

Academic Studies in Social, Humanities and Administrative Sciences

Editorial Board

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Dr. Liza Alili Sulejmani, N. Macedonia
Dr. Sobia Hassan, Pakistan

Project Coordinator
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"En İyi
Akademi, Bir
Kitaplıktır."

Acedemic Studies in Social, Humanities and Administrative Sciences

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APPRECIATION

This e-book study, which is shaped according to today's social and economic problems, is the product of the valuable efforts of our productive academicians with whom we are happy to be together. In the book, there are headings about the political parties' approach to animal rights in elections, the use of artificial intelligence in management, the effects of unregistered employment on occupational health and safety, the provincial cost of migration, the analysis of the economic democracy index of municipalities in Turkey, the importance of lithium resources in the Chilean economy and green finance, environmental responsibility, clean energy and clean technology and the relationship among the environmental responsibility between energy and clean technologies.

We would like to thank all the authors who contributed to our book. It will be helpful for academicians in their future studies. We wish the reader enjoyable reading.

Best regards...

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THE APPROACH OF POLITICAL PARTIES TO ANIMAL RIGHTS IN JUNE 24, 2018 GENERAL ELECTIONS: COMPARATIVE ANALYSIS ON ELECTION MANIFESTOS

Tuba KALÇIK ÜSTÜNDAĞ¹

Introduction

In representative democracies, elections that provide the legitimacy of the authority to govern countries are also extremely important in terms of ensuring the right of individuals to have a say in the administration of the countries of which they are citizens. As Yavaşgel pointed out (2015), the administrators elected by taking the votes of the citizens in the democratic order have the right to speak on behalf of the electoral masses and to carry out various policies to defend their rights. The development and spread of representative democracies have led to the growth of competition in the political sphere as well. As stated by Türk (1996:554), parties constantly compete in the political arena by presenting different programs and policies to the voters within the framework of the views and ideals they propose, and the winner of this competition is determined through elections held at regular intervals. Political actors act by convincing voters that they will represent them in the best way within the framework of their promises and policies, while voters act by believing that the political actor will express and solve their wishes, demands, and expectations in the best way. While the famous political scientist Robert A. Dahl (1971:1) emphasized the necessity in representative democracies for the permanent sensitivity of the ruling cadres to the wants, demands, and expectations of the voters, Sartori (1976) underlined that to achieve this sensitivity, the ruling cadres need to keep their fingers on the pulse without turning a deaf ear to the voice of the people.

In the democratic system in which the most vote-getters are elected to govern, political actors act with an understanding close to competition in the commercial field, as Stokes states (1999:251), to get the votes of the voters to win this democratic race. They design the policies, actions, or practices that the voters want per their political plane and appear before the voters. Political actors who promise to realize the expectations and hopes of the voters for the future embody this at the written, verbal, visual, or discursive level (Arklan & Tanacı, 2020, p. 2). In democratic regimes, political actors who reflect the will of the voters to the will of the state have to produce promises and projects that will respond to their demands, expectations and hopes to get the approval they want from the voters to have the will of the state. In the electoral race, they prepare election manifestos to show these promises and projects to the voters and share them with them. Political actors who pledge their commitments to voters through these declarations aim to make themselves the center of attraction in the eyes of the voters by announcing the projects and promises they plan to carry out in many fields, from economy to culture, education to foreign policy.

Political parties are indispensable elements of the democratic order. Every political party wishes to come to power and enjoy its blessings. Today, it is said that parties and candidates are marketed just

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like a commodity or a service, that ideological differences have disappeared, and that party and candidate images have been made (Sarihan, Z. and Taşcıoğlu, R., 2022:87).

In this study, after considering the election declaration, which is one of the most essential elements of political marketing, the 'animal rights' policies of the parties were evaluated by using the content method over the election declarations on June 24, 2018.

Election Manifesto as an Element of Political Marketing:

The marketing method for commercial goods before the 2nd World War developed itself in the process and evolved into a system where people, ideas, or institutions could be marketed to the service area (Smith & Hirsst, 2001, p. 1058). The concept of 'political marketing' formed within this understanding has also emerged. Since it is the consumers who are in the central position in modern marketing, all marketing activities are carried out in this flow (Çatı and Aslan, 2003: 257). With the transfer of this logic to the political field, the role of the consumer has been assumed by the voters, and the producer position has been assumed by the political actors. In this context, the concept of political marketing is defined as all the activities carried out by political actors to ensure the suitability of the target voters at the fastest and lowest cost, to introduce themselves, and to make their differences from their competitors visible (Tan & Armutçu, 2020, p. 3). To reach voters by using all the elements of political marketing, political actors must first determine their demands, expectations and needs from the political field and carry out the selection process accordingly.

While modern marketing methods have been adapted to the political sphere, marketing mix elements such as product, promotion, distribution, and pricing have also been moved to this area (Bowler, Donsvn, and Fernandez, 1996:172). While the product in political marketing is the political actor's party, ideas, and himself, the campaign of political actors in the election process, the votes and services received from the voters are expressed as pricing; all the tools used to ensure that the political actor's discourse and promises reach the voters are seen as distribution. Promotion in political marketing is seen as a communication process in a wide network, such as campaigns, advertisements, and promotional activities (Tan & Armutçu, 2020, pp. 3-4). Since the elements of the political marketing mix are only voter-oriented activities, the positive effect of one element among themselves can also positively affect the other. In this context, by using these elements correctly in the election process of political actors, it can affect the perception, attitude, and voting style of the targeted constituency and ensure that this mass votes in the direction desired by the political actor (Divanoğlu, 2008, p. 106). In the political arena, where political marketing methods are becoming more effective day by day, voters who are in the position of political customers have to know requests, demands, and expectations from them and act accordingly. In other words, just as the customer stands at the center of all production and marketing activities, the voter stands at the same point in the political sphere (Çatı & Aslan, 2003, pp. 258-259).

To convince the voters who stand at the center of political marketing, to promote themselves, and to get maximum votes, political parties make promises on various issues per the expectations of the voters. The written document in which these promises are presented to the voter for a certain order and system is also called the election manifesto. In the election manifestos, which must be compatible with the ideology of the political actor (Beriş, 2011, p. 109), the most crucial point is that it is the product of the period in which it is located and that it is arranged in a form that meets the conditions, needs, and expectations of this period (Arklañ & Tanacı, 2020, p. 2).

Election manifestos, which date back to the 19th century in England, are detailed political documents prepared before the elections and in which political parties formally declare their proposals (Quinn, 2014). In a way, political actors make commitments to the voters through this document. Election manifestos, which are an important political marketing element today, as Tok points out

(2012: 264-265), contain the policies, objectives, and methods that parties will follow when they win the votes of the majority of the voters and come to power. Election declarations also have an important place in the relationship between voters and political parties, as they are a two-way contract (Terkan, 2010). In the election manifestos, which are an essential tool in terms of informing the electorate, it is vital for the persuasion process that the promises, projects, or solutions presented meet the expectations, wishes, and hopes of the citizens (Ertürk & Şeşen, 2017, p. 60). The election declarations, which will affect the election success in that direction the more they are in terms of meeting the expectations of the voters, are also an important reference in terms of interpreting the success levels of political actors in the following election periods (Polat et al., 2015, p. 297).

Animal Rights in the World and Turkey:

Animal rights, defined as providing the conditions for animals to continue their lives healthily, have been approached with the understanding that animals have a life like humans. It is argued that this right is an inherent right to them and that humans, who are more developed than animals, are obliged to protect them (Aksulu, 2013, p. 25). The first law on the protection of animal rights was enacted in England in 1822. Modern animal rights movements that have survived to the present day date back to the 1960s. In the current period, this situation is also reciprocated on legal grounds (Bekoff & Meaney, 2013). Since it restricts and reflects the behavior and beliefs of societies, animal rights need to make the identity and existence of animals a legal basis (Evans, 2010). In the current era, only 49 countries out of 193 countries have explicit provisions on animal rights and animal protection in their constitutions. Turkey is among these countries (Sinmez, 2022, p. 54).

In Turkey, animals are protected by law to ensure that animals can continue their lives in a healthy environment, to ensure that they behave well and properly, to protect them from torment, pain, or ill-treatment, in short, to protect them from situations where they will be harmed or victimized. The legal step in this regard is the Law on the Protection of Animal Rights No. 5199 in 2014, which was enacted by the AK Party government. 2 years after this law, the Enforcement Regulation on the Protection of Animals was enacted (Kırışık & Öztürk, 2021, p. 361). In Turkey, Animal Protection Law No. 5199 was adopted in 2004 to ensure that animals live comfortably and are treated well and appropriately, that animals are protected in the best way against pain, suffering, and torture, and that all kinds of victimization are prevented. Following this law, the Implementing Regulation on the Protection of Animals was enacted in 2006. With these regulations made in Turkey, the responsibility for stray dogs has been given to the municipalities. However, the current arrangements have been insufficient. A significant part of society, especially NGOs, continues to struggle for animal rights and expresses their demands to political actors in many areas, especially in social media, to bring legal regulations back to the agenda. In the run-up to the June 24, 2018, General Elections, most of the political parties or candidates who could not remain indifferent to the requests, demands, and expectations of the voters expressed this issue both verbally and in writing and explained their solution proposals and promises.

Methodology of the Research:

Under this title of the study, the subject, purpose and importance, scope, limitation, and method of the study are included.

The subject of the study:

Discourses and actions aimed at protecting animals and their rights are becoming increasingly common worldwide and in Turkey. Political parties could not remain indifferent to animal rights,

which started to be frequently brought up due to increased social awareness. In this study, in the June 24, 2018, General Parliamentary Elections, the parties that entered the parliament in the elections under the title of animal rights and the votes they received were examined by taking into consideration. Accordingly, the election manifestos of the AK Party, CHP, HDP, MHP, and İYİ Party, respectively, were analyzed comparatively based on animal rights.

Purpose and Importance of the Research:

The study aims to examine the election declarations of political parties prepared for June 24, 2018, General Elections in terms of animal rights and to reveal how the political parties entering the elections and the possible future government handle the issue of animal rights and what suggestions they offer on this. The research is essential in terms of presenting the policy of political parties on the subject in the face of the increasing demand for the protection of animal rights in today's world, where social sensitivity towards animal rights is increasing, comparing the declarations submitted by the parties to the voters in the elections on June 24, 2018, and revealing the difference of opinion between the parties.

Scope and Limitation of the Research

Within the scope of the study, the election declarations on June 24, 2018, and General Elections were taken as a basis. In the research, the declarations of the parties that were entitled to enter the parliament by getting the most votes in the elections were examined. Since the parties that entered the parliament and received the most votes were AK Party, CHP, HDP, MHP, and İYİ Party, respectively, the declarations of these parties were taken into consideration within the scope of the research.

Method of Research (Universe-Sample and Research Questions)

On June 24, 2018, in General Elections, the policies, projects, and promises of the AK Party, CHP, HDP, MHP, and İYİ Party regarding animal rights in the election manifestos they published during the election process were examined comparatively. In this context, the study was examined using the content analysis method, a qualitative research method. According to Neuman (2017:466), content analysis that refers to a message through materials such as words, meanings, pictures, symbols, and ideas that enable content transmission allows for an objective and systematic analysis (Taşvancıl & Aslan, 2001). With the content analysis method, the content of multiple texts can be compared and analyzed in line with the charts (Irak, 2022, p. 212). Within the scope of the study, to reveal the parties' views on animal rights, election declarations were examined by subjecting them to content analysis comparatively within the framework of their policies and promises for animal rights. The main arguments of the study are as follows:

Since the parties that are the subject of the research have ideological differences, this difference is also reflected in the political approach to animal rights.

The perspective of the parties that are the subject of the research on animal rights is also reflected in the promises in their election manifestos.

In the election manifestos that are the subject of the research, the parties did not include the issue of animal rights at the same level.

Research Findings and Comments:

The AK Party, which entered the elections as the ruling party, prepared a 360-page election manifesto for June 24, 2018, General Election under the name of 'Strong Parliament, Strong

Government, Strong Turkey-If Someone to Do, the AK Party Will Do It Again' (AK Party Election Manifesto, 2018). Touching on the issue of animal rights under the headings of 'What We Have Done' and 'What We Will Do', the AK Party discussed what it has done in the past and what it will do if it comes to power on pages 248-249 and 253 of its election manifesto. The CHP, Turkey's second-largest party, has prepared a 231-page election manifesto with the slogan "We Are Coming for the Nation" (CHP Election Manifesto, 2018). Under the heading 'A life-friendly to nature', the party described its view of animal rights on pages 224-225 of the declaration. The HDP's election manifesto, which was prepared with the slogan "We will change it", consists of 88 pages (HDP Election Manifesto, 2018). The party, which describes its view on animal rights by using the subtitle 'Animal rights exist!' in the declaration, included this on page 60 of its declaration. The MHP, which prepared a 131-page election manifesto with the slogan 'National Resurrection Holy Ascension', did not allocate space to the issue of animal rights. (MHP Election Manifesto, 2018). The election manifesto prepared by the İYİ Party under the name of 'Contract with Our Nation' consists of 134 pages (İYİ Party Election Manifesto, 2018). Under the heading 'animal rights', the party included its view on this issue on page 129 of the election manifesto.

Table 1: The Place of Animal Rights in Election Manifestos by Party

PARTIES	Declaration, Number of Pages	Number of pages devoted to animal rights	A separate heading for the topic of animal rights
AK PARTY	360 38.2%	3 42.8%	AVAILABLE
CHP	231 24.5%	2 28.5%	AVAILABLE
HDP	88 9.3%	1 14.3%	AVAILABLE
MHP	131 13.9%	0 0	N0
İYİ PARTY	134 14.1%	1 14.3%	AVAILABLE
TOTAL	944 100%	7 100%	-

As can be seen in Table 1, the AK Party was the party with the most voluminous declaration with 38.5% and 360 pages in terms of the total number of pages of the parties' election declarations, while the HDP was the party with the fewest pages with 88 pages and 13.9%.

In terms of the place allocated to animal rights in the election manifesto, the AK Party was the first party with a maximum of 42.8% and three pages, while the CHP was the second party to allocate space to this issue with a rate of 28.5%. The MHP, which is the fourth party in terms of vote share in the Assembly, did not give any space on the issue of animal rights. All parties except the MHP have also reserved space for animal rights as a topic.

Table 2: Animal Rights Policies and Promises in the Election Manifestos of Parties

Parties	Policy and Promises
AK Party	<ul style="list-style-type: none"> -We took care of stray animals; The Law on the Protection of Animals entered into force in 2004 to rehabilitate stray animals. To rehabilitate stray animals, we will continue to provide financial support to the municipalities to construct a shelter for stray animals and sterilization activities. - We have protected wildlife and strengthened its ecosystems: In our 81 wildlife development sites, we protect wild animals with their natural habitats. We have prepared action plans for 60 vulnerable species that have been identified as a priority from our endangered species. To protect and support wildlife, we will continue to work on the production of wild animals and their placement in nature. We will continue to establish wildlife rescue and rehabilitation centers for the treatment and rehabilitation of wild animals damaged in nature. We will complete action plans for 100 vulnerable species that have been identified as a priority from our endangered species.
CHP	<ul style="list-style-type: none"> -We will prevent the mistreatment of animals by enacting deterrent penal codes. -We will effectively protect damaged natural habitats and endangered species. -We will remove the legal obstacles preventing district municipalities in metropolitan cities from opening animal shelters. We will provide infrastructure services to private animal shelters free of charge and support all shelters to raise their qualifications.
HDP	<ul style="list-style-type: none"> -With an approach based on the right to life of all living things, we will enact the Animal Rights Law. -We will increase the penalties for crimes such as torture, ill-treatment, sexual assault, and killing against animals in a way that will be a deterrent. -We will abolish animal shelters that have turned into concentration camps.
MHP	Uncovered
İYİ Party	<ul style="list-style-type: none"> -We will adopt the text of the Declaration of the Rights of Animals published by UNESCO as state policy. While ensuring that wild animals live undisturbed in their natural habitats, we will take all kinds of precautions by conducting scientific studies on endangered animals. -In cooperation with NGOs and Local Governments, we will increase the number of animal shelters and improve the conditions of existing shelters, and meet the vaccination, food, shelter, and health needs of stray animals.

