in Short-Term (Thousand TRY)	CREDITshort	The Bank Association of Turkey
Agricultural Credit in Long-Term (Thousand TRY)	CREDITlong	The Bank Association of Turkey

Unit root tests are widely employed to ascertain the non-stationarity of time series data. When constructing econometric models for time series analysis, the stability of the mean, variance, and covariance of the relevant series over time serves as an indicator of the series being stationary. The utilization of non-stationary series gives rise to a spurious regression problem, where an evaluation of a meaningful relationship among the series in the model occurs. Furthermore, the parameters of the model are misconstrued due to this circumstance. Hence, it is crucial to transform the series into a stationary form before their inclusion in the model to ensure the reliability of the estimated parameters (Baltagi, 2003; Gujarati, 2004). In this investigation, the Augmented Dickey-Fuller (ADF) unit root test has been utilized to appraise the stationarity characteristics of the series. The null hypothesis in the unit root test posits that the series is non-stationary and contains a unit root. The stationarity of the series is assessed using three different models: stationary without a trend and intercept, stationary with an intercept, and stationary with an intercept and trend. The equations for the models and the test procedure for the ADF unit root test are provided in equations (1), (2), and (3) correspondingly. Various criteria such as Akaike Information Criterion (AIC) and Schwarz Information Criterion (SC) are applied to determine the appropriate lag length for the ADF unit root test. The value that minimizes the lag count according to both information criteria is deemed as the optimal lag length (Dickey & Fuller, 1979).

$$\Delta y_t = \rho y_{t-1} + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + \varepsilon_t \quad (1)$$

$$\Delta y_t = \alpha + \rho y_{t-1} + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + \varepsilon_t \quad (2)$$

$$\Delta y_t = \alpha + \beta\, t + \rho y_{t-1} + \sum_{i=1}^{k} \varphi_i \Delta y_{t-i} + \varepsilon_t \quad (3)$$

The equation of the model created with the variables used in the study is as given in equation (4). the dependent variable GDPagriculturalt represents the value of agricultural GDP, and the independent variables CREDITshort and CREDITlong represent the short-term and long-term loans used in the agricultural sector, respectively in equation (4).

$$GDPagricultural_t = \beta_0 + \beta_1\, CREDITshort_t + \beta_2\, CREDITlong_t + \varepsilon_t \quad (4)$$

The ARDL model provides the flexibility for cointegration testing even when the series exhibit stationarity at different orders. In simpler terms, it is not mandatory for the variables employed in the model to demonstrate cointegration at the same level. Furthermore, in research scenarios characterized by limited datasets, this approach tends to produce more robust and consistent outcomes, presenting an advantage over alternative methodologies. In accordance with the study's objectives, equation 5 presents the unrestricted error correction model designed to assess the impact of energy consumption and greenhouse gas emissions in the agricultural sector on agricultural gross domestic product

$$\begin{aligned}\Delta \ln GDPagricultural_t = {} & \beta_0 + \sum_{k=1}^{m} \beta_{1k} \ln GDPagricultural_{t-k} + \\ & \sum_{k=1}^{m} \beta_{2k} \ln CREDITshort_{t-k} + \sum_{k=1}^{m} \beta_{3k} \ln CREDITlong_{t-k} + \\ & \beta_4 \ln GDPagricultural_{t-1} + \beta_5 \ln CREDITshort_{t-1} + \\ & \beta_6 CREDITlong_{t-1} + \varepsilon_t\end{aligned} \quad (5)$$

The symbol Δ represents the difference operator, where m denotes the appropriate lag length, and β_1, β_2, β_3 represent the error correction coefficients, while β_4, β_5, β_6 represent the long-term coefficients. The error term is denoted as εt, and k indicates the number of lags for each variable in equation 5. Cointegration in the model is assessed using the F-test statistic. The null hypothesis tests for no cointegration ($H_0 = \beta_4 = \beta_5 = \beta_6 = 0$; No cointegration), while the alternative hypothesis tests for cointegration ($H_1 = \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$; Cointegration exists). The presence of cointegration is determined by comparing the calculated F-statistic value with lower and upper critical values, which are derived from studies by Pesaran et al. (2001). If the calculated F-statistic value is less than the lower critical value from studies by Pesaran et. al., (2001) it suggests no cointegration among the series. Conversely, if the F-statistic value exceeds the upper critical value, it implies cointegration among the series. However, if the calculated F-statistic value falls between the lower and upper bounds, a conclusive decision regarding

the presence of cointegration cannot be made. The short-term coefficients are derived through the estimation of the error correction model (ECM) after establishing the cointegration relationship for the long term, as outlined in equation 6.

$$\Delta \ln GDPagricultural_t = \beta_0 + \sum_{k=1}^{m} \beta_{1k} \ln GDPagricultural_{t-k} + \sum_{k=1}^{m} \beta_{2k} \ln CREDITshort_{t-k} + \sum_{k=1}^{m} \beta_{3k} \ln CREDITlong_{t-k} + \varphi ECT_{t-1} + \varepsilon_t \quad (6)$$

The parameter φ, representing the rate of convergence for variables in the long run, is anticipated to be negative and statistically significant. Predictions utilizing the ARDL model have relied on critical values established by Pesaran et. al., (2001). Model estimations have been conducted using Eviews 12 software.

4.FINDINGS AND DISCUSSIONS

The stationarity and cointegration degrees of the series have been determined before transitioning to the ARDL model In the analysis process. To achieve this goal, the Augmented Dickey Fuller (ADF) unit root test has been applied to all series, and the obtained statistical results are presented in Table 3. According to the unit root test analysis, it has been determined that the GDPagricultural variable becomes stationary when the first difference is taken in models with intercept, trend, and both at a 5% significance level. Moreover it has been found that the independent variables CREDITshort and CREDITlong exhibit stationarity at different levels. The CREDITshort variable has been observed to be stationary when the first difference is taken in the model with an intercept and in the model with both trend and intercept. On the other hand, the CREDITlong variable has been found to be stationary when the first difference is taken in the model with an intercept, while it becomes stationary at both the level and the first difference when the model includes both trend and intercept. Since variables have been stationary at different levels, ARDL boundary test approach have been conducted next part of the study.