As can be seen in Table 2, the most prominent issues in the election manifestos of the parties that entered the parliament, except for the MHP, in terms of animal rights were shelters and the protection of wildlife. Unlike the others, since the AK Party is in the position of the ruling party, it announced its policies and actions towards animals to its voters with the title 'What have we done' in its election manifesto. Stating that it has put into effect its actions against stray animals and the Animal Rights Protection Law to protect them, the AK Party explained the projects it has implemented to protect wildlife and strengthen the ecosystem. Under the heading 'What will we do', the party announced that if they come to power again, they will build a nursing home for the rehabilitation of stray animals and they will give financial support to the municipalities for this. Secondly, the AK Party, which talked about its actions against wildlife, announced that they protect wildlife and strengthen the ecosystem, and for this purpose, they create wildlife development areas and prepare action plans for those who are in danger of extinction. The AK Party, which also included its promises on this issue, announced that it would carry out projects as a continuation of its actions to date. The most striking aspect of the AK Party's approach to animal rights is its statement that it will continue these policies steadily if they come to power. The AK Party, which approaches the issue of animal rights on the axis of stray animals and wildlife, has mentioned the law it has enacted to protect animal rights, but as a continuation of this, it has no promise of reorganizing criminal sanctions for animal rights violations. The AK Party, which has specifically included the issue of shelter in its election manifesto, has underlined that it has built 233 animal shelters with a capacity of 85,000 so far and that this will continue if elected (AK Party Election Manifesto, 2018: 248-253)

The CHP, which entered the parliament as the second party in terms of vote share, pointed out in its election manifesto that it would make legal arrangements for animal rights, unlike the AK Party, and promised to impose deterrent criminal sanctions on those who tender rights. The party, which announced that it would make moves to increase animal shelters, also announced that it would protect their natural habitats and endangered animals. The CHP did not include in its declaration what kind of policy it would follow regarding stray animals. (CHP Election Manifesto, 2018: 224-225)

The most different aspect of the HDP, which is the third party, in terms of animal rights is that, unlike the other three parties, it has announced that it will abolish animal shelters, which it describes as 'concentration camps'. Another noteworthy point is that the HDP has not made any promises for wildlife protection or endangered animals among its election promises. What stood out in the election manifesto was their promise that they would enact a law based on the right to life of all living things for animal rights. The HDP, like the CHP, has not announced what kind of policy it will follow toward stray animals (HDP Election Manifesto, 2018: 60).

The most striking promise of the İYİ Party towards animal rights was its announcement that it would adopt the UNESCO Declaration of Animal Rights, which is a universal text. In light of this text, the party also announced that it would make the necessary legal arrangements to protect animal rights. The İYİ Party, which announced that it would make moves to improve the current situation of animal shelters and stray animals, announced that it would work with non-governmental organizations on this issue, unlike other parties (İYİ Party Election Manifesto, 2018: 129).

Conclusion:

Depending on the development of democracy, political actors are entering the electoral race to get the legitimacy of the authority to govern. In this race, where most voters are convinced of their policies and promises, political actors resort to various methods to convince voters to vote for themselves. Election manifestos, which are a kind of contract between the voter and the political actor, are one of the most effective political marketing tools in today's political field. Their declarations, which are important documents in terms of reflecting the ideology of political parties, should also include the problems, expectations, demands, and hopes of the voters about the current conditions. Election manifestos, in which political actors present their promises, projects, and policies to the voters, have become an important tool used by every party, large or small, in today's political life. Within the scope of the study, the view of animal rights of the five parties that entered the Parliament on June 24, 2018, General Elections were examined by using the content analysis method mutually through the election declarations. When the election declarations of the AK Party, CHP, HDP, MHP, and İYİ Party are ranked according to their vote ratios, remarkable findings emerge when considered both in terms of the allocated place and the promises. In terms of the number of pages, the AK Party had the most voluminous election manifesto with 360 pages, while the HDP prepared the least page election manifesto with 88 pages. While the party that devoted the most space to programs and promises for animals was the AK Party with 3 pages and 42.8% of the votes, the MHP never included this issue in its election manifesto. Since it is the ruling party, it has explained its actions in the past period to the voters under the title 'What We Have Done'. With the 'What Will We Do' section, the party explained its election promises. In its election manifesto, which was prepared with the understanding that "what it has done is the guarantee of what it will do", the AK Party addressed two important points regarding animals; drew attention to the protection of stray animals and wildlife and the strengthening of the ecosystem. Underlining that they will further develop what they have done in the past if they come to power, the AK Party stated that it enacted the animal rights law in 2004, but did not make any promises to regulate criminal sanctions for the violation of animal rights as a continuation of this. The CHP, on the other hand, has promised to impose deterrent criminal sanctions

against animal rights if they are elected, unlike the AK Party. It is noteworthy that the CHP has not announced what kind of policy it will follow toward stray animals. The HDP, on the other hand, unlike the other three parties, likened the animal shelters to "concentration camps" and announced that they would abolish them. It is also noteworthy that the HDP did not make promises about stray animals and wildlife in its election manifesto. The MHP did not include its policies and promises on animal rights in its election manifesto. The İYİ Party, which is the fifth party in the parliament according to its vote share, has announced that it will pursue policies in the light of the UNESCO Declaration of Animal Rights, which is a universal text. In addition to the AK Party, the İYİ Party also made promises about stray animals in its election manifesto and announced that it would cooperate with municipalities as well as NGOs to improve shelters. In summary, four of the five parties that are eligible to enter the parliament have made various promises to voters for animal rights, whose awareness is increasing in the world and in Türkiye. The study argues that the AK Party, CHP, HDP, and İYİ Party have approached animal rights differently from both a promise and a political point of view because they are parties with different ideological tendencies. Another argument of the study, which is that the parties do not include the election declarations in equal proportions, is seen in the numerical ratios in Table 1. This study is important for political parties in terms of revealing the differences among themselves on animal rights and will be useful in terms of contributing to the policies and promises they will follow on animal rights in the next elections.

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ARTIFICIAL INTELLIGENCE STRATEGIES OF G20 COUNTRIES AND IMPLICATIONS FOR MANAGEMENT

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Abstract

This section comprehensively overviews the national Artificial Intelligence (AI) strategies of G20 countries. To understand each country's approach toward AI development, we reviewed the official documents and strategies released by the governments and relevant agencies. Our analysis covers critical aspects such as each country's strategy's main goals and objectives, focus areas, and objectives. We found that all G20 countries have recognized the potential of AI to drive economic growth and have developed strategies to support its development. However, each country's strategy's specific focus and priorities vary depending on factors such as the current level of development of their AI industry, the challenges and opportunities they face, and their overall national priorities. Common themes across G20 countries include investing in research and development, fostering a supportive ecosystem for AI startups and businesses, developing a skilled workforce, addressing ethical and societal concerns, and international cooperation. In this study, we focus on specific AI goals and objectives of G20 countries' strategy documents by making a content analysis. Our results highlight the importance of national AI strategies as a way for countries to leverage the potential of AI while addressing the associated challenges and risks and the need for international cooperation to share best practices, align efforts and mitigate the negative impacts.

Introduction

As a game-changer technology, artificial intelligence (AI) represents intelligent machines that can think and learn (Grewal, 2014). AI research claims that a machine can think like a human if the proper techniques are found (Sarker, 2022; Lake et al., 2017). This goal is still elusive, but AI has made significant progress recently. Today, AI systems are used in many fields, from medicine to finance to self-driving cars (Chen & Luca, 2021). These machines can be programmed to perform various business tasks, such as digital marketing, machine learning, decision-making, and digital business transformation (Ruiz-Real et al., 2021). AI, in this respect, is considered an essential enabler of business value (Sestino & de Mauro, 2022). Machine learning is a vital business technology that has driven progress in AI (Botvinick et al., 2019). Machine learning allows computers to find patterns and make predictions in data, which can be used to improve a wide range of business applications (Carney et al., 2020). AI is a rapidly evolving field with the potential to transform many aspects of our lives (Singh et al., 2019). It has the potential to improve healthcare, transportation, communication, and many other fields. AI can revolutionize how businesses operate and provide new opportunities for growth and efficiency (Garbuio & Lin, 2019; Makridakis, 2017; Ahmad et al., 2021; Dwivedi et al.,

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2021; Xu. and et al., 2018). Some of the key ways that AI can benefit businesses include: automating repetitive tasks(Spring et al., 2022), enhancing decision-making (Shrestha et al., 2019), personalizing customer experiences (Sidaoui et al., 2020), improving productivity(Marikyan et al., 2022), enhancing cybersecurity (Aliahmadi & Nozari, 2022), optimizing supply chain management (Modgil et al., 2022).

However, implementing AI in business also poses challenges, such as the need for trained workers, data privacy and security, regulation, and ethical considerations (Munoko et al., 2020). As a result, it is essential that businesses carefully evaluate the potential benefits and drawbacks of using AI and develop a strategy for its implementation that fits with their goals and priorities. There are reasonable concerns about the unethical misuse of AI by firms which can harm customers (Hermann, 2022). AI can lead to more significant problems like job displacement(Mutascu, 2021), bias and discrimination(Henman, 2020), lack of transparency (Schmidt et al., 2020), security risks (Rahman et al., 2022), and ethical concerns (Munoko et al., 2020).

The importance of this new technology has attracted the attention of policymakers. Governments try to develop macro-level strategies to catch the opportunities coming along with AI. In this respect, many countries have developed national AI strategies in recent years to establish a framework for developing and deploying AI technologies within their borders (Allen, 2019; Wong & Sabanayagam, 2020; Johnson, 2019). These strategies often aim to promote the AI industry's growth and address ethical and societal concerns related to technology. The goals and actions outlined in national AI strategies can vary widely between countries. However, these strategies have a central economic dimension that is strategic for management and organization knowledge.

This study tries to outline these focus areas by analyzing the content of the current AI strategies of G20 countries.

Literature

International policy documents

There is an international interest in AI, and policymakers are trying to design AI's potential impact on future economies. In this regard, several international organizations have discussed or released documents related to national AI strategies. The Organization for Economic Cooperation and Development (OECD) has published reports and guidelines on AI's ethical and societal implications, as well as a toolkit for policymakers to help them develop national AI strategies (OECD, 2022). The European Commission (EC) has released a strategy for a "Human-Centric AI," which includes a set of principles for the development and use of AI, as well as a series of actions to support the implementation of these principles (Helberger & Diakopoulos, 2022). The G20 has included discussions of AI in the agenda of its summits. It has issued several statements on the topic, including the "G20 AI Principles" endorsed by all G20 countries in 2019 (Jelinek et al., 2021). The principles cover issues such as transparency, accountability, and the responsible use of AI, as well as calls for international cooperation in the development of AI. The United Nations (UN) has also started to address AI in its agenda, particularly on AI for sustainable development and its ethical use (Fournier-Tombs, 2021). Also, the UN Secretary-General has established a High-level Panel on Digital Cooperation (HLPDC), which, among its tasks, has to examine the opportunities and challenges of AI and digital technologies for international cooperation (UN, 2019).

These organizations provide guidance and examples for countries to develop their strategies and serve as a platform for international cooperation and coordination on AI-related issues.

G20 Countries

The G20, or Group of Twenty, is a forum for governments, central bank governors from 19 countries, and the European Union (EU). The G20 was established in 1999 as a means for leaders from the world's largest economies to come together and discuss key economic and financial issues. (Cooper & Thakur, 2013). The G20 countries control around 85% of global GDP and 75% of global trade and represent two-thirds of the world's population (OECD, n.d.). The G20 plays a significant role in shaping global economic policy, and its member countries work together to promote growth and stability in the global economy. The G20 also works to address a range of other global issues, including climate change, financial regulation, anti-corruption, and development. Each year, the G20 holds a summit of leaders from member countries to discuss these and other issues. The G20 presidency rotates among the member countries, and the leaders meet annually, usually in a different country. The G20 leaders also usually discuss and agree on important statements and communicate outlining their positions and common goals. It is also worth noting that G20 also has different formats of engagement with stakeholders such as business, civil society, think tanks, academics, etc., to ensure the broader impact and diverse perspectives on the G20's agenda and initiatives (Cooper & Pouliot, 2015)

OECD AI Principles

OECD has undertaken an important mission of developing principles on how to use AI. Through analyzing the economic and social impacts of AI technologies and applications, OECD identified major policy considerations and provided roadmaps to all stakeholders in 2019. With the assistance of over 50 experts, OECD declared five value-based principles and five recommendations for policymakers regarding AI:

Table 1 OECD AI principles and recommendations

value-based principles	recommendations for policymakers
inclusive growth, sustainable development, and well-being	investing in AI research and development
human-centered values and fairness	fostering a digital ecosystem for AI
transparency and explainability	shaping an enabling policy environment for AI
robustness, security, and safety	building human capacity and preparing for labor market transformation
accountability	International cooperation for trustworthy AI

Resource: (OECD, 2022)

These principles and recommendations are important criteria for national strategies as well. In this study, we also illustrate how countries embrace these principles & recommendations in their strategies.

Method

We apply the content analysis method to portray the current situation of AI strategies in G20 countries. First, we count the occurrences of the words in national AI strategies to find out which words are used to describe AI strategies. Then, we point out the addressed OECD principles to compare country-level differentiation. Lastly, we will summarize each national strategic plan's covered relevant policy areas.

The atlas-ti qualitative analysis software program is used to count the occurrences of words in the AI strategy document's goals and objectives to determine the central positions of concepts.

Frequencies illustrate the centrality of the words, so we can understand the significance of some concepts in developing AI strategies. OECD has declared some principles & recommendations on AI strategies, which will be the second focus of our study. By providing national AI strategies' compliance levels with the OECD principles and recommendations, we will point out the diffusion among G20 countries.

Lastly, we will focus on the policy areas of individual strategy documents and speculate on the role of AI in different sectors.

Sample

Based on the above considerations, we have selected our sample as G20 countries, which is adequate to understand the AI strategies at the global level. All G20 countries have recently developed different national AI strategies. Table 2 summarizes the official national strategies of G20 countries and their publication dates:

Table 2 G20 Countries and Strategy Documents on AI

G20 Country	Published	Strategic Plan Document
Argentina	2019	Plan Nacional de IA Gobierno de Argentina - IALatam
Australia	2018	Australia's AI Action Plan
Brazil	2021	Inteligência Artificial — Português
Canada	2017	Pan-Canadian AI Strategy - CIFAR
China	2017	Next Generation AI Development Plan
France	2018	AI For Humanity
Germany	2018	Artificial Intelligence Strategy of the German Federal Government
India	2018	India's National Strategy for Artificial Intelligence
Indonesia	2020	Strategi nasional kecerdasan artifisial indonesia
Italy	2022	Artificial Intelligence Strategic Programme 2022-2024
Japan	2019	AI Strategy 2019 Governance Guidelines for Implementation of AI Principles
Mexico	2018	National Strategy for Artificial Intelligence: Toward AI World Leader beyond IT
South Korea	2020	Towards an AI Strategy in Mexico
Russia	2019	Decree of the President of the Russian Federation on the Development of Artificial Intelligence in the Russian Federation
Saudi Arabia	2020	Realizing Our Best Tomorrow
South Africa		Not yet released
Turkey	2021	National AI Strategy 2021-2025
United Kingdom	2021	National AI Strategy
United States	2019	National AI Initiative Act of 2020
European Union	2021	Coordinated Plan on Artificial Intelligence 2021 Review

Resource: (Vats & Natarajan, 2022)

Results

Our initial word count analysis of strategic objectives ends with the following results. As it can be understood from Graph 1, AI-related strategies are mostly associated with words, *data*, *research*, *development*, *objective*, *innovation*, and *ecosystem*. This initial result illustrates both the economic and social implications of AI.