Table 3. Augmented Dickey Fuller (ADF) Unit Root Test Results

	INTERCEPT			TREND AND INTERCEPT		
	Test Statistics		Decision of Stability	Test Statistics		Decision of Stability
VARIABLE NAME	Level I(0)	First Difference I(1)		Level I(0)	First Difference I(1)	
Ln(GDPagricultural)	-0.312 (0.917)	-5.558*** (0.000)	I[1]	-3.106 (0.113)	-5.5156*** (0.000)	I[1]
Ln(CREDITshort)	0.785 (0.993)	-3.467** (0.011)	I[1]	-1.129 (0.916)	-3.596** (0.0371)	I[1]
Ln(CREDITlong)	0.960 (0.995)	-4.517*** (0.000)	I[1]	-3.969** (0.014)	- 6.484*** (0.000)	I[0] I[1]

(**Notes:** ***, ** and * indicate significance at the 1%,5% and 10%level, respectively. The lag order determine using the Schwartz information criterion and the numbers in parentheses of are p-values) (Source: Author's own computation Using E-view 12)

The analysis reveal that the optimal model is the ARDL (1,7,2) model. Table 3 presents the results of the ARDL bounds testing approach for cointegration analysis. The calculated F-statistic and the relevant critical values for the ARDL model are provided in Table 4. As the calculated F-statistic value in the ARDL model is greater than the upper critical value at a 5% significance level, the null hypothesis (Ho) is rejected. Therefore, it can be concluded that there exists a long-term cointegration relationship between GDPagricultural and the variables CREDITshort and CREDITlong. In other words, these variables move together in the long term.

Table 4. ARDL Bound F-Test Results for Cointegration

Dependent Variable: ln(GDPagricultural)				
			Bound Critical Values	
F Statistic Value	k	Significance Level	Lower Bound I(0)	Upper Bound I(1)
4.602**	2	10%	2.730	3.445
		5%	3.243	4.043
		1%	4.398	5.463

(**Note:** ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. The critical values for the lower I(0) and upper I(1) bounds are obtain from Pesaran et al. (2001), Appendix: Case II (Source: Author's own computation Using E-view 12).

The short and long-term coefficient estimates are summarized in Table 5 along with the results of diagnostic tests. Analyzing the diagnostic test results, it can be concluded that the model exhibits no autocorrelation, as indicated by the Breusch-Godfrey Serial Correlation LM Test. Furthermore, the model does not inclued varying variance, according to the results of the White Heteroscedasticity Test. Also the Ramsey Reset Test indicates that the model is correctly specified. Additionally, the Jarque-Bera Normality test results affirm the assumption of a normal distribution for the error term in the mode.

Table 5. Long-Run and Short Run Coefficients Using the ARDL (1, 7, 2) Approach

LONG-RUN COEFFICIENTS				
Dependent Variable: Δln(GDPagricultural)				
Independent Variables	Coefficient	Standart Deviation	t-Statistic	Prob.Values
Constant	14.869***	0.285	52.039	0.000
ln(CREDITshort)	0.034	0.039	0.892	0.375
ln(CREDTlong)	0.083***	0.022	3.749	0.000

SHORT RUN COEFFICIENTS				
Variables	Coefficient	Standart Deviation	t-Statistic	Prob.Values
Δln(CREDTlong)	-0.0607	0.0440	-1.3802	0.1730
Δln(CREDTlong)-1	0.0340	0.0479	0.7092	0.4811
Δln(CREDTlong)-2	0.0272	0.0488	0.5585	0.5787
Δln(CREDTlong)-3	-0.1720***	0.0501	-3.4270	0.0012
Δln(CREDTlong)-4	0.0065	0.0483	0.1364	0.8919
Δln(CREDTlong)-5	0.0327	0.0419	0.7805	0.4383
Δln(CREDTlong)-6	-0.0897**	0.0399	-2.2482	0.0285
Δln(CREDTshort)	-0.0294	0.0358	-0.8204	0.4154
Δln(CREDTshort)-1	-0.0444	0.0368	-1.2064	0.2327
ECM(-1)	-0.4023***	0.0913	-4.4041	0.0000

DIAGNOSTIC TESTS		
	F Statistic	Prob.Values
Jargue-Bera Normality Test	0.23	0.889
Breusch–Godfrey Serial Correlation LM Test	0.645	0.573
White Heteroscedasticity Test	0.337	0.321
Ramsey Reset Test	2.551	0.115

(**Note:** ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Diagnostic tests results are based on F-statistic. (Source: Author's own computation Using E-view 12)

In addition to diagnostic tests, it has been determined that in the long term, the CREDITlong variable in the agricultural sector in Turkey moves in the same direction as GDPagricultural based on the obtained cointegration findings. To put it differently, a positive relationship has been found between long-term agricultural loans and agricultural GDP. According to the long-term coefficient results, when CREDITlong increases by 1%, the value of GDPagricultural increases by 0.08%. This result is consistent with findings from studies by Anthony (2010), Vincent et. al., (2011), Narayanan (2015), Nnamocha & Eke (2015), Rehman, et. al., (2017), Duramaz & Taş (2018) Koç et. al., (2019), Bahşi & Çetin (2020), Kaya & Kadanalı (2022), Önder, (2023). However, it has been observed that the CREDITshort value has a positive but statistically insignificant effect on GDPagricultural.

Figure 2. *Plot of Cumulative Sum of Recursive (CUSUM) Residuals and Cumulative Sum of Square of Recursive CUSUMQ Residuals*

*(***Note:** *The straight blue lines represent critical bounds at 5% significance level)*

(Source: Author's own computation Using E-view 12)

After conducting a long-term analysis focused on uncovering short-term relationships among variables, it becomes necessary to calculate the ECM(-1) error correction model coefficient, which is crucial for the overall understanding of the study. The coefficient for the ECM(-1) error correction term, which measures at -0.402, has been determined as both negative and statistically significant at the 1% level, aligning with theoretical expectations. This result denotes that short-term imbalances within the model will reconcile and return to equilibrium in approximately 2.49 periods (1/0.402). To evaluate the model's stability and reliability, we employed the CUSUM and CUSUM-SQ tests, proposed by Brown, Durbin, and Evans (1975). Figure 2 illustrates the results of these tests. The parameters' movements within specified limits at the 5% significance level affirm the stability of the estimated coefficients within the model where GDPagricultural is the dependent variable.

4.CONLUSION

The agricultural sector is a crucial sector, especially for countries classified as developing, even though the share of the agricultural sector in the gross domestic product in Turkey has decreased. To attain sustainable economic growth and development in the agricultural sector, maintaining continuity in agricultural production is essential. Thus, is important to provide financial support to agricultural production.