While evaluating the national AI strategies, OECD gives criteria of whether principles and recommendations developed in 2019 (OECD, 2022) are addressed. Tables 3 and 4 illustrate that both are largely addressed in many G20 country AI strategy documents. China, France, Japan, South Korea, Turkey, the UK, and the USA have adopted all value-based principles in their documents. The most frequently addressed principles are appeared to be *inclusive growth*, *sustainable development*, *well-being*, and *human-centered values and fairness*. This is an important indicator that most strategies are aware of the sustainability issues and human dimensions as well as the economic & business impacts.

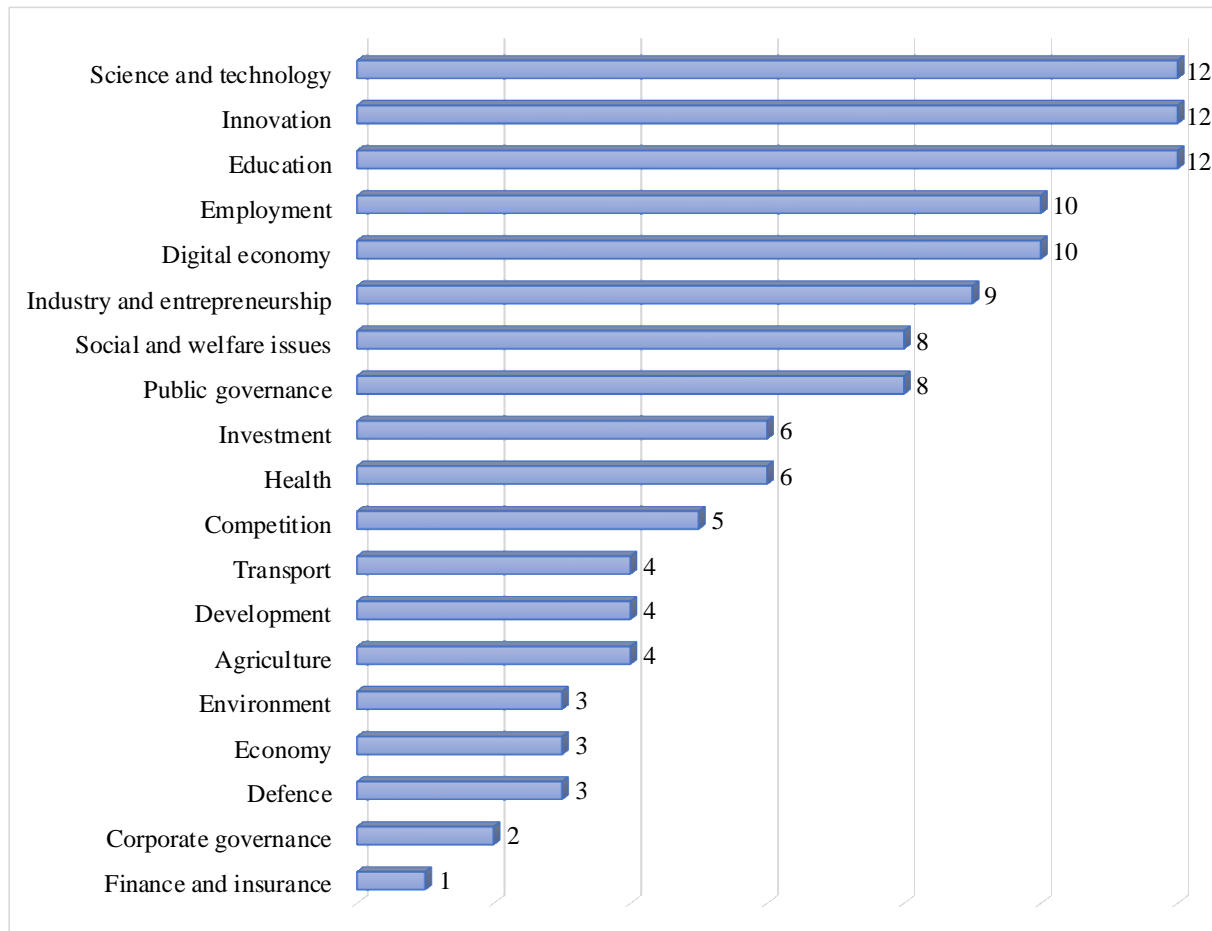
Table 4 Adaptation levels to OECD AI recommendations for policymakers in National Strategies

	Providing an enabling policy environment for AI	Investing in AI R&D	Fostering a digital ecosystem for AI	Building human capacity and preparing for labour market transition	International cooperation for trustworthy AI	% of the recommendations adopted
Argentina		X		X		40%
Australia	X	X	X			60%
Brazil	X	X	X	X	X	100%
Canada		X		X		40%
China			X	X		40%
France	X	X	X	X	X	100%
Germany	X		X	X	X	80%
India		X		X		40%
Indonesia	X	X	X	X	X	100%
Italy		X	X	X		60%
Japan		X		X	X	60%
Mexico			X			20%
South Korea	X	X	X	X	X	100%
Russia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Saudi Arabia		X	X	X		60%
South Africa						0%
Turkey	X	X	X	X	X	100%
United Kingdom	X	X	X	X	X	100%
United States	X	X	X	X	X	100%

The results are similar for recommendations for policymakers as well. Brazil, France, Indonesia, South Korea, Turkey, the UK, and the USA have addressed all dimensions. All dimensions are highly mentioned in national strategies. This implies that G20 countries are aware of the need to invest in AI R&D and develop ecosystems supporting AI. Labor market improvements are also essential to meet the professional human capacity in AI-related jobs.

Regarding public policies, OECD has also categorized strategies on whether they have objectives covering 20 policy areas. As summarized in Graph 2 most referenced policy areas are science & technology, innovation, education, employment, digital economy, industry, and entrepreneurship. This illustrates that most G20 countries acknowledge the potential of AI technologies and applications as an economic value. It is a source of innovation, a key concept in creating a competitive advantage for firms and nations (Danneels, 2002). Moreover, it is also associated with employment and entrepreneurship, implying that G20 is aware of the potential AI contributions to the labor market and startups.

In addition to the business dimension, AI is central to public governance and societal issues like welfare and education. This indicates that G20 countries also expect to use AI tools in developing public strategies. Although addressed by only some countries, topics like environment, transportation, agriculture, corporate governance, and finance are also mentioned. This shows that AI has an extended position in economic and social contexts.



Graph 2 # of countries that have addressed the relevant policy areas

Discussion

When the content of the national strategy documents is analyzed, some common themes are evident:

- It is investing in research and development to advance state of the art in AI. This can include funding for universities and research institutions and programs to encourage collaboration between academia and industry.
- It is fostering a supportive ecosystem for AI startups and businesses. This can include initiatives to promote entrepreneurship, provide funding and other forms of support for companies, and attract global talent to the country.
- It is developing a skilled workforce to support the growth of the AI industry. This can include initiatives to train workers in AI-related skills and programs to encourage the study of computer science and related fields.
- They are addressing ethical and societal concerns related to AI. This can include the development of guidelines and regulations for the use of AI, as well as initiatives to promote transparency and accountability in the development and deployment of AI systems.
- International cooperation for sharing the development and benefits of AI to build more ethical and beneficial AI for humanity

There are important implications of our results at both business and country levels. At the country level, G20 policymakers acknowledge the significance of AI for the success of nations in the future.

Economic, social, and environmental problems faced today would require more complex solutions in the future. AI has significant potential here to provide innovative, technology-based solutions. For example, AI can improve energy efficiency, reduce waste, and monitor and predict the effects of climate change. AI is also advantageous for analyzing big data to identify patterns and insights that can inform decisions related to social and economic issues, such as poverty and inequality. Additionally, AI-powered automation can help increase productivity and economic growth while addressing unemployment-related issues.

Technology is claimed to be an important factor affecting the firm performance (Uzkurt et al., 2023). We claim that AI will be a central competency in future business based on these results. As an important core competency (Barney, 1991; Prahalad & Hamel, 1990), companies that can better adapt to AI technologies and applications would be better off their rivals. AI will be an important source of competitive advantage. AI can analyze large amounts of data to identify trends and patterns that can inform business strategy and decision-making.

Additionally, using AI can help companies create new products and services and improve the customer experience. It is important to note that the benefits of AI are not limited to technology and data-driven firms. However, all companies can leverage AI to gain a competitive advantage by identifying new opportunities, improving efficiency and effectiveness, and reducing costs. Also, it is worth mentioning that adopting AI is becoming common practice for firms, and not having it will put companies in a disadvantageous position.

It is also important to note that AI can create new problems if not used responsibly and ethically. When misused, AI can be used to make decisions that discriminate against certain groups of people, such as those based on race, gender, age, or other protected characteristics. It can also lead to collecting and analyzing personal data without the knowledge or consent of the individuals involved, violating privacy laws and regulations. AI can also be used to manipulate, exploit and deceive customers (Hermann, 2022) if not monitored properly. It is crucial for firms to be aware of these potential misuses of AI and to implement proper governance, regulations, and ethical considerations to avoid them. Additionally, governments and regulators must put in place laws and policies that prevent these misuses and ensure that companies are held accountable for any misuse of AI.

Conclusion

In conclusion, the analysis of G20 countries' national AI strategies provides insight into the various approaches governments are taking to support the development and deployment of AI. The official documents and strategies review reveals that all G20 countries have recognized the potential of AI to drive economic growth and have developed strategies to support its development. However, each country's strategy has a different focus and priorities, depending on factors such as the current level of development of their AI industry, the specific challenges and opportunities they face, and their overall national priorities.

Common themes across G20 countries include investing in research and development, fostering a supportive ecosystem for AI startups and businesses, developing a skilled workforce, addressing ethical and societal concerns, and international cooperation. These common themes suggest that countries are aware of the same challenges and opportunities related to AI. By implementing these actions, countries aim to promote the AI industry's growth and address ethical and societal concerns related to technology.

Overall, national AI strategies play an important role in promoting the responsible and sustainable development of AI, providing a framework for developing and deploying AI technologies within each country. However, further international cooperation is necessary to share best practices, align efforts,

and mitigate the negative impacts of AI. Such cooperation can be facilitated through platforms such as the G20, OECD, and the United Nations, which provide guidance and examples for countries to develop their strategies and also serve as a platform for international cooperation and coordination on AI-related issues. It is also important to note that AI is expected to be an important source of competitive advantage for firms. AI has the potential to directly/indirectly affect the way of doing business in the future. More studies in this respect are needed to portray the role of AI in strategic management. Our study is limited to G20 countries; future studies focusing on other developing, under-developed economies would also enrich our understanding of AI's potential impact on the rest of the world. Another important limitation is that we only analyzed the AI goals and objectives in national strategy documents. However, our knowledge needs to be broadened on how these strategies are applied in practice and what kind of difficulties are faced. This could be an important future research topic.

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THE EFFECTS OF INFORMAL EMPLOYMENT IN TERMS OF OCCUPATIONAL HEALTH AND SAFETY

Tufan ÖZTÜRK¹

Abstract

There are studies on informal employment and its effects in Turkey. However, there are no specific studies on the reflection and effects of informal employment on occupational safety applications. However, the adverse effects of informal employment on occupational health and safety are increasing every day. Therefore, this study aims to identify the effects of informal employment on the state, employer, and employee in terms of occupational health and safety, raise attention among the public for the harmful effects of informal employment on occupational safety and increase awareness about this subject. It is believed that this study will contribute to the literature. This study adopts the expert view method. The results of this study provide recommendations for various public institutions and organizations, researchers, employers, employees and their families.

Keywords: *Occupational Health and Safety, Informal Employment, Social Policy*

INTRODUCTION

Informal employment is when officials are either entirely or partially uninformed about the income received in exchange for either working hours or a working period (SGK, 2023a). Informal employment is widespread worldwide, including in Turkey (Fidan & Sami, 2013, p. 139). Social, economic, and other structural dynamics influence the rise of informal employment (Karaca & Kaleli, 2019, pp. 769–792; Korkmaz, 2003, pp. 51–96).

Informal employment has several impacts on the state, employer, and employee. There are significant studies on those impacts in Turkey (Sarılı, 2002, pp. 32–50; Göktaş, 2007; İpek, 2014, pp. 163–186; Yandık, 2017; Yıldız & Yıldız, 2017, pp. 30–46; Çiftçi, 2018, pp. 1–17; Dam et al., 2018, pp. 293–318; Kutbay, 2018, pp. 172–189).

Sarılı (2002) highlights the reasons for informal employment, how to measure it, how it affects financial activities and measures to prevent it. Goktas (2007) discusses the negative impacts of informal employment on Social Security Systems. Ipek (2014) emphasizes the adverse effect of informal employment on disadvantaged groups. Yandik (2017) studies the negative impact of informal employment on the tax system. Yildiz and Yildiz (2017) focus on informally employed Syrians' positive and negative influence on the Turkish economy. Ciftci (2018) claims that informal employment has adversely impacted financial growth and the proper use of resources. Dam et al. (2018) determine that unemployment boosts informal employment. Kutbay (2018) emphasizes that informal employment decreases the state budget.

Informal employment directly or indirectly impacts the state, employer, and employee regarding occupational safety. For instance, informal employment causes tax loss to the government, which

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negatively affects the budget for occupational safety applications. Informal employment helps cut down on employee expenditure, and thus it may seem highly profitable to the employer. However, the employer suffers from severe tangible and intangible loss when an informal employee experiences a work accident or when there is a legal procedure concerning the task performed by the informal employee. Employees may opt for informal employment for temporary reasons, such as contributing to the family budget through some extra income. Yet, they are deprived of their social security rights and thus suffer from tangible and intangible losses for their future, which will lead to various issues for all parties, in the long run. Nevertheless, no literature study focuses on the reflection and impact of informal employment on these three in terms of occupational safety.

This study aims to analyze how problems in occupational health and safety applications due to informal employment affect the state, employers and employees and raise public awareness of the negative impacts of informal employment.

This study is estimated to put forward the negative impacts of informal employment on occupational health and safety, raise public awareness in the fight against informal employment, and motivate public officials, researchers, employers, employees, and families. Therefore, the study is expected to offer a fresh approach to literature.

The first chapter of the study introduces the Turkish social security system, overall practices of occupational health and safety, work accidents and occupational diseases, and the concept of recourse lawsuits. The second chapter presents a graphical interpretation of informal employment in different years and sectors. The third chapter focuses on the impact of informal employment on the state, employer, employee, and their relatives regarding occupational health and safety. The fourth chapter presents the opinion of social security experts, occupational security experts, employers, and employees on the topic. The final chapter is reserved for various public institutions, researchers, employers, employees, and their families.

Social Security System

The social security system protects against financial and social problems due to work accidents, occupational disease, disability, ageing, disease, child labor, old age, or even death (Güvercin, 2004, p. 89). Countries have Social Security Systems charge individuals while actively working by reserving a certain amount of their salary for social security so that these savings can offer some security to the individuals when the time comes. The longer the individual stays in the system and pays for the system, the more considerable benefit he will have.

Occupational Health and Safety Practices

Occupational health and safety practices are needed to protect employees from work-related risks. Thus, the state, employer, and employee have liabilities and obligations. The state's primary responsibility is to design regulations and conduct inspections, ensuring the regulations are followed. After Act No. 6331 on Occupational Health and Safety was issued on June 30, 2012, in the Official Gazette, several regulations were designed, and inspections were carried out. The employer's primary responsibility is to ensure the employee's safety through all kinds of measures. Accordingly, the employer offers occupational health and security service, depending on the risk class of the workplace and the number of employees. However, the employee must carry out his work by complying with health and safety terms.