This study examines the impact of short and long-term agricultural credits on agricultural GDP in Turkey. The value of agricultural gross domestic product serves as an indicator of economic growth in the agricultural sector in the study. The indicator of agricultural credit is added to the model as the short and long-term agricultural credit values provided by banks. Quarterly data from the period 2005:Q4 to 2023:Q3, which has been seasonally adjusted, is utilized for estimating the econometric model. All series are estimated by applying a logarithmic transformation. Agricultural credits are analyzed for the first time by categorizing them into short and long-term credits unlike other studies. In this context, the study first investigates whether the variables contain unit roots, and the Augmented Dickey-Fuller (ADF) unit root test is applied to each variable. The Autoregressive Distributed Lag (ARDL) boundary test method and the Vector Error Correction Model (VECM) are used in the coefficient estimation of variables found to be stationary at different levels. According to the ARDL long-term boundary test results, it is determined that there is a cointegration relationship between the variables. Moreover, a 1% increase in long-term agricultural credits increases agricultural GDP by 0.08%. Before moving on to the short-term error correction prediction results in the model, diagnostic test results are provided. According to the diagnostic test results, there are no problems of changing variance and autocorrelation in the model, the error terms are normally distributed, and there is no specification problem at the model determination stage. Finally, the short-

term error correction model is estimated, and the short-term error correction coefficient is founded -0.402. This result implies that the error correction mechanism is in operation. In other words, it is determined that short-term imbalances are corrected in (1/0.402) = 2.49 periods. Then, the model is tested for structural breaks with CUSUM and CUSUMS tests, and it is concluded that the model prediction results are consistent and stable.

It is considered that agricultural credit interest rates provided to farmers should be kept low; insurance and risk management tools should be offered against natural disasters, diseases, and price fluctuations to ensure the security of credit repayments; to promote the widespread use of technology in agriculture, credit support should be increased, and transitions to sustainable agricultural practices should be encouraged; and monitoring and evaluation mechanisms should be established to assess the effectiveness of credit utilization.

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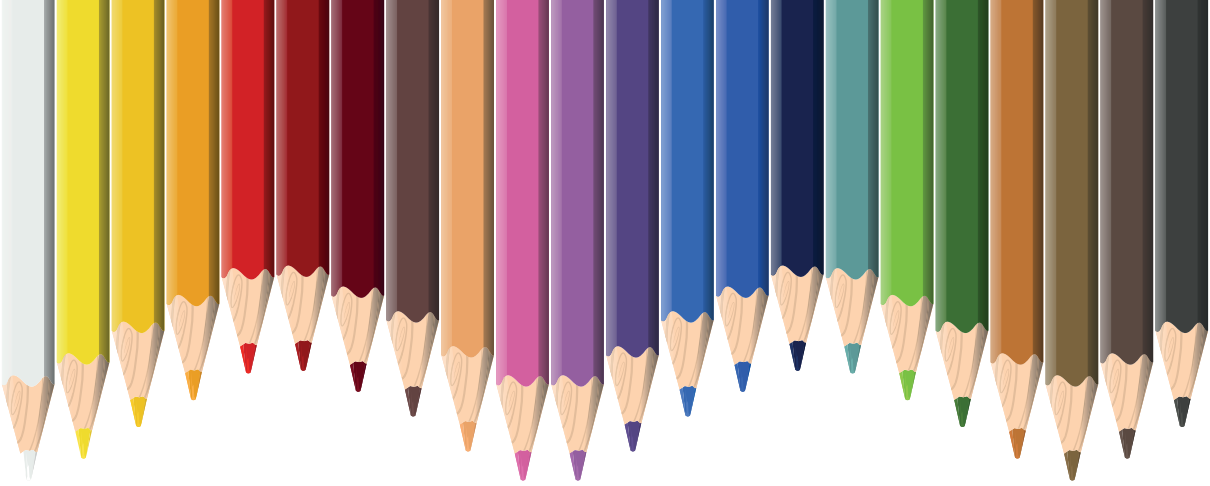

Chapter 7

THE IMPACT OF GLOBAL FACTORS ON OIL PRICES

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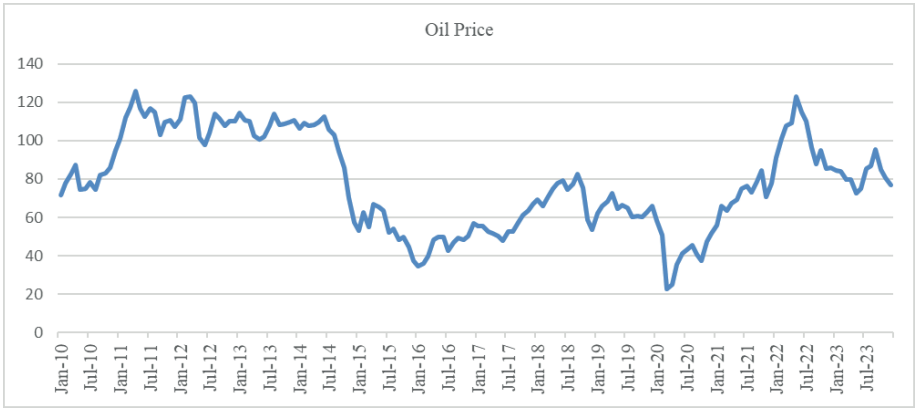
Introduction

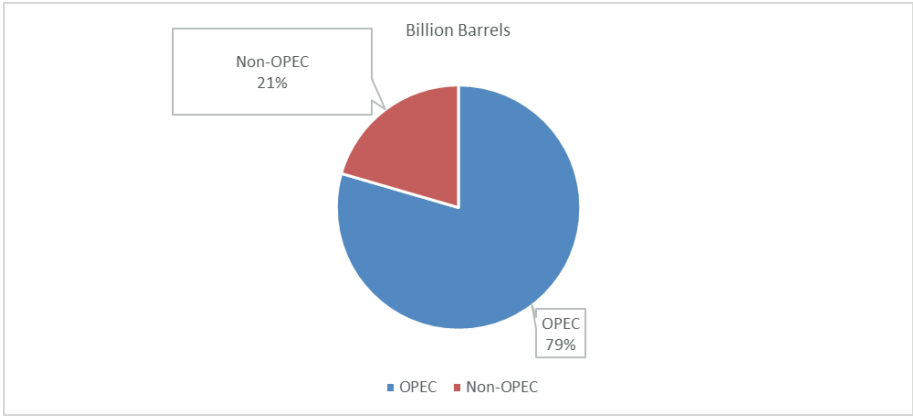
Petroleum and petroleum derivative products have direct or indirect effects on many sectors, especially production and transportation. Although the effect of the change in oil prices on various economic indicators varies depending on the country's oil import-export, level of development and the existence of different energy use, it has direct and indirect effects. Hamilton (1983) pointed out oil prices as the cause of economic slowdown and cooling in the USA, while Bernanke et al., (1997) stated that direct oil prices cannot have such an effect, but economic policies followed against price changes can have such an effect. Park and Ratti (2008), Bharn and Nikolovan (2010) talked about its impact on stock markets, Burbidge and Harrison (1984) talked about the pressure that oil prices put on the national incomes of developed countries, and Jacquinot et al., (2009) talked about its inflationary effects. Henriques and Sadorsky (2011) showed that this inflationary effect affects investment decisions and firm performances. Like these studies, many studies in the literature have mentioned the effect of oil prices on the market. Therefore, the change in oil prices is important for investors, academics and politicians. In this study, the global factors affecting oil prices were investigated. The graph shows the change in Brent oil prices during the study period.