Work accident

Act No 5510 Social Insurances and General Health Insurance defines a *work accident* as "an incident that occurs when the insurance holder is at the workplace due to work carried out by the employer or by the insurance holder if he/she is working on behalf of own name and account, or when an insurance holder working under an employer is not carrying out his/her main work due to being sent on duty to another place out of the workplace, or during the time allocated for nursing to a nursing female insurance holder as per labor legislation, during insurance holder's commuting to the workplace, on a vehicle provided by the employer, and that causes, immediate or delayed, physical or mental handicap in the insurance holder." Act No 6331 Occupational Health and Security defines as "any occurrence taking place at the workplace or due to the performance of work which leads to death or physical or mental impairment to the physical integrity of the victim".

Occupational Disease

Act No 5510 Social Insurances and General Health Insurance defines *occupational disease* as "a temporary or permanent state of physical or mental handicap, caused by a reason reiterated due to the operational terms or quality of the work made or worked by the insurance holder or by the working conditions." Act No 6331 Occupational Health and Security defines it as "a disease caused by exposure to occupational risks."

Recourse Lawsuits

Recourse refers to a claim for partial or complete fulfilment from another party or institution due to someone else's unfair act or action upon the execution of his own or someone else's debt (Kılıçoğlu, 1974, p. 395; Nomer, 1997, p. 248).

Informal Employment by Sectors and Years in Turkey

Figure 1 illustrates data on the transformation of informal employment by sectors and years in Turkey.

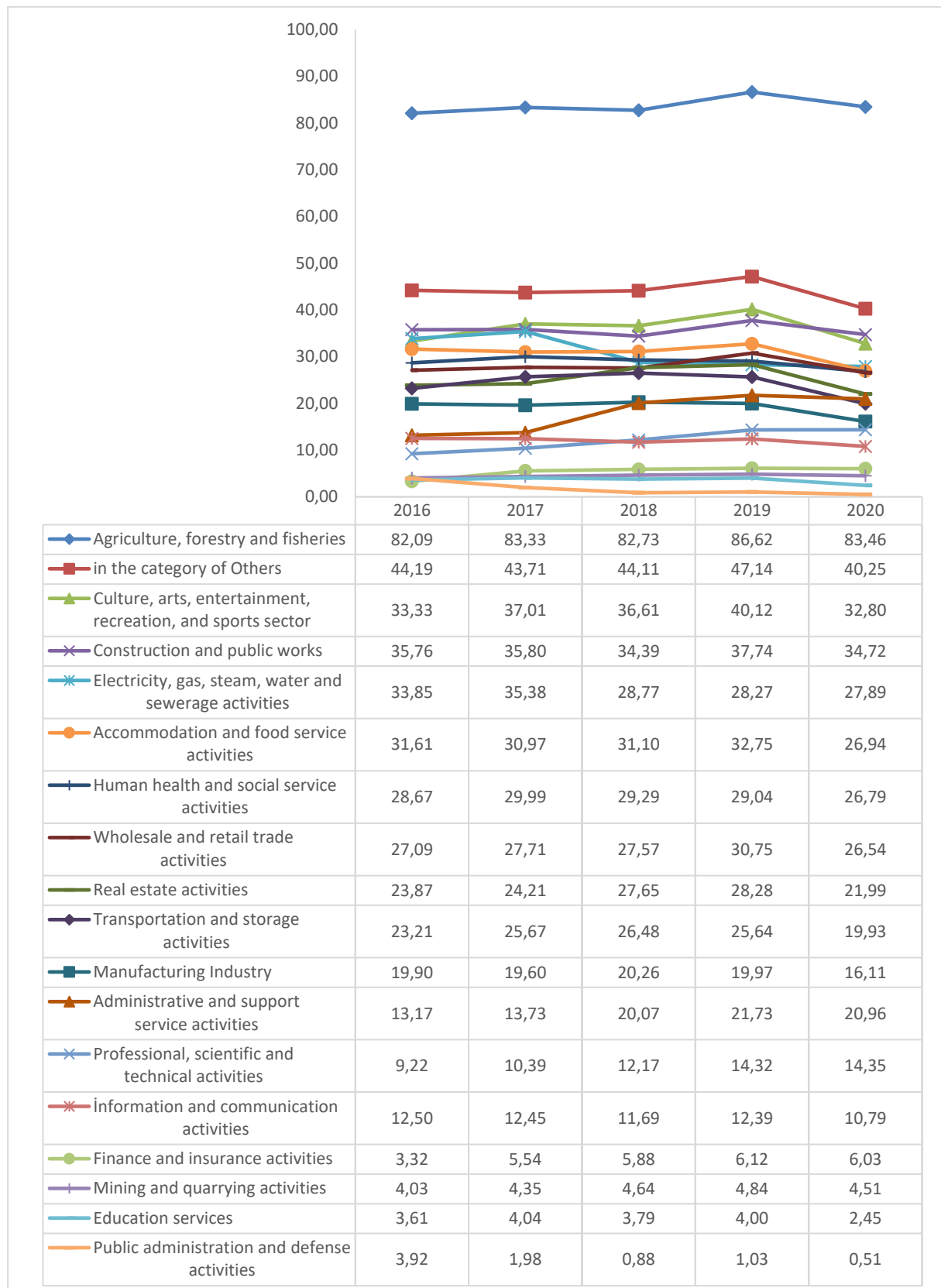


Figure 1. The 5-Year Change in Informal Employment Data in Turkey by Sectors and Years
(SGK, 2023b)

An analysis of Figure 1 reveals that the informal employment rate from 2016 to 2020 in Turkey was 85% in agriculture, forestry and fisheries; 44% in the category of Others, 36% in culture, arts, entertainment, recreation, and sports sector, 36% in construction and public works, 30% in electricity, gas, steam, water and sewerage activities, 30% in accommodation and food service activities, 28% in human health and social service activities, 27% in wholesale and retail trade activities, 25% in real estate activities, 24% in transportation and storage activities, 19% in Manufacturing Industry, 18% in administrative and support service activities, 12% in professional, scientific and technical activities, 12% in information and communication activities, 5.5% in finance and insurance activities, 4.5% in mining and quarrying activities, 3.5% in education services, and 1.5% in public administration and defence activities. Notably, the informal employment rate is significant in agriculture, forestry, and fisheries. An analysis of the yearly transformation in informal employment points to a considerable rise in administrative and support service activities as well as in professional, scientific, and technical activities. However, there is a severe decline in informal employment for electricity, gas, steam, water, sewerage, public administration, and defence activities.

Like the rest of the world, informal employment also leads to specific problems in Turkey. A literature analysis on the topic reveals that no study focuses on the relationship between informal employment and occupational health and safety. Within this scope, adverse outcomes of informal employment on “state,” “employer,” and “employee and employees’ relatives” are studied qualitatively in terms of occupational health and safety.

Its Impact on The State

Tax and social security premiums, calculated based on the wages the employees are entitled to have, can be neither fully nor partially accrued by the state when informal employment takes place, leading to a loss of income for the state (Schneider & Enste, 2002, p. 1; Güloğlu et al., 2003, p. 53). Furthermore, employees cannot benefit from the financial aid offered to those suffering from a work accident or occupational disease when they are informally employed, causing a financial burden not just on the state budget but also on all citizens (Karaca & Kaleli, 2019, p. 771).

Informal employment also makes it impossible for the states to have accurate data on employment rates. Due to informal employment, the state's periodical reports published for or sent to international organizations do not reflect accurate information on employment, unemployment, work accidents, and occupational disease (Temiz, 2004). Due to such statistical errors caused by informal employment, the state loses prestige and is incapable of accurate budget planning, adversely affecting occupational health and safety planning and practices.

Those who do not have the papers to document the minimum education requirements for the position also prefer informal employment. Consequently, it is assumed that some work accidents and occupational diseases might occur due to a lack of training and proper education in informal employees.

Its Impact on the Employer

Forensic units determine the rate of fault and negligence when a work accident or occupational disease occurs. In the case of informal employment, this rate is almost the highest for the employer. Thus, legal and administrative sanctions on the employer are more significant when a work accident or occupational disease occurs during informal employment. Depending on the degree of loss and damage, the employer may face a prison sentence, pay high compensations or administrative fines, and deal with recourse lawsuits in addition to closing the workplace and ending the operations.

Since data on formal employees are used for calculating such incentives as OHS, employers with informal employment are not eligible to benefit from these incentives. Even if they can somehow benefit from the incentives, they are asked to pay them back with legal interest when the informal employment is unveiled. In that case, those employers cannot benefit from this incentive for the next three years. Employers also face an administrative fine when there is a sign of informal employment during inspections.

Even years later, there is still a chance that an informal employee may claim that he has not been offered proper working conditions and thus is now suffering from various occupational diseases. For formal employees, it is easy to prove or disprove the claimant's statements since such records as medical surveillance, workplace environment measurements, and personal exposure measurement are accessible through the archives of the workplace or the institution, in addition to personal medical records. However, the employer cannot prove that the working conditions were compatible even through official records in the case of informal employment.

Employers practising informal employment may save on labor costs, reduce their production costs in the short-run, pave the way for unfair competition and thus adversely affect all employers. Furthermore, such employers are not considered eligible for grants, credits or tax deductions offered by public and private institutions (SGK, 2023a).

When work accidents occur due to informal employees who do not fulfil minimum education and training requirements, such accidents also damage the other employees and the machinery and equipment in the workplace.

Its Impact on Employees and Employees' Relatives

When the employee's premium code is registered with a lower occupational code, he benefits less from the social security system in case of possible work accidents, occupational disease, loss, and damages.

The number of employees at the workplace is taken into consideration to establish the vital OHS boards at the workplace. As a result, informal employment negatively affects the number of board members and the board's organizational structure.

Premium payments for informal employees are not paid at all or partially, making it impossible for the employee to fully benefit from the actual number of working days for retirement calculations.

When a work accident or occupational disease occurs, neither informal employees nor their relatives can easily benefit from the income for either temporary or permanent incapacity, widow's pension, or disablement pension in case of death or injury. In addition to a lack of annual, weekly, or maternity leaves, they are also vulnerable when receiving severance and notice pay and unemployment insurance in case of unemployment (SGK, 2023a).

LIMITATIONS

SGK (Social Security Institution) data is used to create data on informal employment. Nevertheless, informal employment data is limited to the number of cases detected by SGK in the field. The impact of informal employment on parties, from the aspect of occupational health and safety, is the primary concern of this study, concentrating on a particular issue.

CONCLUSION AND SUGGESTIONS

Informal employment has some direct and indirect impact on the state, the employer, the employee, and the employee's relatives, in terms of occupational health and security. Informal employment has been changing yearly in different sectors. It is seen that it has been increasing in some sectors while decreasing in others. This finding is consistent with the findings of Şenel & Öcal (2021). It is understood that informal employment has a negative impact on occupational health and safety practices and there is a need for a deeper analysis on a sectoral basis.

Within that scope, when informal employment is studied from the aspect of occupational health and safety, the ones suffering most – the state, the employer, and the employee- should be considered. The state suffers from income loss due to informal employment, which indirectly impacts the living standards of all citizens negatively. Therefore, it is recommended that all citizens are highly aware of informal employment and report suspicious incidents to ALO 170. Employers and their representatives must be provided with training on the damages of informal employment, and leaflets must be handed out so that the employer does not face legal and administrative sanctions and can satisfactorily benefit from grants, incentives and credits. Formal employees cannot fully benefit from OHS practices and OHS budgets due to informal employees. Furthermore, some informal employers may face inhumane practices. Therefore, formal employees are advised to report informal employment practices in their organization to ALO 170. The employees should regularly check their occupational codes in their insurance statements through the e-Devlet (electronic government) system and compare if they comply with the work they conduct in the workplace. Moreover, they should also check the number of working days with the registered number of working days. In case of any incompliance, they should report it to the employer.

When employers recruit properly educated staff for a position and the employees cannot meet the minimum educational requirement, the employer should provide the training.

It is clear that informal employment negatively affects occupational health and safety and there needs to be a deeper analysis on a sectoral basis. As a result, it is advised for future research to concentrate on the impact of informal employment on occupational health and safety on a sectoral basis.

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THE PROVINCIAL COSTS OF MIGRATION IN TURKEY¹

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Maya MOALLA³

Introduction

Migration, which is an essential component of population growth, has effects on both the country of origin and the hosting country. The extent to which migration affects the economy of the hosting countries can be determined by analyzing its short and long-run impact on employment, wages, and per capita impact on taxes and expenditures. Higher short-run liabilities may incur if the migrants initially spend less than they receive in public services, especially in the provinces that receive top-heavy shares of them. The net fiscal effect of migrants equals the difference between the taxes they pay to public finances and the government expenditures on public uses and services they receive. As well migration also influences many natives' fiscal equation, at least indirectly through capital and labor markets (Addison & Worswick, 2002; Blanch flower et al., 2007; Dustmann et al., 2008; Manacorda et al., 2006; Gott & Johnston, 2002; Ottaviano & Peri, 2006; Borjas, 2003; Lach, 2007; Cortes, 2008; Stahl, 1989; Ruhs et al., 2018; Borjas, 1994; Card, 2001 and Altonji & Card, 1991). In turn, natives' returns stemming from benefiting from high-skill migrants such as innovators or entrepreneurs should be considered since their indirect influences on properties, sales, taxes, and per capita costs (Dustmann et al., 2003; Chiswick & Miller, 2002 and Borjas, 1994). It is essential to differentiate migrants by their characteristics such as age and education as well as their success in assimilating economically and socially, family composition, health status, fertility patterns, place of destination, the business cycle, their impact on labor and other markets, their accessibility standards, the utility of government services and whether their replacement is temporary, permanent, or circular; to accurately measure the difference between their costs and returns. Regarding the country of origin, the migration of highly skilled people (brain drain) has long been viewed as detrimental. Indeed, since the imperfect substitutability between qualified and unqualified workers, the brain drain is perceived as a negative externality in the country of origin.

However, several articles investigating the extent to which migration affects human capital formation have disputed this vision. The argument is that there is a risk of a low return on capital in low-income economies with insufficient capacity for growth. This leads to a restricted incentive to obtain the education that drives economic growth. In general, education is valued around the world. Therefore, permitting migration upsurges the proportion of the educated populace under the condition of heterogeneous workers and when no more than the most qualified inhabitants migrate, the average educational attainment of the rest populace will rise (Mountford, 1997; Docquier & Rapoport, 1997). In this research, we attempt to evaluate the impact of migration by investigating Turkish welfare loss or gains associated with it, especially after the significant influx of migrants and the related congestion externalities. We use statistics on annual migration flows to/from Turkey produced by the Turkish

¹ This work had been presented as an oral presentation at the Eighth International Conference on Economics (IceTea2022) of the Turkish Economic Association held at Cappadocia University, Nevşehir, Turkey, on 1-4 September 2022.

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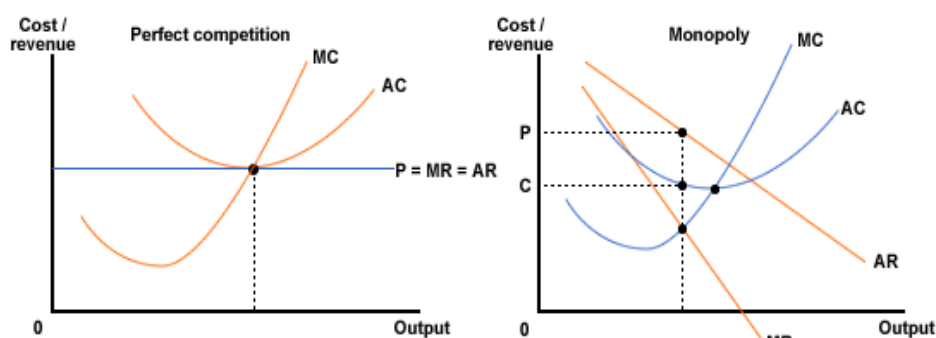
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Statistical Institute via the administrative documents of citizens of the Republic of Turkey and foreigners. As far as we are aware, there are few studies in the literature dealing with provincial migration in Turkey despite the fact that Turkey has been one of the most influenced countries by migration through diverse types of massive migratory movements and refugee flows (Hecker, 2006). Thus, this study is expected to contribute to the literature by providing an up-to-date investigation of the provincial migration costs in Turkey. This work is made up of four sections. The first section includes the introductory part in which the impact of migration has been summarized. In the second section, the theoretical background has been structured. The third section includes data and methodology and explains Migration Trends in Turkish provinces. The fourth section is about evaluating the results and conclusion.

Theoretical Background:

Demographics, which is the science that examines the size, structure, and geographical distribution of the population and their change over time, as well as the processes of fertility, death, marriage, divorce, and social mobility, is the basis of economics. Individuals evaluate the phenomena they experience at different levels and measures. This is due to the different preferences of individuals to maximize their interests and to the differences in measurement and evaluation methods. Economists generally make profit decisions at the margin; that is, where the marginal cost is the same as the marginal revenue, equilibrium can be achieved. In a perfectly competitive market, equilibrium is achieved when the marginal cost curve crosses the bottom of the average cost curve. At this point, marginal cost = marginal revenue = price = average cost ($MC = MR = P = AC$). In short, the price paid by one party should equal the cost paid by the other party. Thus, there is no dispute between the parties. Unlike the perfect competition market, in monopoly markets, the price is higher than the marginal costs ($P > MC$). In a monopoly market, $MC = MR$ in the short run, and MC satisfies the ascending condition in both markets, and even though $demand = P = AC$, $AR > AC$ or $TR > TC$ then $AC < P$. As there is no correlation between production and price, there is no supply curve for a monopolist. Moreover, under a monopoly, the demand curve takes on several shapes.

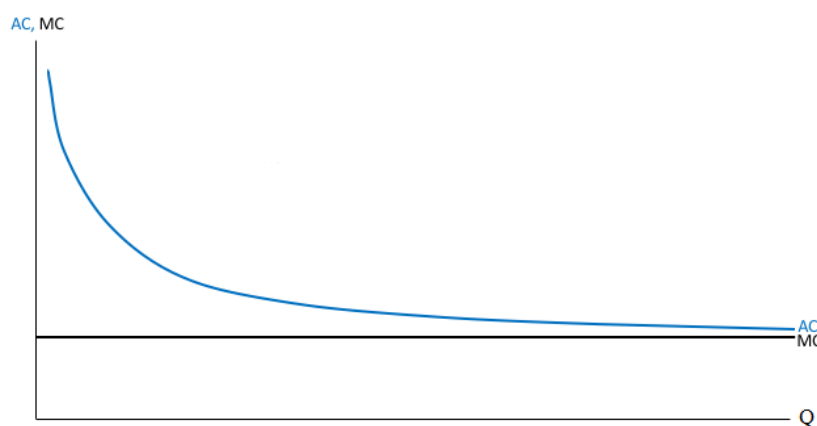
Figure (1): Perfect competition vs monopolist



Although it requires the effective price (P) to equal the marginal cost (MC); under increasing returns to scale, the condition $P = MC$ would mean negative profit, and it could thus be said to be allocatively inefficient. At high production levels, since the fixed cost is being dispersed across more products, the average costs (AC) decrease as output increases. Under conditions of increasing returns, at a point where $P = MC$, the average cost is consistently higher than the marginal cost ($AC > MC$). As a result, in a market where fixed costs (FC) are not met, there will be no production unless $P > MC$. At the point of $P > MC$, where fixed costs (FC) can be recovered, the firm will produce. To be clearer, assessing the change in total cost while holding factor prices constant is a suitable method to

determine the rise in inputs if several inputs are employed to manufacture the firm's output. It is unimportant if factor prices don't vary as the firm adjusts its output level since holding factor prices constant gives an index for total factor quantities under the criterion of production technology. The changes in output with multiple factors could be determined using the total cost's per cent change along with holding factor prices constant to approximate the inputs' per cent change as follows $\gamma = (\Delta q/q)/(\Delta TC/TC) = (TC/q)/(\Delta TC/\Delta q) = AC/MC$. As $AC = (FC + qMC)/q = (FC/q) + MC$; if dividing two sides of equation by MC; then $AC/MC = 1 + (FC/MC)/q$. Such an equation denotes that the proportion of returns to scale declines as the firm increases its output level if a fixed cost is coupled with a rigid marginal cost, as shown in figure (2). Moreover, with constant MC, the proportion of returns to scale has a similar curve to the average cost one, though its vertical scale would have 1 in place of MC.

Figure (2): Relationship between fixed costs and increasing returns



Firms endeavor to set their prices where the marginal cost corresponds to marginal revenue. However, firms will want to set their pricing at least as far above their marginal cost. The rate of the desired markup p/MR , which determines the proportion of imperfect competition, differs from the rate of actual markup P/MC when the firms have full price inelasticity. However, they will be equal in long-run equilibrium. The demand's price elasticity is closely correlated to the rate of the desired markup.

The increase in the rate of the desired markup matches up not only to an imperfect competition but also to a lesser price elasticity of demand. Given the circumstances of monopolistic firms' unfettered entry and exit, p equals AC in the steady state. However, there will be an entry if $p > AC$, that is if the proportion of returns to scale is smaller than that of imperfect competition, then as the number of firms rises, p and AC converge until they become equivalent. On the contrary, there will be an exit if $p < AC$ and as n comes down, AC and p will converge until they are equal. In both cases, the output of a typical firm varies as the firms' numbers adjust. Consider the following cases (see Miles Spencer Kimball):

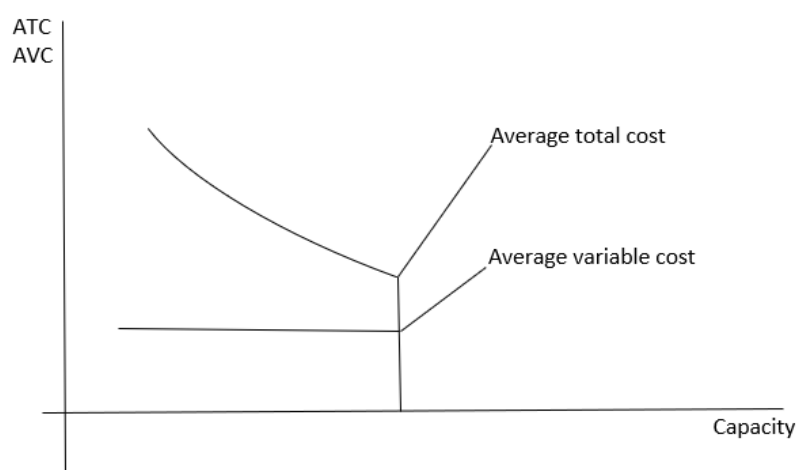
- If the firms' number and the typical firm's output increase, then the proportion of imperfect competition and that of returns to scale decrease. Moreover, a decrease in the desired markup takes place as new firms enrol in the industry.
- If the fixed cost decreases, then the firms' number increases but the size of a typical firm decreases, and both the proportion of imperfect competition and that of returns to scale decrease. As new firms enrol in the industry, the desired markup decreases. The decrease in the rate of the desired markup coupled with the entire marginal cost decreases the price. This

leads to expanding the industry's size since the elasticity of demand for the industry is nonzero.

- If the marginal cost decreases, then the returns to scale increase since the average cost does not decrease as much as the marginal cost. Moreover, firms' number decreases concomitantly with increasing the typical firm's output. Furthermore, the decrease in costs stemming from improving the industry's performance increases the long-run proportion of imperfect competition as well as that of returns to scale. The proportion of returns to scale increases more than the equilibrium desired markup ratio. The increase in the proportion of returns to scale is smaller than the decrease in MC. The price will decrease more and more before firms exit the market. If the whole industry's elasticity of demand is nonzero, then the decline in price boosts production.
- If the price elasticity of demand increases means that the market becomes "more price-competitive", then the firms' number declines, and the rate of desired markup dwindles. Both the proportion of imperfect competition and that of returns to scale decrease in long-run equilibrium. The rate of the desired markup and, consequently the price will decrease coupled with the unchanged MC before firms exit the market.

Economies of scale are supposed to exist if generating one more unit is not as much of the average of all prior units—specifically, if the $MC < AC$ in the long run, thus the AC is falling. On the contrary, there could be production levels where $AC < MC$ and AC varies as an increasing production function. Where economies of scale exist, total costs will not be covered if the price and marginal cost are equivalent and a subvention will be required. Thus, the minimum AC occurs at the point where $AC = MC$. Kaldor started the discussion on whether the firm should continue producing even though the cost is increasing. Based on real-world data and the assumption that technical coefficients will remain constant in the short run, post-Keynesians accept that firms will continue their production for the reason that even with producing zero quantity, firms would still be deleterious since they would still need to indemnify for their fixed costs and that the incremental cost stage will only occur at the next production level. Thus, the cost curve (average total cost ATC and average variable cost AVC) will not be "U" shaped as the neo-classical theory suggests. It will be like Figure (3).

Figure (3): Average Total Cost and Average Variable Cost



If the ATC and the AVC are parallel to the capacity production level, the firm should not raise its price due to the increase in cost stemming from the increasing demand. In the case of perfect elasticity, this situation presents the supply curve in the short run. Furthermore, profits will be a direct

function of the capacity utilization rate (quantity of demand). If the average variable cost remains constant when production increases, the difference between the price and ATC will increase due to the continuous decrease in the average fixed cost. The increase in the firm's profit will affect its distribution at the macro level.

Migration Trends in Turkish provinces:

With deepening globalization, different pull and push social, political, economic, and environmental factors lead to migration. Undoubtedly, the high net migration imposes significant negative externalities such as higher housing costs, higher land prices, higher demand for government resources, more stress on social services, greater public congestion, and a need for significant investment in infrastructure. People will suffer high costs if those necessary investments are made. If they are not made, then the costs will still be higher. Furthermore, it may lead to market failure because the true costs and benefits of products or services are not accurately reflected, which creates a gap between individual and social loss and returns. In order to measure the impact of migration on the Turkish economy, the association between MC and AC in Turkish provinces from 2014 to 2020 was estimated. We employed statistics on annual migration flows to/from Turkey produced by the Turkish Statistical Institute via analysing the administrative documents of citizens of the Republic of Turkey and foreigners. In addition, we adopt the definitions given by the Turkish Statistical Institute for Citizenship and the foreign population. TurkStat defines Citizenship as the specific legal connection between an individual and his/her state, obtained by birth or naturalization, whether through declaration, choice, marriage, or other procedures according to national law.

Moreover, it reported that the foreign population covers individuals with a valid residence/work permit on the reference day, those holding an identity record equivalent to a residence permit with a valid address declaration on the reference day, and individuals who have already renounced his/her T.R. citizenship and who are residing in the country with a valid address declaration on the reference day. Furthermore, the data does not cover Syrians under temporary protection, foreigners with visas or residence permit lesser than three months for the reason of training, tourism, scientific research, etc. Four variables from the database are being used, namely population, immigrants, and emigrants,⁴ and GDP by provinces/regions in a chain-linked volume index. Immigration⁵ Has been defined as the migration from abroad to reside in the Republic of Turkey within a year. However, emigration⁶ Has been defined as the migration from the Republic of Turkey to reside abroad within a year. To investigate the efficiency of migration policies in Turkish provinces, the correlation between AC and MC of net migration had been explored. TurkStat defined net migration as the difference between the number of immigrants and that of emigrants as follows:

$$N = (I - E) \quad (1)$$

⁴ According to the Turkish statistical institute: “Immigration and emigration statistics are computed in proportion to the standards used for determination of foreign population in ABPRS. In the computation process of international migration statistics, definitions and concepts of the “Recommendations on Statistics of International Migration” announced by the United Nations and the reference metadata of international migration statistics disseminated by the Statistical Office of the European Union (Eurostat) are taken into respect. Annual migration flow statistics are computed based on the Address Based Registration System, where the documents of T.R. citizens and foreigners residing in Turkey are kept, and the database on T.R. citizens living abroad. Both these two systems are revised by the General Directorate of Civil Registration and Citizenship Affairs affiliated with the Ministry of Interior. In addition to these data sources, residence permits obtained from the Directorate General of Migration Management and work permits obtained from the Council of Higher Education and Ministry of Family, Labor, and Social Services are also used to determine migration flows”.

⁵ Immigration covers citizens of the Republic of Turkey and foreign nationals who exist in the reference year ABPRS but not in the preceding year ABPRS.

⁶ Emigration covers citizens of the Republic of Turkey and foreign nationals who do not exist in the reference year ABPRS while present in the preceding year ABPRS.

Where; N = net migration, I = the number of immigrants entering the province, and E = the number of emigrants leaving it. We measure the total cost of net migration in a certain province as follows:

$$TC_i = P_i + N_i \quad (2)$$

Where; TC_i = Total cost of net migration in a certain province, P_i = population of the province, and N_i = the net migration of it. The average cost of the net migration had been calculated as in equation (3):

$$AC_i = TC_i / GDP_i \quad (3)$$

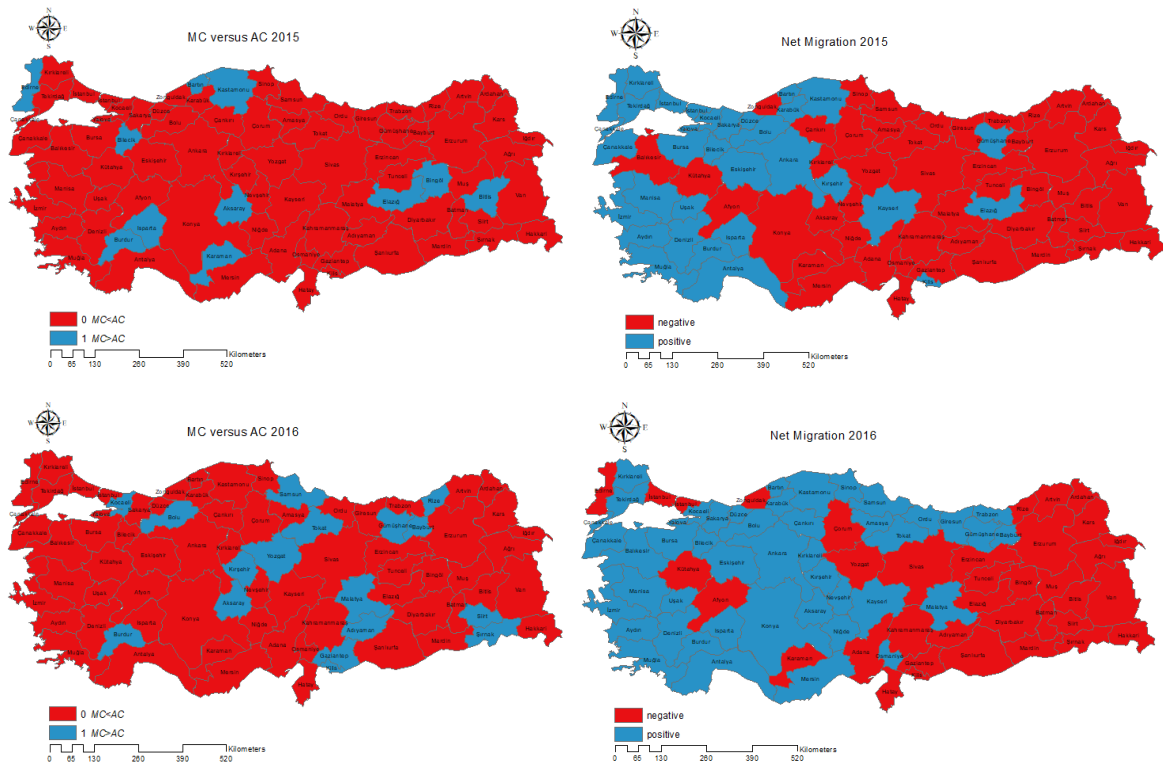
Where; AC_i = average cost of net migration in a certain province and GDP_i = Gross domestic product by provinces in chain-linked volume index. The marginal cost of net migration had been calculated as in equation (4):