Graph 1: *Brent Oil Prices 2010-2023*

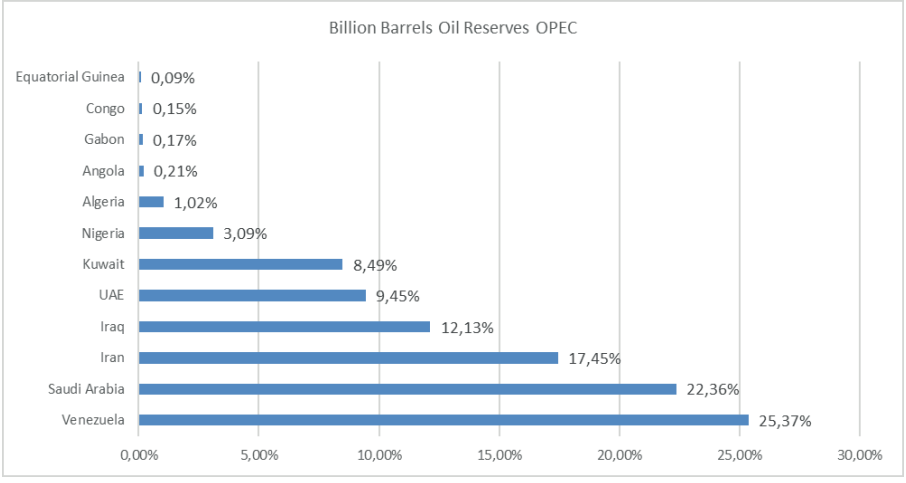
As seen in Graph 1, oil prices appear to have a fluctuating structure over the years. The uncertainties experienced during the Covid19 process and the government restrictions implemented with the increase in the number of deaths reduced oil prices to 20 dollars, and with the Russia-Ukraine war, they reached 120 dollars again. While oil prices vary over time, the status, distribution and development of oil reserves also have direct or indirect effects on oil prices. Considering proven oil reserves and increasing consumption, it can be expected to be depleted within 40-50 years unless new large reserves are discovered. This, together with the use of alternative energy sources in the

future, may make the amount of reserves the most important factor affecting prices. As seen in graphs 2-3, 79% of today's oil reserves are in the OPEC (Organization of Petroleum Exporting Countries) region, and the remaining 21% of the reserves are in other countries. The size of the oil reserves of OPEC members Venezuela, Saudi Arabia, Iran, Iraq, UAE and Kuwait constitute 95% of the total OPEC reserves and 75% of the world reserves. These countries, which have a significant portion of oil reserves, have limited impact on oil prices.



Graph 2: *OPEC and Non- OPEC World Crude Oil Reserves 2023*

Source: *OECD*

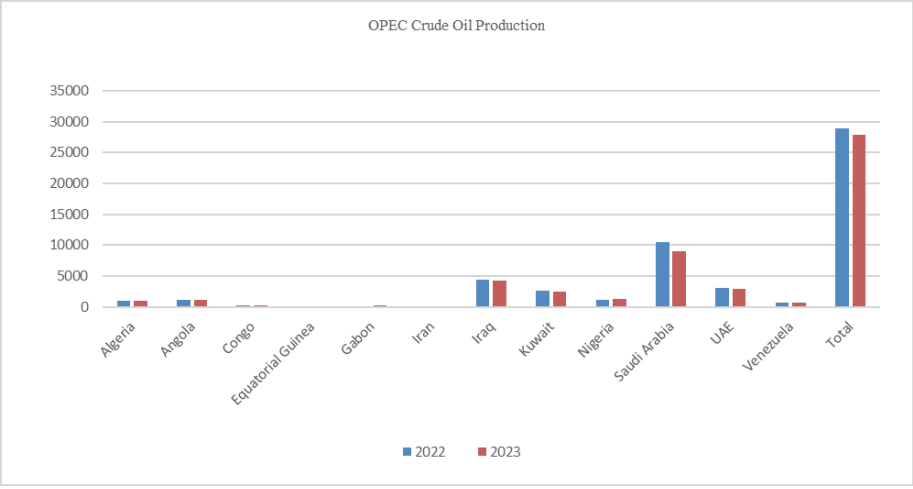


Graph 3: *World Crude Oil Reserves 2023*

Source: *OECD*

When the oil production amounts of OPEC countries, which are

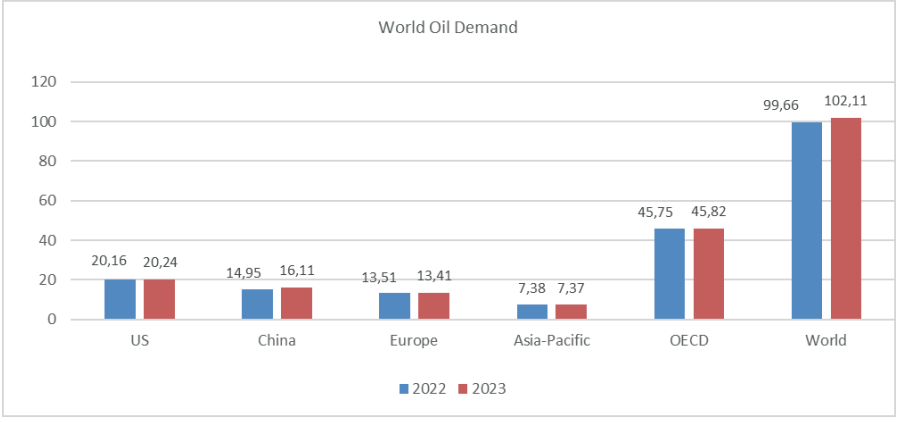
important in terms of oil reserves, are examined in graph 4, it is seen that they are not proportional to their reserve amounts and countries that are not under embargo come to the fore. It is also seen that there is a slight decrease in the oil supply of OPEC countries in 2023.