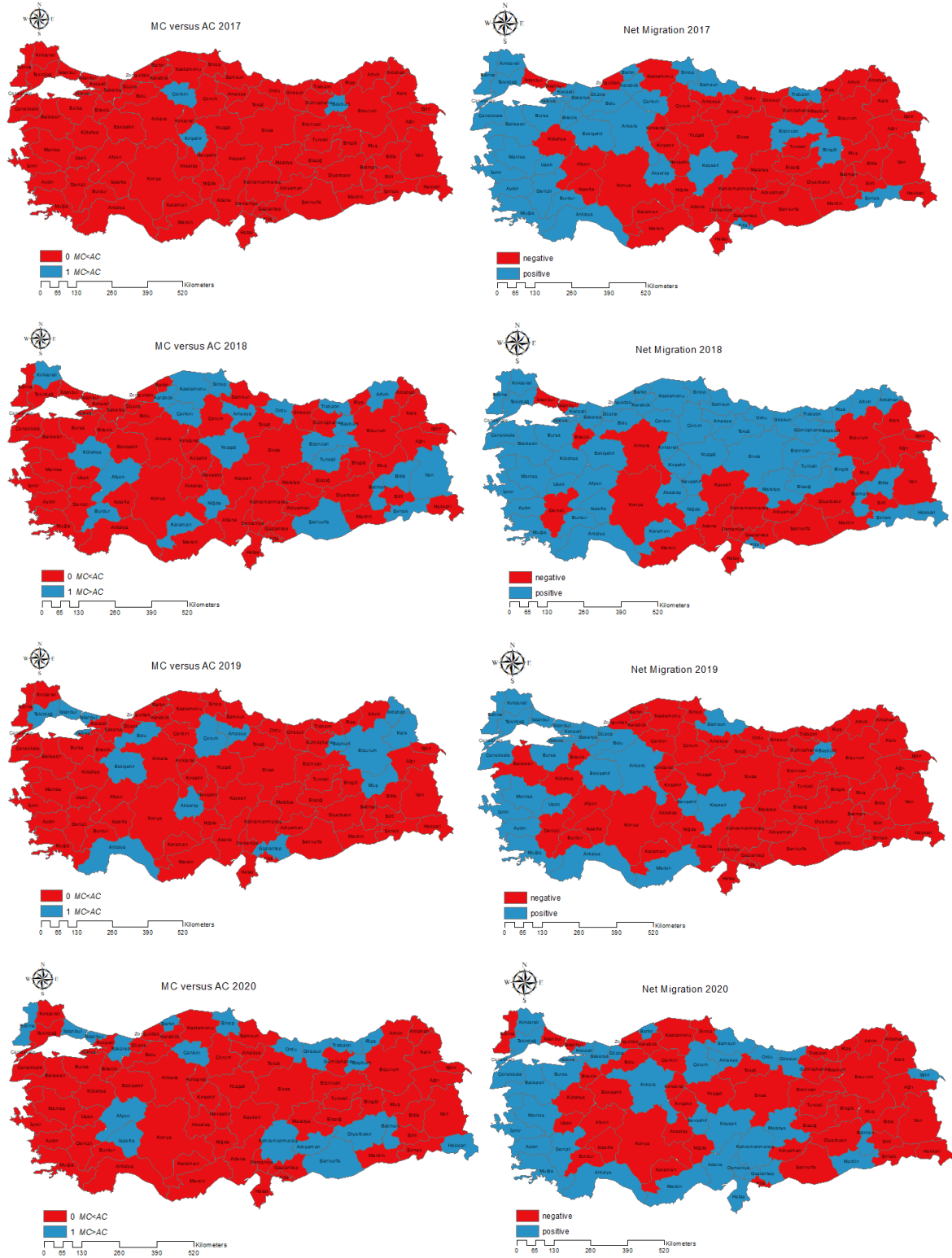
$$MC_i = dTC_i / dGDP_i \quad (4)$$

Where; MC_i = the marginal cost of net migration for a certain province.

For most of the Turkish provinces, the results revealed that the MC of net migration was less than the AC, and such a result may mirror the insufficient distribution of Turkish resources stemming from inappropriate net migration policies. Figure (4) shows the net migration of Turkish provinces and the association between the net migration's MC and AC during the period from 2015 to 2020.

Figure (4): MC&AC and Net migration





Source: Authors' calculation based on STAT.

The results show that the marginal cost of net migration is below the average cost ($MC < AC$) in most Turkish provinces during the studied period.

Conclusion:

In order to evaluate the impact of migration, we tried to estimate the Turkish welfare loss or gains associated with it, especially after the significant influx of migrants and the related congestion externalities. Turkish Statistical Institute (TURKSTAT) data of population, immigrants, emigrants, and GDP by provinces/regions in chain-linked volume index had been applied to microeconomic equations to estimate the impact of migration on Turkish provinces. The results revealed that the marginal cost of net migration in most of the Turkish provinces was less than the average one. This matter imposes a rethinking of the implied policies to draw the future route of decisions concerned with migration. The fact that there is no compensation for costs stemming from migration disturbs those who are affected by this situation and drags them to a thought characterized by injustice. The marginal cost should be the last straw that affects when making decisions, as the classical economic theory claims that in perfectly competitive markets, the maximum economic welfare can be attained by the efficient distribution of resources. There is no cost-free efficiency. Zero welfare loss could be achievable if the marginal costs were larger than the average. True-up pricing is the vital catalyst that mirrors the costs and increases, in turn, the efficiency. Efficiency in competitive markets may be achieved by making a lump-sum payment at the beginning, taking taxes or incentives into consideration instead of breaking it up into instalments. The basic idea behind that is to solve the problem from the beginning rather than interfere with a race when a problem arises. In other words, the emphasis on competition rather than increasing the scarcity of power makes more sense in the market economy.

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ANALYSIS OF THE FISCAL DEMOCRACY INDEX OF THE MUNICIPALITIES IN TÜRKİYE AND ASSESSMENT OF THE RELATIONSHIP BETWEEN FISCAL AUTONOMY

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Durdane KÜÇÜKAYCAN²

Introduction

The Fiscal Democracy Index (FDI), utilized to determine mathematically to what extent fiscal democracy is implemented in a country, denotes the ratio of the total public revenues obtained by the deduction of mandatory public expenditures to the total revenue budget. General conviction suggests that the higher this ratio is, the stronger the fiscal democracy in the relevant country is. In terms of local administrations, fiscal federalism and autonomy are closely related to fiscal democracy. Notably, the local administrations having a sufficient amount of their own income allows them to allocate more resources for optional expenditures in their budgets.

The study seeks to measure the FDI index of Turkish municipalities and to determine the relationship between fiscal autonomy and local FDI. The study analyses the FDIs of the municipalities, divided into four groups for analytical purposes: metropolitan municipalities, metropolitan district municipalities, non-metropolitan provincial municipalities and non-metropolitan district municipalities. The municipalities supervised by the Court of Auditors in Türkiye are included in the scope of the study, and the findings correspond to the municipalities that have been audited by the Court of Audit. In the analysis, the local FDI values of all municipalities have been mathematically calculated by using the final budget income and expenditure amounts of the municipalities retrieved from the reports of the Court of Audit. The conclusion part of the study presents what measures can be taken to increase the local FDI and how the current situation can be improved in Türkiye.

The Conceptual Framework of Fiscal Democracy and Index

Democracy is the rule of the people by the people, where the right to rule belongs to the nation or the people. In democratic countries, the absolute superiority of the nation's will is underlined and guaranteed by the constitution. Democracy has legal, social, political, and economic aspects (Sahin & Uysal, 2013). Democracy refers to the right of citizens to have an equal vote in determining national necessities (Steuerle, 2008). Democracy is essentially a fiscal issue, and determining a country's current needs includes fiscal implications because the participation of citizens in the process of political decision has important fiscal outcomes, and fiscal democracy is closely related to the opportunity of voters to change the government and to determine fiscal policies in line with the election preferences of the governments (Genschel & Schwarz, 2012).

The concept of fiscal democracy, which expresses the financial dimension of democracy, is directly related to the capacity of the legislature to draft a budget for the needs of citizens (Lobna et

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al., 2019) because the right to draft a budget is an essential touchstone in the basic of fiscal democracy, the fiscal dimension of democracy has been established via the recognition of this right, thereby the fiscal sovereignty of the people being promoted. The use of budget right and the active participation of citizens in budget-making are indicators that fiscal democracy functions quite well (Sahin & Uysal, 2013). The capacity of governments to respond to the growing needs of citizens through the budget is fundamental to democratic practices in modern economies, and the existence of the right to the budget, which is an essential indicator of democratization, reinforces the principle of fiscal transparency (Lobna et al., 2019). Towards the end of the 20th century, the citizens' right to information regarding fiscal transparency and accountability gained importance through the development of information and communication technologies, the transition to an information society, and the tendency to question representative democracies (Akcha et al., 2019a). The development of the right to information impacts fiscal transparency and accountability, and it is now effective in the institutionalization of fiscal democracy (Sahin & Uysal, 2013).

To better understand the concept of FDI, the notion of economic-fiscal political heritage should be first examined. The concept of political heritage, an important research topic in the public finance literature since the late 1970s (Akcha et al., 2019a), is determined by the institutional commitments of the ruling government and parliament and is based on laws, institutions and budgets rather than individual preferences (Rose, 1990). A political heritage that is taken over as a compulsory programme can be an obstacle to the allocation of public revenues to meet current public needs (Lobna et al., 2019) because in most democratic countries, the budget deficits and increase in debt stock are opposing heritages to the current governments (Akcha et al., 2019a). Steuerle-Roeper measured the FDI in 2012 to show how economic and fiscal political heritage -economic and financial decisions inherited from the past- shapes today, and how the past decisions affect the future negatively (Steuerle, 2010) since the past decisions are challenges for the public budgets, and affect both the present-time and future decisions. The primary finding of the study on the index calculation suggests that the elected governments are confronted with the governance problem arising from the economic-financial political legacy, and that this problem is relevant to the reduction of the capacity of administrators to find solutions to social problems (Streeck and Mertens, 2010).

FDI is the ratio of the amount reached to the income budget after compulsory expenditures, which are budget expenditures controlled by laws other than appropriation laws (Levit, Austin and Stupak, 2012) are removed. This ratio is related to the flexibility of fiscal funds and calculated as the ratio of public revenues not allocated to these mandatory payments to the budget (Steuerle, 2010). The total of compulsory expenditures consists of staff salaries, social security payment, retired salaries, interest payments (Lobna et al., 2019), current expenditures and transfer payments. As for investment, payments and capital transfers are classified as discretionary expenditures (Akcha et al., 2019a). In the basic FDI, also known as Steuerle-Roeper FDI (Steuerle, 2010), public expenditures are classified as compulsory expenditures and discretionary expenditures (Streeck & Mertens, 2010), and it includes determination of the extent the executive body is flexible while implementing a budget (Akcha et al., 2019a). With FDI, the probability of governments making decisions freely in budget decisions is measured (Sahin & Uysal, 2013), and it is determined how much movement area or fiscal space the countries have in the field of public finances (Akcha et al., 2019a). Because fiscal space means to reduce the foreign dependency of them by ensuring the financing needs of countries for economic growth and development. Thus countries put in force their income and expenditure policies according to their national priorities (Sahin, 2014). The FDI rises with an increasing ratio of discretionary expenditures. Thus, in line with the preferences of citizens, the capacity of governments to introduce new service programs improves. Otherwise, implementing new programmes becomes limited for the governments, and the function of fiscal democracy weakens (Sahin & Uysal, 2013).

Literature Review

The literature review regarding the FDI analysis is limited. The first analysis was conducted in 2010 in the United States (US). The study by Steuerle and Roeper calculated the index value of the United States since 1962 by subtracting compulsory expenditures from the total income (Steuerle, 2016). The index value since 1962 has shown a downward trend since the 1970s. Especially since it was below zero during the 2009 Global Finance Crisis. In this period, compulsory expenditures, including interest payments, also exceeded the total government revenues, and discretionary expenditures were financed by borrowing (Streeck & Mertens, 2010). Germany is another country for which the FDI has been measured. The differentiation of compulsory and discretionary expenditures is not formal in the country. However, four essential expenditure items are allocated: (i) Payments for Nazi victims, (ii) personnel payments, (iii) Incentive payments to social security funds and (iv) Long-term unemployment benefits. In the calculation for Germany, it was determined that FDI values have decreased since the 1970s (Streeck & Mertens, 2010). The FDI was calculated for Czechia between 1995 and 2009, demonstrating that the index value of Czechia declined over time, caused by increases of social expenditures and interest payments in the long term (Akcha et al., 2019a).

Lobna et al. (2019) analyzed FDI the values for Jordan, Egypt, and Tunisia for the period 2010-2017, relying on two different calculation methods. Subsidy payments are not considered in the first calculation. Findings based on the first method suggest that the FDI value of Tunisia declined until 2016 while slightly increasing in 2017. On the other hand, the FDI value in Jordan has followed an unstable trajectory but has been on the rise since 2015. The index value of Egypt decreased until 2015, so dramatically that it was below zero, showing, however, a tendency of slight increase since then. The second method included the subsidy payments and features the index results for the three countries that are much lower than the figures in the first. The FDI value for Egypt was lower than minus 10 in all years examined, and the value for Jordan was under zero from 2011 to 2013, whereas the value for Tunisia was stable compared to the other two countries.

Akcha et al. (2019a) calculated the Turkish FDI value for the period between 1950 and 2018. The findings proposed that the index value, negative in 1950, began to rise in 1960, but the index declined by half because of the 1960 military coup. Although it improved since the middle of the 1970s, the index suffered from a sharp decline again with the 1980 military coup. The index value fell below the 1950 level due to the impacts of the 1994, 1998 and 2001 crises, falling to around minus 10. The recovery process started again in the mid-2000s, but Global Financial Crisis in 2008-2009 affected Türkiye. Even though it partially recovered post-global crisis, the FDI index of Türkiye remained far below the high rates attained in the past. Another study by Akcha et al. (2019b) analysed the FDI of the Turkish Central Government between 1980 and 2018 by relying on two different models of panel data analysis.

The Impact of Local Fiscal Autonomy on the FDI

To become autonomous, the local administrations must have sufficient sources of their income and must be equipped with powers such as taxing and setting rates at the local level (Ulusoy & Akdemir, 2009). Having sufficient income and being less dependent on the central government positively affect their service capacity. Thus, these administrations can expand their service range and allocate more resources for their optional expenditures in their budgets (Ulusoy & Tekdere, 2019). While the FDI value of local administrations increases, on the other hand, the size of their fiscal space will expand. But if local administrations have unproductive income sources, and sources of income against economic fluctuations are inflexible, the FDI will be affected negatively. Under these conditions, they may also experience insufficient allocation of resources for discretionary expenditures, and the FDI value may decrease. Local administrations with strong fiscal autonomy and

with self-income will rarely rely on borrowing, enabling them to reduce the expenditures allocated to the interest payments in the budget (Ulusoy & Akdemir, 2009), thus effectively taking them out of the debt-interest spiral (Ulusoy & Tekdere, 2019). With the decline of the proportions in the budget of interest rates referred to as compulsory expenditures, the total amount of compulsory expenditures will also decline; and while discretionary expenditures rise, the FDI is affected positively.