Graph 4: *OPEC Crude Oil Production (thousand barrels per day)*

Source: *OECD*

After being evaluated in terms of oil reserves and production, the change in oil demand is presented in graph 5. It is seen that oil demand is increasing in the USA, China and OECD countries, which have an important place in world production. Although there is a slight decrease in Europe, there is an increase in oil demand worldwide in 2023 compared to the previous year.



Graph 5: *World oil Demand (million barrels per day)*

Source: *OECD*

The production amounts of countries with world oil reserves are shaped according to their relations with countries in the global production and economic system. It is thought that oil prices are shaped according to world supply and demand, but various global factors are important in this supply and demand balance. For this reason, this study was designed based on global financial factors, the direct or indirect effects of economic policies followed in the world, uncertainties, wars and investor perception on oil prices.

Miao et al. (2017) claimed that financial factors have more impact on oil prices than oil supply. The impact of financial factors on oil prices is a debated issue in the literature. Frankel (2006) stated that there is an inverse relationship between the increase in interest rates and oil prices. Since the monetary policies of many countries in global markets are affected by the FED interest rate policy, the interest rates of US 5-year bonds were used in the study. Studies such as Basher and Sadorsky (2006), Bharn and Nikolovan (2010), Miller and Ratti (2009) stated that there is an interaction between stock markets and oil prices. In particular, the increase in stock market indices is expected to have a positive impact on oil prices as it reflects positive expectations about the increase in production or future production. The Dow Jones Index, which includes the largest companies in the USA, was used in the study. In addition, the companies in this index are larger in size than many countries' stock markets. Many studies such as Chai et al., (2011), Tokic (2015) and Khan et al., (2017) have shown that the change in the US dollar affects oil prices. Since world oil trade is largely carried out in dollars, movements in dollar value are expected to affect oil prices. Studies such as Sadorsky (2000) and Wang and Wu (2012) stated that the decline in the value of the dollar created a cost-cutting effect in other countries, which increased the demand for oil and affected oil prices. In this study, the dollar index, which shows the change of the dollar against 6 important currencies, was used. Additionally, gold prices, which is an important commodity in global commodity markets, were used.

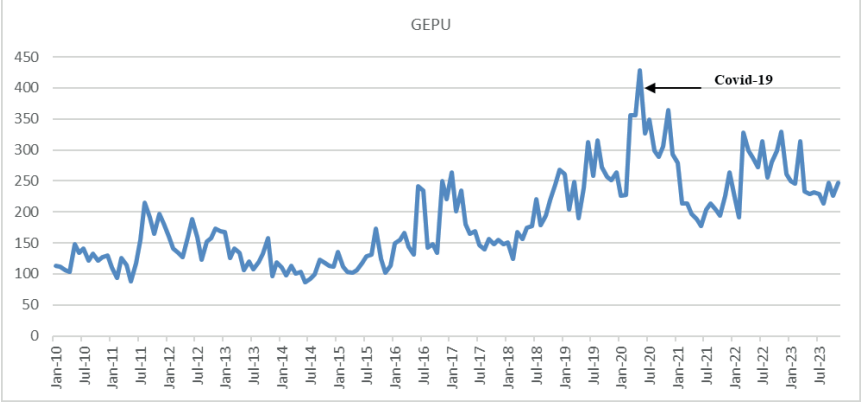
On the other hand, in addition to financial factors, global risks, uncertainties, geopolitical risks and investor sensitivity can be expected to have an impact on oil prices. Studies such as; Miao et al. (2017), Wan and Sun (2017) mentioned the impact of geopolitical risks such as war and political disagreement on oil prices. It is expected that the increase in risks in regions active in terms of oil reserves will affect oil prices, especially due to disruptions in terms of supply, and the increase in risks in other regions due to disruptions in terms of demand. In the study, the geopolitical risk index (GRI), which reflects geopolitical risks in the world, was used. Studies such as Yin (2016) and Wei et al. (2017) stated that economic policy uncertainty will lead to deteriorations in the basic supply and demand balance, which will affect oil prices through its effect on the amount of oil production. To see the impact of these uncertainties, global policy uncertainty index (GEPU) and

world uncertainty index (WUI) were included in the study. Studies such as Bekaert et al., (2011) and Silvennoinen and Thorp (2013) have shown VIX as a measure of investor sentiment. VIX is a good measurement tool, especially for the reactions of investors to risks in the markets. VIX was used to reveal the effect of investor perception on oil prices.

Dataset and Methodology

This study aims to investigate which global factors affect oil price changes and the nature of this effect. Brent crude oil prices were used as the dependent variable in the study. As independent variables; Dow Jones index, interest rates of US 5-year bonds, gold prices, Dollar index, VIX volatility index, global economic policies uncertainty index (GEPU), Geopolitical risk index (GRI) and world uncertainty index (WUI) were used. Data sets for the GEPU, GRI and WUI variables used in the study were obtained from the www.policyuncertainty.com website, and data for other global factors were obtained from the Refinitiv-datastream database. Since the frequency of some data in the study is monthly, all data were included in the study on a monthly basis. Since the world uncertainty index (WUI) is a data that started to be calculated with the 2008 crisis, the study period was determined as the period between 2010 and 2023 after the 2008 crisis.

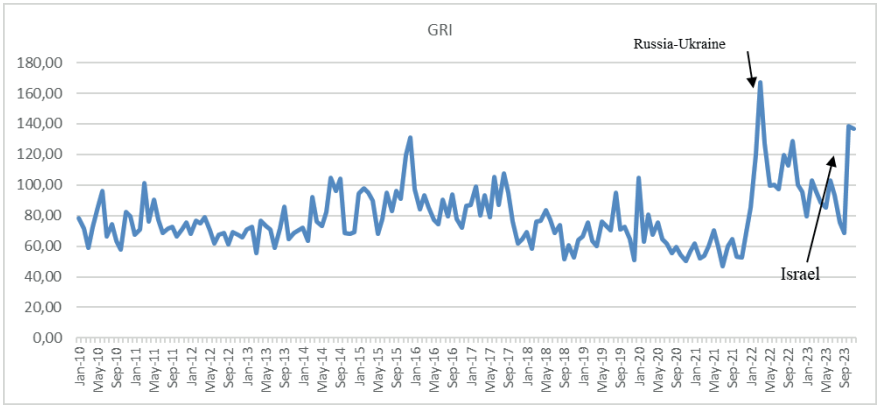
The global economic policy uncertainty index (GEPU) is created by weighting the economic uncertainty indices calculated separately for 21 countries according to the GDP size of the countries. These countries represent approximately 70% of world production. GEPU change during the study period is seen in graph 6. When graph 6 is examined, it is seen that economic policy uncertainty had a fluctuating structure during the study period and peaked especially during the Covid19 period. For this reason, the study was examined over 3 periods. These; the whole period, the period excluding Covid19 and the Covid19 period.



Graph 6: *Global Economic Policy Uncertainty Index (GEPU) 2010-2023*

Source: *www. policyuncertainty.com*

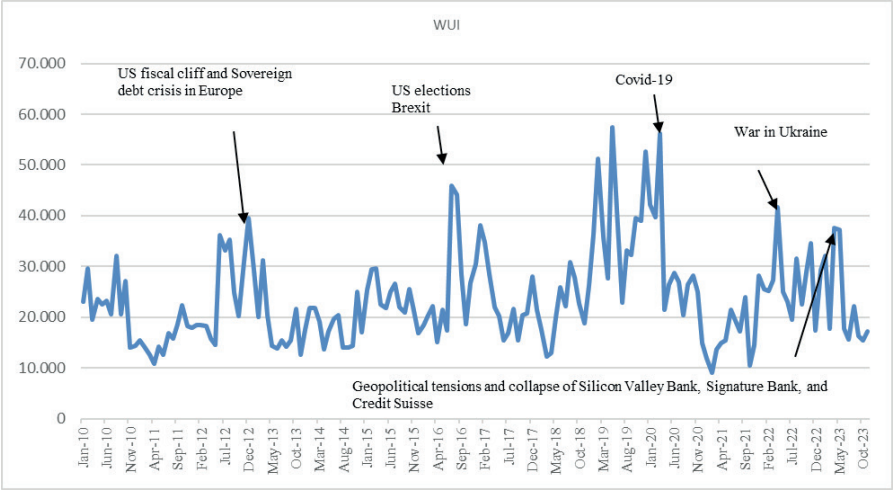
The geopolitical risk index (GRI) started to be calculated in 1985 and is based on news published in 10 newspapers with high circulation in the world. This index examines the news published in newspapers based on keywords such as war, peace, terrorism, weapons, nuclear, and reveals the frequency of publication of these headlines in total news. As seen in Graph 7, the change of the GRI index during the study period peaked especially during war periods.



Graph 7: *Geopolitical Risk Index (GRI) 2010-2023*

Source: *www. policyuncertainty.com*

Another variable used in the study, the world uncertainty index (WUI), was created by weighting the calculated uncertainty indices of 71 countries according to gdp. It is created by examining the economic policies of countries, stock market indices, risks and reports published about the countries. As seen in Graph 8, events with global effects cause changes in the index.



Graph 8: *World Uncertainty Index (WUI) GDP weighted average 2010-2023*

Source: www.worlduncertaintyindex.com

After giving information about the study period and the variables used in the study, the calculation methods of these variables and their abbreviated versions used in the study are presented in Table 1.

Table 1. Variables and abbreviations used in the study

Variables	Abbreviation	Description
Oil Prices	OP	Monthly logarithmic change in oil prices.
Dow Jones Index	DWJ	Monthly logarithmic change in Dow Jones Index.
US Bond Rate	USBY	Monthly interest rates on US 5-year bonds % change
VIX Volatility Index	VIX	Monthly logarithmic change in the VIX index.
Gold prices	GP	Monthly logarithmic change in gold prices.
Dollar Index	DI	Monthly logarithmic change in the dollar index.
Global Economic Policy Uncertainty Index	GEPU	Monthly logarithmic change in GEPU index.
World Uncertainty Index	WUI	Logarithmic change in the WUI index on a monthly basis.
Geopolitical Risk Index	GRI	Logarithmic change in the GRI index on a monthly basis.

After giving information about the data sets used in the study, the stationarity of the variables must first be ensured to avoid spurious relationships in the models to be established. Stationarity was ensured in the series through the ADF unit root test. After the series became stationary, the following models were created to determine the global factors affecting oil prices:

Model 1:

$$OP_{it=}\alpha_{it+}\beta_1(DI_{1it})+{}_+\beta_2(DWJ_{2it})+\beta_3(GP_{3it})+\beta_4(USPY_{4it})+\beta_5(VIX_{5it})+\varepsilon_{it} \quad (1)$$

Model 2:

$$OP_{it=}\alpha_{it+}\beta_1(DI_{1it})+{}_+\beta_2(DWJ_{2it})+\beta_3(GP_{3it})+\beta_4(USPY_{4it})+\beta_5(VIX_{5it})+\beta_6(GEPU_{6it})+\varepsilon_{it} \quad (2)$$

Model 3:

$$OP_{it=}\alpha_{it+}\beta_1(DI_{1it})+{}_+\beta_2(DWJ_{2it})+\beta_3(GP_{3it})+\beta_4(USPY_{4it})+\beta_5(VIX_{5it})+\beta_7(GRI_{7it})+\varepsilon_{it} \quad (3)$$

Model 4:

$$OP_{it=}\alpha_{it+}\beta_1(DI_{1it})+{}_+\beta_2(DWJ_{2it})+\beta_3(GP_{3it})+\beta_4(USPY_{4it})+\beta_5(VIX_{5it})+\beta_8(WUI_{8it})+\varepsilon_{it} \quad (4)$$

Model 5:

$$OP_{it=}\alpha_{it+}\beta_1(DI_{1it})+{}_+\beta_2(DWJ_{2it})+\beta_3(GP_{3it})+\beta_4(USPY_{4it})+\beta_5(VIX_{5it})+\beta_6(GEPU_{6it})+\beta_7(GRI_{7it})+\beta_8(WUI_{8it})+\varepsilon_{it} \quad (5)$$

In the above models, the estimation procedure was run through the OLS method and the models were examined in terms of heteroskedasticity and autocorrelation. Models where these basic assumptions are not met may give biased and deviated results (Hayashi, 2011). The GMM method introduced by Hansen (1982) was used together with the process of Newey and West (1987) to ensure the effectiveness of models containing heteroscedasticity and autocorrelation. Finally, the study period was divided into the entire period, the Covid19 period and the period excluding Covid19, and the global factors affecting oil prices were analyzed.