Another regulation that may create a positive effect on the FDI is that local donations, as stated in the European Charter of Local Self – Government are not as conditional much as possible. Under this regulation, local administrations are not obligated to make investments and produce services requested by the central governments (Yontar & Dağ, 2014) because conditional donations undermine fiscal autonomy, and also the arbitrary practices of the central government cause both resource constraints and the formation of an administrative structure dependent on a high level of central government (Ulusoy & Akdemir, 2009). On the contrary, when they do not have to depend on the donations and aids for special purposes allows the local administrations to determine their expenditures in accordance with their own plans and policies, thus encouraging them to create an environment that will strengthen fiscal democracy. Providing offsetting allowance to local administrations with limited fiscal sources (Ulusoy and Akdemir, 2009) is a solution for the protection of weak local administrations and the performance of local services (Yontar and Dağ, 2014). For example, in Türkiye, some of the central budget tax revenues allocated to local administrations are collected in another account in order to be distributed to the local administrations in need again. This process is called offsetting allowance (Cetinkaya, 2020), and this appropriation is seen as a second offsetting mechanism among municipalities after the distribution of general budget tax revenues (Marmara Municipalities Union, 2015). Discretionary expenditures might likely be halted for underdeveloped local administrations. Thus, supporting local administrations with insufficient income ensures that more resources are allocated for optional expenditures.

In addition, one aspect of the relationship between fiscal autonomy and fiscal democracy concerns participation. When they provide a substantial part of the revenues of the local administrations, the people will tend to ask for a visible return for what they have paid in form of taxes and to become more ambitious to take part in the decision-making of the budget deliberations. Fiscal autonomy, thus, encourages local participation and offers an incentive for change in the political behaviours of the people (Cetinkaya, 2020). Ultimately, when fiscal democracy improves, the public will determine where and how part of the discretionary expenditures will be spent.

Research Methodology

The current status of municipalities in Türkiye using the proportionate method of analysis for the purposes of the study are investigated. For this reason, the study first retrieves the actual budget revenues and expenditures of the municipalities. The universe of the research includes all municipalities in Türkiye. The sample of the study includes the municipalities in Türkiye whose audit reports for the 2012-2018 fiscal years by the Court were made public. The study chooses the year 2012 as the start of the analysis because it is since when the Court of Accounts decided to share the Public Administrations Audit Reports. Table 1 presents quantitative information about the municipalities that make up the sample of the research by years.

Table 1. Numbers of analyzed municipalities

Municipalities	2012	2013	2014	2015	2016	2017	2018
Metropolitan	16	16	30	30	30	30	30
Metropolitan District	39	62	96	112	122	129	119
Provincial	51	60	51	51	38	28	20
District	7	14	17	15	10	14	19
Total	113	152	194	208	200	201	188

Source: Public Administrations Audit Reports of the Court of Accounts.

The study analyzes the actual budget revenues and expenditures of metropolitan, metropolitan district, provincial and district municipalities audited by the Turkish Court of Accounts (TCA 2019) for the period 2012-2018. Other municipalities that were not audited by the Court of Accounts are not included in the scope. The audit reports by the Court of Accounts have been retrieved from the Public Administrations Audit Reports section under the heading of the reports on the official website of the TCA. The auditing reports, done by the TCA, are presented to the public in the form of reports since the 2012 fiscal year. Both the regularity and performance audit results of each public administration can be accessed in the reports that consist of two main sections: one on the information on the regularity audit of the public administrations, and another section on the results of the performance audit of the same administration. Thus, within the scope of the analysis, the actual budget revenues and expenditures of each municipality audited in the relevant reports are examined.

The total expenditures of the municipalities for the relevant fiscal year are presented in the budget expenditure estimation and actual amount table in the reports. As stated in the theoretical part, it is a prerequisite for the FDI to be calculated as mandatory and discretionary expenditures. In calculating the FDI for the municipalities, an evaluation was made of the economic classification within the scope of the analytical budget classification. Accordingly, personnel expenditures, premium payments to social security institutions, purchase of goods and services, interest payments and current transfers are considered compulsory expenditures. Discretionary expenditures consist of capital expenditures, capital transfers and lending schemes. In this context, in the first stage of the analysis, discretionary expenditures were identified by using the formula below.

$$\text{Total Expenditures} - \text{Total Mandatory Expenditures} = \text{Total Discretionary Expenditure} \quad (1)$$

In order to reach the final result of the FDI, the remaining amount (the sum of discretionary expenditures) after subtracting the mandatory expenditures from the total expenditure budget in the second stage of the analysis should be proportioned to the revenue budget of the relevant municipality. The second formula used in the FDI index calculations is given below. The method used in the literature was used to reach the FDI, known as Steuerle-Roeper Index, in the research (Steuerle, 2010). According to the literature, the remaining amount after deducting the mandatory expenditures from the total expenditure budget of the municipality is the total of discretionary expenditures. For FDI, the total discretionary expenditures of the municipality must be proportioned to the total revenue. The second formula used in the FDI calculations is below.

$$\frac{\text{Total Discretionary Expenditures}}{\text{Total Public Revenues}} = \text{Fiscal Democracy Index} \quad (2)$$

Results and Discussion

With the enactment of Law No. 6360, a remarkable increase was experienced in the duties and responsibilities of metropolitan municipalities, provoking discussions on fiscal autonomy once again because, with the abolition of the legal personality of the special provincial administrations, the duties and responsibilities of these administrations were transferred to the metropolitan municipalities (Ulusoy & Tekdere, 2019).

According to the table, the index values of metropolitan municipalities have declined over time. Especially in 2014, as a result of the transformation of 14 provinces into metropolitan municipalities, the number of metropolitan municipalities increased. Despite this increase in the number of municipalities, the index value has decreased. There has been a reverse development between the number of municipalities and the FDI value. Of the years examined, the lowest index value is from the year 2016, which can be attributed to the coup attempt against the government in 2016. Some increases in the index value in 2017 and 2018 contributed to the expansion of the financial area of metropolitan municipalities. However, this increase is lower than the results calculated for 16 metropolitan municipalities between 2012 and 2014. The FDI values of metropolitan municipalities are presented separately in Table 2.

Table 2. FDI Values of Metropolitan Municipalities

Mun.	2012	2013	2014	2015	2016	2017	2018	Ave.
Adana	31,9	35,9	37,4	6,2	-1,9	-0,9	-7,0	16,5
Ankara	46,4	40,2	30,3	40,9	42,1	46,9	49,5	43,3
Antalya	-3,7	19,1	1,8	41,5	27,3	35,9	35,1	23,5
Aydın	-	21,0	55,0	41,9	25,6	31,8	28,6	34,0
Balıkesir	-3,7	29,3	51,6	48,8	25,8	20,3	45,9	32,2
Bursa	47,7	39,6	42,6	38,4	30,7	40,2	35,7	39,2
Denizli	47,7	55,1	-5,4	47,1	43,3	48,1	28,4	37,7
Diyar.	7,2	10,9	37,3	-7,81	18,0	61,1	42,9	24,2
Erzurum	28,1	38,3	37,9	-7,8	18,0	61,1	42,9	31,2
Eskişehir	25,4	20,0	28,3	23,2	16,0	27,3	28,3	24,1
Gazi.	47,9	52,2	45,5	26,6	23,3	39,7	40,2	39,3
Hatay	-	29,0	69,0	44,6	26,3	29,0	33,5	38,6
İstanbul	60,8	64,6	67,4	53,7	49,5	48,3	50,1	56,3
İzmir	58,6	52,7	59,6	54,7	51,1	53,9	52,8	54,8
Kahra.	23,7	43,3	63,4	33,2	23,8	22,8	18,7	39,5
Kayseri	46,5	59,3	57,2	58,2	41,4	35,0	42,6	48,6
Kocaeli	45,6	54,2	43,1	53,4	52,4	48,0	47,5	49,2
Konya	38,8	5,4	25,7	18,9	39,6	21,6	39,1	27,0
Malatya	-	11,9	20,0	13,6	10,9	19,8	37,9	19,0
Manisa	43,7	38,5	46,5	-6,1	42,9	37,8	40,3	41,4
Mardin	-14,0	7,8	59,0	52,6	42,6	36,6	28,0	30,3
Mersin	29,7	34,3	33,2	18,2	-29,6	12,6	12,6	15,8
Muğla	30,8	29,2	69,2	52,7	39,5	46,0	47,6	45,0
Ordu	-	-	35,2	30,7	15,7	32,0	27,3	28,2
Sakarya	30,3	33,3	39,7	39,4	43,2	30,4	34,8	35,9
Samsun	34,1	32,1	30,6	41,8	41,0	41,8	33,8	36,5
Şanlıurfa	26,1	45,4	33,6	50,0	47,2	38,4	44,6	40,8
Tekirdağ	27,9	18,0	72,1	53,4	38,1	48,2	44,1	43,1
Trabzon	13,8	18,2	46,8	47,8	24,8	31,2	36,0	31,2
Van	14,4	28,9	38,8	18,0	14,3	23,2	23,8	23,0

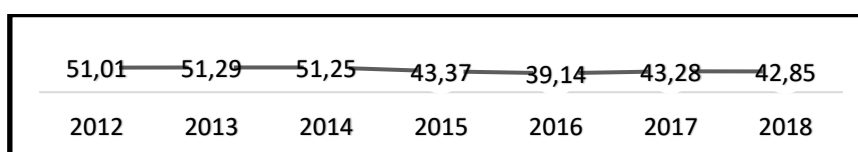
(-): Null **Source:** Calculated with the data in Regularity Audit Reports of the Court of Accounts.

According to the table, the FDI values of metropolitan municipalities vary by year. However, when analyzed in terms of the averages of the relevant years, the index average in Istanbul and Izmir is above 50 per cent, while the index values of Kocaeli, Kayseri, Ankara, Muğla, Manisa, Şanlıurfa and Tekirdağ are between 40-49 per cent. The most striking result in the table is the index value of Adana Metropolitan Municipality. According to the socio-economic development ranking analysis conducted by the Republic of Türkiye Ministry of Industry and Technology (2017), Adana was placed among the 30 most advanced provinces in Türkiye. However, the average FDI is 16.52 per cent. Especially in recent years, the local FDI value of Adana Metropolitan Municipality has been calculated as negative (negative value). This means that the metropolitan municipality's ordinary revenues are insufficient to meet even the obligatory expenditures. The same research ranked Bursa as the fifth most advanced province. The average index value of the Bursa Metropolitan Municipality is 39.29 per cent and there has been a decrease in the index value of the Bursa Metropolitan Municipality in recent years. The average index values of Eskişehir and Antalya Metropolitan Municipalities are also lower than 25 per cent.

An analysis of the situation of metropolitan municipalities in the Southeast and East Anatolia reveals that the average index values are less than the metropolitan cities in other regions. Except for Şanlıurfa, Kahramanmaraş and Gaziantep provinces, the average local FDI values of metropolitan municipalities in these regions is 30 per cent or less. An assessment of the case in the metropolitan cities in the Black Sea Region shows that the average index values of Ordu and Trabzon Metropolitan Municipalities is around 30 per cent. However, since the economic classification of the budget income and expenditure realization figures in the audit report of the Municipality of Ordu in 2012 and 2013 was not reached, the local FDI value for these years could not be calculated. The lowest average index value among metropolitan municipalities belongs to Mersin Municipality. In 2016, the local FDI value of Mersin Metropolitan Municipality was minus 29.64. Based on a general analysis of the data in Table 4, it can be stated that municipalities that did not have the status of metropolitan municipalities before Law No.6360 were inadequate to meet the current and transfer expenditures, which were considered mandatory, and their fiscal areas were considerably narrowed. The possibility of municipalities applying for extraordinary incomes (such as borrowing) for investment expenditures, which are expressed voluntarily, may increase, especially in the years when the local FDI decreases. One of the main reasons metropolitan municipalities allocate a large portion of their total revenues to mandatory expenditures and allocate a small share for discretionary expenditures can be attributed to poor fiscal autonomy because municipal administrations in Türkiye are dependent on central government transfers and a high level of inadequate revenues.

With the adoption of Law No. 6360, there has been a severe increase in the duties and responsibilities of metropolitan municipalities. With the implementation of the law that resulted in the abolition of the legal personality of the particular provincial administrations within the metropolitan borders, metropolitan municipalities had to undertake the duties of extraordinary provincial administrations. The fact that the total revenues of the metropolitan municipalities are insufficient to meet the services they undertake brings to the agenda that they should be more financially autonomous not only in the law texts but also in practice. With Law No. 6360, the loss of the spending capacity of other municipalities to the metropolitan municipalities increases the importance of the relevant municipalities.

Graph 1 Average FDI Value of Metropolitan Municipalities



Source: Calculated with the data in Regularity Audit Reports of the Court of Accounts.

The second municipal group investigated in the study is metropolitan district municipalities. The FDI values of metropolitan district municipalities are presented in Table 3. There has been a remarkable increase in the number of metropolitan district municipalities audited by the TCA during the years examined. Especially in recent years, the number of metropolitan district municipalities audited by the Court of Accounts is around 120.

Table 3. FDI Values of Metropolitan District Municipalities

Year	Number of Municipalities	FDI
2012	39	23,79
2013	62	25,32
2014	96	26,24
2015	112	22,15
2016	122	16,16
2017	129	17,73
2018	119	10,00

Source: Calculated with the data in Regularity Audit Reports of the Court of Accounts.

In the report drafted by the Special Expertise Commission of Local Administrations in 2014, it was emphasized that especially small municipalities experienced a bottleneck in creating funds (Republic of Türkiye State Planning Organization 2014). In addition, small municipalities that are financially inadequate and unable to borrow have problems even in financing social projects (the Republic of Türkiye Presidency Strategy and Budget, 2019). According to Table 5, the FDI value of metropolitan district municipalities has started to decrease over time. In 2018, the FDI value was calculated as 10 per cent. This value shows that metropolitan district municipalities allocate a large part of their total income to their mandatory expenditures and their financial areas have shrunk.

Provincial municipalities with no metropolitan status were subjected to a new regulation with Municipal Law No. 5393, adopted in 2005. First, the practice of differentiating municipal duties according to the income groups of municipalities has been abandoned. However, the evaluation of municipalities equally in terms of structure and size (as provincial, district and town municipalities) has led to the evaluation of all municipalities equally, regardless of their size, in the context of their mandatory and discretionary duties. Since 2014, the number of other provincial municipalities other than the metropolitan city has decreased from 65 to 51. Table 4 includes the FDI values calculated using the data obtained from the TCA audit reports drafted for other provincial municipalities.

Table 4. FDI Values of Provincial Municipalities

Year	Num. of Municipalities	FDI
2012	51	26,47
2013	60	26,54
2014	51	24,95
2015	51	25,70
2016	38	22,36
2017	28	24,05
2018	20	15,05

Source: Calculated with the data in Regularity Audit Reports of the Court of Accounts.

According to the table, 10% decrease in the index value in recent years is remarkable, indicating that the fiscal areas of other provincial municipalities have shrunk and a small part of their ordinary income is allocated to discretionary expenditures. Although the index value was interrupted in 2016, it increased slightly in 2017. However, by 2018, there was a decline by 10 per cent in the index value. In

addition, it is understood that the FDI value of the municipalities examined in this group is quite low compared to the general average of metropolitan municipalities. The result suggests that other provincial municipalities, such as metropolitan municipalities, are not sufficiently autonomous financially and have an insufficient income of their own. Similarly, the increase in the level of fiscal autonomy of the municipalities in this group contributes to the increase of the local FDI value. Table 5 contains the local FDI values of the district municipalities in the provinces with no metropolitan status.

Table 5. FDI Values of District Municipalities (2012-2018)

Year	Num.of Municipalities	FDI
2012	7	29,78
2013	14	24,21
2014	17	34,73
2015	15	26,52
2016	10	14,71
2017	14	15,41
2018	19	12,90

Source: Calculated with the data in Regularity Audit Reports of the Court of Accounts.