Results

Basic statistics of the variables used in the study, calculated as percentage changes for US bond interest rates and logarithmic changes for other variables, are presented in Table 2.

Table 2. Descriptive Statistics of Variables

	Mean	Median	Maximum	Minimum	Std. Dev.
DI	0.000372	0.000587	0.013482	-0.012519	0.004641
DWJ	0.000778	0.001040	0.012722	-0.014577	0.004186
GEPU	0.001727	-0.002970	0.127770	-0.097918	0.035245
GP	0.000536	0.000325	0.015678	-0.017893	0.006101
GRI	0.001698	-0.003591	0.184587	-0.109382	0.043903
OP	0.000397	0.002000	0.103763	-0.203511	0.027003
USBY	0.01671	0.007783	0.7136	-0.6071	0.1659
VIX	0.001787	-0.003505	0.341738	-0.168845	0.082129
WUI	0.000280	-0.000955	0.099353	-0.088152	0.031837

When Table 2 is examined, it is seen that the global economic policy uncertainty index increased by a maximum of 12%, the geopolitical risk index increased by 18% and the world uncertainty index increased by approximately 10% on a monthly basis logarithmically during the study period. On the other hand, it is seen that the VIX index, also known as the fear index, increased by 34%. This shows that the magnitude of the psychological impact of events may

be greater than the events themselves. On the other hand, oil prices increased by 10% and decreased by 20% monthly during the study period. It is seen that the variable that fluctuated the most during the study period was US bond interest rates. After giving basic statistics about the variables used in the study, the correlation matrix showing the relationships of these variables with each other is presented in Table 3.

Table 3. Correlation Matrix

	DI	DWJ	GEPU	GP	GRI	OP	USBY	VIX	WUI
DI	1.000	-0.455	0.037	-0.396	0.169	-0.290	0.024	0.331	0.093
DWJ	-0.455	1.000	-0.151	0.061	-0.191	0.497	-0.153	-0.723	-0.075
GEPU	0.037	-0.151	1.000	0.115	0.041	-0.231	0.069	0.012	0.074
GP	-0.396	0.061	0.115	1.000	0.053	0.073	-0.114	-0.034	0.038
GRI	0.169	-0.191	0.041	0.053	1.000	-0.174	0.115	0.129	0.050
OP	-0.290	0.497	-0.231	0.073	-0.174	1.000	-0.365	-0.277	-0.144
USBY	0.024	-0.153	0.069	-0.114	0.115	-0.365	1.000	-0.008	0.219
VIX	0.331	-0.723	0.012	-0.034	0.129	-0.277	-0.008	1.000	-0.061
WUI	0.093	-0.075	0.074	0.038	0.050	-0.144	0.219	-0.061	1.000

When Table 3 is examined, it is seen that the strongest relationship between the variables is between the Dow Jones index and the VIX index and there is a 72% negative relationship. The increase in the VIX index puts pressure on the US market. When this relationship is evaluated together with the previous table, it is seen that the Dow Jones index is affected by the VIX index, but the reflection of the reaction of the events on the VIX index to the stock market is more stable. Apart from this, it is seen that there is no relationship between the variables exceeding 50%. On the other hand, oil prices have a correlation of over 10% with all of the variables used in the study except gold prices. This shows that the selected global factors may have an impact on oil prices and are suitable for modeling. Before starting the modeling, the data were first made stationary to eliminate the existence of spurious relationships in the established models. To ensure stationarity, the ADF unit root test was used and is presented in Table 4.

Table 4. ADF Unit Root Test Results

	With Constant		**With Constant & Trend**		**Without Constant & Trend**	
	t-Statistic	**Prob.**	**t-Statistic**	**Prob.**	**t-Statistic**	**Prob.**
DI	-13.6983	0.0000	-13.6568	0.0000	-13.6484	0.0000
DWJ	-14.6378	0.0000	-14.6118	0.0000	-14.1132	0.0000
GEPU	-10.9601	0.0000	-10.9328	0.0000	-10.8961	0.0000

GP	-14.0733	0.0000	-14.0306	0.0000	-14.0028	0.0000
GRI	-18.0014	0.0000	-17.9779	0.0000	-18.0174	0.0000
OP	-11.0184	0.0000	-10.9843	0.0000	-11.0498	0.0000
USBY	-11.9564	0.0000	-11.9204	0.0000	-11.8122	0.0000
VIX	-17.1294	0.0000	-17.0775	0.0000	-17.1694	0.0000
WUI	-13.2912	0.0000	-13.2499	0.0000	-13.3304	0.0000

In Table 4, according to the ADF unit root test results, which take into account the constant, constant-trend and without constant-trend approaches of the variables used in the study, it is seen that all variables are significant and stationary at 1% level value. In order to prevent biased and deviated estimates, the models established must be appropriate in terms of heteroscedasticity and autocorrelation, as well as the stationarity of the data. For this reason, the 5 models explained in the methodology section were estimated using the EKK method. Then, the compatibility of the models with the basic assumptions was tested with the Breusch-Godfrey autocorrelation test and the White heteroscedasticity test and is shown in Table 5.

Table 5. Autocorrelation and Heteroscedasticity Tests

	Breusch-Godfrey	**White**
Model1	4.6500**	6.3157*
Model2	4.4137**	3.9193*
Model3	4.9914*	4.4957*
Model4	4.6695**	4.8542*
Model5	4.7343**	2.3247*

Note: ** and ** indicate 1% and 5% significance, respectively.*

In Table 5, the models established for the study were examined with the Breusch-Godfrey autocorrelation test and White heteroskedasticity test. It was observed that there were both autocorrelation and heteroscedasticity problems in all established models. Estimations made with Least Squares may reveal spurious relationships. For this reason, Hansen's (1982) GMM method was used, which does not require assumptions about the distribution of error terms and can provide effective results in case of autocorrelation. In addition, all models were estimated by simultaneously running the Newey and West (1987) process, which increases efficiency in the presence of autocorrelation and heteroskedasticity problems, and are presented in Table 6.

Table 6. Oil Prices and Global Factors Relationship Models Prediction Results with GMM Method

Whole Period					
	Model1	**Model2**	**Model3**	**Model4**	**Model5**
c	-0.000727	-0.000399	-0.000707	-0.000736	-0.000389
DI	-0.652535	-0.629516	-0.605902	-0.628727	-0.561337
DWJ	3.065790*	2.808997*	3.037163*	3.042495*	2.760308*
GP	-0.132861	-0.044764	-0.104317	-0.117748	-0.002795
USBY	-0.003034***	-0.002976***	-0.002981**	-0.002972	-0.00286***
VIX	0.032921	0.023819	0.033014	0.031094	0.022341
GEPU		-0.108097**			-0.107755**
GRI			-0.027993		-0.028447
WUI				-0.024467	-0.021439
R^2	0.3450	0.3637	0,3469	0.3457	0.3663
Period excluding Covid19					
	Model1	**Model2**	**Model3**	**Model4**	**Model5**
c	-0.001493	-0.001000	-0.001463	-0.001424	-0.000917
DI	-0.894003**	-0.918475**	-0.870939**	-0.87374**	-0.87664**
DWJ	2.112083*	1.793956**	2.051673*	2.019678*	1.656476**
GP	0.224566	0.275011	0.229882	0.266423	0.316416
USBY	-0.000459	-0.000522	-0.000427	-0.000325	-0.000371
VIX	0.019233	0.012719	0.019797	0.013347	0.008226
GEPU		-0.084615**			-0.08312**
GRI			-0.026130		-0.026686
WUI				-0.049955	-0.043993
R^2	0.2531	0.2775	0.2556	0.2582	0.2842
Covid19 Period					
	Model1	**Model2**	**Model3**	**Model4**	**Model5**
c	0.002967	0.002965	0.002960	0.002195	0.002132
DI	-3.832792**	-3.833989**	-3.805017**	-4.45094**	-4.12528**
DWJ	4.534813**	4.537831**	4.537700**	5.425798**	5.373441**
GP	-1.671782	-1.672429	-1.650539	-1.489667	-1.170869
USBY	-0.005990*	-0.005996**	-0.005974*	-0.006281*	-0.005740*
VIX	0.035730	0.035920	0.035496	0.072034	0.061182
GEPU		0.001752			-0.119694
GRI			-0.004766		-0.056121
WUI				0.276095	0.313246
R^2	0.7639	0.7639	0,7640	0.79	0.7937

Note: **,**,*** indicate significance of 1%, 5% and 10% respectively*

In Table 6, 5 different models were created to reveal the effect of global factors on oil prices, as explained in the methodology section, and this effect was examined by dividing it into 3 periods, taking into account Covid-19. While creating the models, variables measuring world riskiness such as the global economic policy uncertainty index, geopolitical risk index and world uncertainty index were added, and new models were created by adding these variables to the models both separately and collectively. Looking at the GMM results for the whole period, it is seen that there is a significant and positive relationship between the Dow Jones index and oil prices at 1% in all models. It is seen that US bond interest rates have a significant and negative relationship in 4 models. On the other hand, both models including the global economic policy uncertainty index appear to have a significant and negative effect at 5%. It has been determined that the explanatory power of all models established for the whole period is close to each other, and the explanatory powers of model 2 and model 5 are slightly better than the others. In the modeling made for the period excluding Covid19, the results were similar to the whole period, only the significant effect of the US bond interest rates, which was effective in the whole period, disappeared, instead a negative and significant effect of the dollar index emerged at 5%. In the analyzes conducted for the Covid 19 period, the global economic policy uncertainty index lost a significant relationship, unlike whole period models. In this period, the Dow Jones Index is positive and significant, the dollar index is negative and significant, and the US bond interest rates are negative and significant. When all models and periods were evaluated, no significant relationships were found between the VIX index, gold prices, geopolitical risk index, world uncertainty index and oil prices. It has been determined that there is a relationship between the Dow Jones Index and oil prices in all periods and models. It is seen that US bond interest rates had an effect during the Covid19 period, but when the Covid19 period was separated, this effect disappeared and was effective throughout the whole period.

Conclusion

In this study, the impact of global factors on oil prices between 2010 and 2023 was investigated. As global factors; global economic uncertainty index (GEPU), geopolitical risk index (GRI), world uncertainty index (WUI), VIX index, dollar index, Dow Jones index, US bond interest rates and gold prices were used. In research; A model without GEPU, GRI and WUI indices was created, 3 models were created by including these indices one by one, and 1 model was created by modeling all of these indices together, thus 5 different models were obtained.In addition, due to a major epidemic such as Covid19 during the study period; it is divided into 3 period as the whole period, the period excluding Covid19 and the Covid19 period. 5 different models were examined in terms of heteroskedasticity and autocorrelation using the OLS method, and all models were found to contain hypothetical problems.

To avoid biased and spurious relationships, GMM method was estimated simultaneously with the Newey-West process. As a result of the analysis, no significant effect of GRI, WUI, VIX and gold prices on oil prices was found as a result of 3 different periods and 5 different modeling. On the other hand, a significant and positive effect of the Dow Jones index was detected in all models and periods. US bond interest rates had a negative and significant effect, but this effect disappeared when the Covid19 period was excluded. It was determined that GEPU was negative and significant in the models it was included in, but lost its significance only during the Covid19 period. Finally, it was observed that the dollar index was negative and significant in both the Covid19 and excluding Covid19 periods, but the effect disappeared when the two periods were combined.

Although the Dow Jones index was dominated by industrial companies when it was first established, it now includes sectoral diversity. However, since this index consists of the largest companies in the USA, it provides information about the general course of the economy along with investor expectations. In addition, the companies in this index have a market value greater than many countries' stock markets, either alone or when several companies come together. For this reason, it is thought that the increase in the index positively affects the demand for oil and its prices by positively affecting the general economic course. It is seen that the negative effect of US bond interest rates has emerged and continues especially with Covid19. The production and supply chain, which was disrupted by Covid19, created an inflationary effect with the cheap credit support of the states, which increased the interest rates. Since US interest rates are the rates followed by the whole world, the increase here puts pressure on the markets and is thought to cause a decrease in oil prices. Before Covid19, such an interaction did not exist. The GEPU index, which was chosen to represent the uncertainty in economic policies, appears to be effective in the period when Covid19 was not present, but lost its effectiveness with Covid19. Although Covid19 has ceased to be a pandemic, its economic effects continue due to the situation it creates. Countries are still struggling to return to more normal economic processes. For this reason, GEPU is thought to have a negative effect on oil prices in normal economic periods. Finally, the negative effect of the dollar index, which shows the value of the dollar against important currencies, was determined. Since the dollar is a currency used in all world trade, it is thought that the increase in the dollar index has a cost-increasing effect for other countries and may have a demand-reducing effect for the USA, as its products are more expensive. This creates negative pressure on oil prices. In addition, since oil prices are determined in dollars, it may have a demand-reducing effect on other countries.

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