The findings in Table 5 suggest that although there has been an increase in the number of district municipalities in provinces other than metropolitan cities audited by the Court of Accounts, the index value of these municipalities has decreased very dramatically that the index value of the district municipalities audited in 2012 is 29 percent, but the relevant value has declined to 12 percent in 2018. When compared to metropolitan district municipalities, the number of district municipalities that are audited by the TCA is quite small. In 2018, a total number of 119 metropolitan district municipalities were audited. However, only 19 district municipalities were audited in the same fiscal year. At the same time, the local FDI values for both metropolitan district municipalities and district municipalities decreased by more than 10 percent from 2012 to 2018, indicating that for both district municipal groups, the amount of income allocated from the municipal budget for mandatory expenditures has increased over time, but a smaller share is allocated from the budget for discretionary expenditures.

Conclusion and Recommendations

This study, focusing on the local FDIs of the municipalities in Türkiye, concludes based on the initial findings that the index values of the metropolitan municipalities are better than those of the other municipalities. One of the most important reasons is that metropolitan municipalities have higher income generation capacity than small municipalities. In addition, the fiscal insufficiency of small municipalities and limited borrowing opportunities pose an obstacle to implementing even social projects. While the index average of metropolitan municipalities is above 40 percent except for 2016, the average of index values for other municipal groups varies between 10-30 percent. In addition, when the year 2016 of the seven-year period covering the 2012-2018 fiscal years is looked at, there was a decrease in the FDI for each municipal group in general. One of the main reasons for this decline can be considered as the financial reflection of the coup attempt in Türkiye in 2016 on municipalities.

While the index value of each municipality group was higher between 2012 and 2014, there has been a decrease in the index values since 2015. These declines may be associated with the consequences of adopting Law No. 6360. After the 2014 local elections, with the implementation of Law No. 6360, 14 provincial and district municipalities affiliated with these municipalities have become metropolitan municipalities. After the March 2014 local elections, the particular provincial administrations and villages, whose legal personalities were abolished, were attached to the metropolitan municipalities together with their movables, immovable and personnel; and a continuous

personnel change was experienced in the following years. Therefore, deviations have also occurred in the estimated budget income and expenditure figures.

Moreover, despite these changes, fiscal decentralization has remained limited and municipalities still need financial resources to fulfil the responsibilities delegated to them. When the change between the analysis's beginning (2012) year and the end (2018) year is examined, an average of 10 per cent decrease has occurred in the 10% index value for each municipality group. In other words, the financial areas of the municipalities have started to decline in recent years. The decrease in the index value means that the municipalities allocate a large part of their ordinary revenues to current and transfer expenditure items considered mandatory. There is an average of 10% decrease in revenues allocated to their discretionary expenditures. It can be interpreted as reducing the capacity of local administrations' capacity to implement new service programs in line with the citizens' preferences and weakening the functionality of fiscal democracy.

Although it is emphasized that municipalities are administratively and financially autonomous in the current legislation on municipalities, the fact that most of their revenues are covered by central transfers shows that the level of fiscal autonomy of the municipalities is inadequate. A number of quantitative and qualitative several studies that investigated the fiscal autonomy level in Türkiye drew attention to this issue, recalling that the municipalities cannot set their own tax policies, also identifying significant flaws such as the municipalities not having sufficient income commensurate with the duties and responsibilities. In other words, the tax revenues of the municipalities are insufficient to meet their expenditures, creating an obstacle in financing the increasing local expenditures. Since the balance of income and expenditure cannot be achieved, the municipalities, having to cut the resources they will allocate to their long-term programs, prefer borrowing and outsourcing as an alternative for investment expenditures.

High dependency on central transfers causes fragility in municipal budgets, while macroeconomic problems and unforeseen fluctuations in central budget applications can directly affect the expenditure policies of municipalities. In addition, there is not a strong link between central transfer payment criteria and expenditures. For this reason, municipalities can have expenditure management supported by fiscal autonomy, with the opportunity to determine their expenditures independently of the central administration. For this, it is recommended that the municipalities spend most of their expenditures through local fiscal resources. In addition, it is important that the municipalities have their own sufficient income and simple and easy-to-implement tax procedure legislation.

Additionally, municipalities should be able to create new sources of income. Maintaining stability over the financial structures of municipalities in order to strengthen the FDI value may enable them to use resources more efficiently. Greater fiscal autonomy in the municipalities in Türkiye will positively impact the local FDI values. For example, the amount of borrowing of municipalities with sufficient income will decrease and the budget share of the interest item, which has a significant share in compulsory expenditures, may decrease as the increase in the interest payments of the municipalities can affect the service provided on the one hand and damage the budget structure on the other.

To improve the existing fiscal situation in municipalities and to strengthen the local FDI, relevant regulations should be introduced to make sure that municipalities will have sufficient income in line with their duties and responsibilities specified in the relevant laws, citizen satisfaction should be prioritized, municipal tax tariffs should be re-examined in line with the economic fluctuations and the municipalities should be recognized greater discretion in determining their tax policies. It is also vital to develop democratic control mechanisms. Thus, the fiscal autonomy level of the municipalities can be improved by realizing the relevant suggestions. In addition, as stated in Article 9 of the European Charter of Local Self-Government, having sufficient fiscal resources proportional to the duties and responsibilities of municipalities in the Constitution and other laws will increase the value of the FDI and support the strengthening of local fiscal democracy.

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THE IMPORTANCE OF LITHIUM RESOURCES IN THE CHILEAN ECONOMY: GEOLOGICAL, POLITICAL, ECONOMIC AND PRODUCTIVE FACTORS RELEVANT TO THE DEVELOPMENT OF THE LITHIUM INDUSTRY IN CHILE

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Abstract

Chile has a small economy based mainly on exploiting metallic and non-metallic resources. For social and the lack of strong government policies, the country's progress, according to the universal standards and indicators, is unsatisfactory. We, as a country, need to improve the quality of living of our citizens and contribute to the world with goods of high quality.

We need to open our Economy and become efficient and competitive, which is not a trivial task. We know the experiences of countries such as the United States of America, China, Russia, India and the European Community. Our priority is to learn from them and develop, in the short term, a comprehensive strategy to get the right balance between our import and export processes of goods. The discussion becomes relevant to the exploitation of Lithium due to the many applications in the productive sector worldwide. Chile must export refined Lithium and not just the material without proper analytical treatment. We believe that our study should concentrate on several economic and technical issues.

I. INTRODUCTION.

The production of Chilean Lithium declared as a strategic resource in its current Mining Code, has been increasing over time, being based on private production regulated under special contracts of operation of Lithium (CEOL) granted by tender by the Chilean State, achieving this model of resource management an important position of Chile in the world market of Li. On the other hand, there is the growing participation of actors on the world stage, such as Australia, which has positioned itself as the world's leading producer, moving Chile to second place and being able to maintain this position in the medium term.

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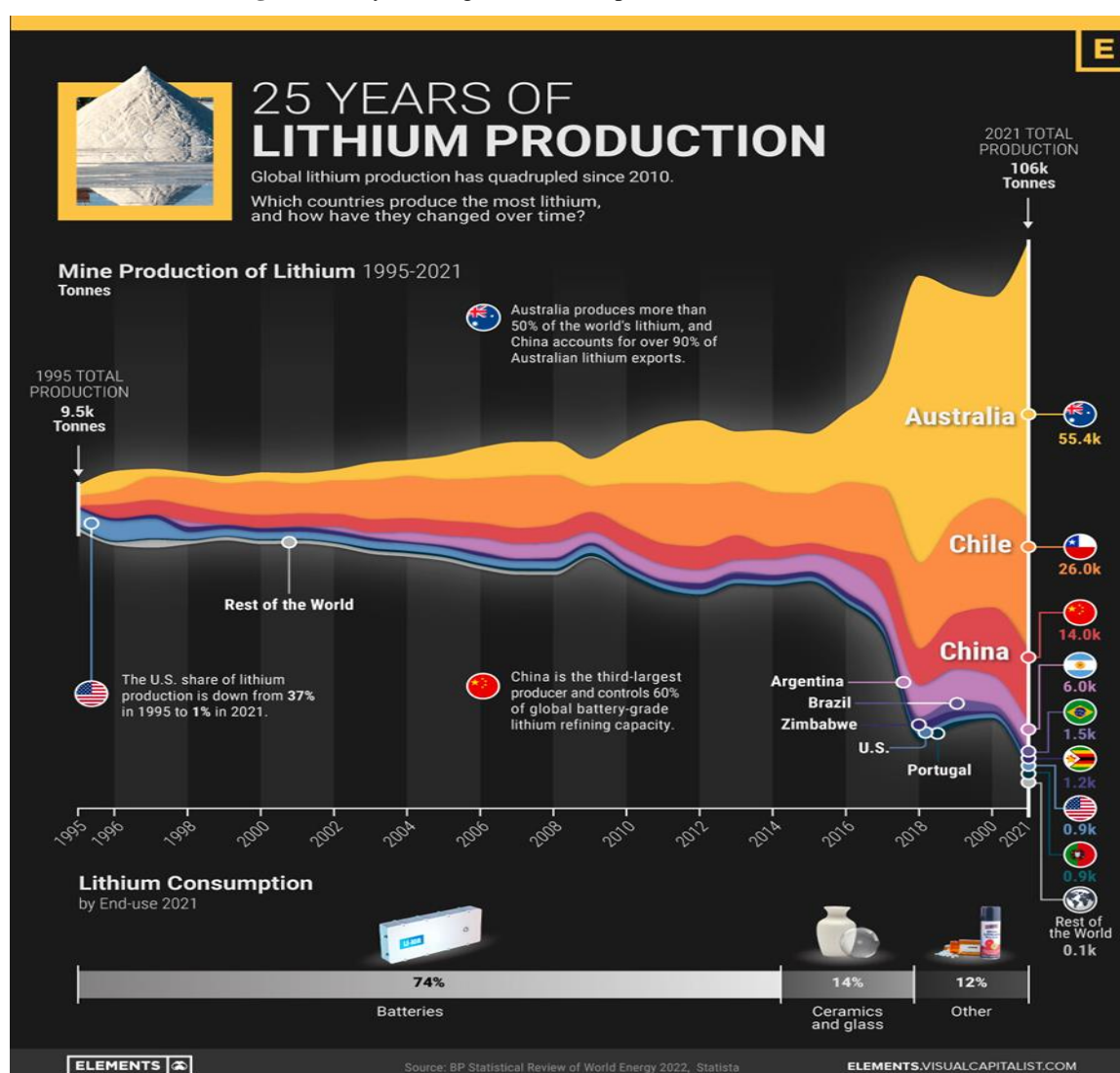
II. LITHIUM PRODUCTION WORLDWIDE

According to the Ministry of Mining of Chile, this country has, in the form of brines, about 52% of the world's lithium reserves, highlighting that the largest Chilean production is mainly based on lithium carbonate obtained by evaporation of brines contained in the Atacama Salt Flat, located in the Second Region of Chile, generating a controlled precipitation of salts. Chile has options to increase its participation in the Li market in the short term if the Salar de Maricunga comes into production or if other producers enter in the medium and long term based on some type of resource other than the salt flat, which requires mining exploration instances.

For some years, Australia ranked second among the world's producers due to the exploitation of pegmatites and held a significant percentage of the world's lithium reserves. But it increased its production, currently generating more than half of Lithium worldwide, while Chilean brines are now the second most productive.

Currently, Argentina, like China, are relevant producer positioned immediately after Australia and Chile. With regard to Bolivia, it has appreciable state reserves in the Uyuni salt flat, which may make it a significant producer in the short to medium term to consolidate its alliance with the German company ACI Systems or with another company that allows it to concretize productive instances.

Australia is one of the world's largest mining powers, and that includes huge reserves of lithium minerals. In 2021 52% of the international production of Lithium was Australia being, China, its main buyer since the Asian giant is multiplying its manufacture of batteries for electric cars, increasing last year its sales to Europe by approximately 165% in an emerging market for the rest of the countries and which is estimated to grow significantly, since all-electric vehicles need lithium batteries. The rest of the production is completed by Chile, China, Argentina, Brazil and Zimbabwe. Figure 1, taken from an article by Buthada, G. (2022) published by *VisualCapitalist*, shows the evolution of the last 25 years of lithium production between 1995 and 2021, illustrating its absolute volumes and pointing out the leading players in the lithium production industry, where since 2018 Chile loses its first place being displaced by Australia.

Figure 1: 25 years of global lithium production (1995-2021)

Source: Buthada (2022)

Argentina has captured the interest of important players in the lithium industry and is betting on developing operations to exploit the energy mineral with an investment of US\$4.2 billion that, in an optimistic scenario for this country, could lead it to double production by 2025 (BNAmericas, 2022). In this scenario, by 2028, Argentina could move Chile to third place in production due to having more than ten lithium projects.

In Argentina, the companies involved in lithium projects are public and private; however, there are potential scenarios of legal conflicts between the Instituto Argentino de Derecho para la Minería (AIDEM), the Argentine Mining Law Institute, and the provincial government of La Rioja around the emergence of new provincial legal norms aimed at declaring Lithium as strategic natural resources for its contributions to the energy transition and contributions to socio-economic development, which would allow a province, So with these rules, a provincial government could suspend mining concessions for the exploration and exploitation of Lithium exploration and mining concessions in the territory of the corresponding province, that is to say, decree their expiry due to causes not provided for in the Argentine Mining Code (page 12, 2023). If this problem escalates to other provinces, this could slow down private investment in Argentina.

III. LITHIUM RESOURCES AND RESERVES IN THE WORLD

Table 1 below presents a basic classification of the types of lithium deposits in the world, indicating an approximate share of these resources worldwide and their natural state.

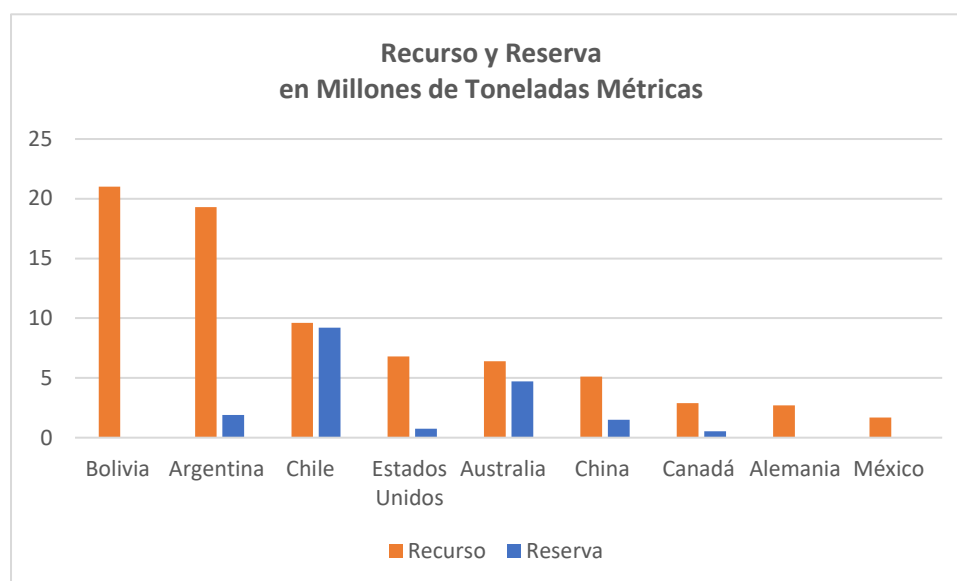
Table 1: Classification of lithium resources in potentially exploitable natural state.

Guy	Types of deposits	Estimated global share of resources and reserves	Natural State	Location of the largest deposits
Pegmatites	Minerals of considerable size, mainly spodumen and second petalite, amblygonite and eucryptite and litiferous micas as lepidolite	27%	Crystallized rock from magmatic conditions - hydrothermal	Australia, USA. DRC, Canada
Brines in Salt Flats and Salt Lakes	Mainly Salt Flats and second Continental Salt Lakes	60%	Brines incorporated into pores of mineral salt and sand deposits; saltwater bodies.	Salt flats of the South American Triangle of Lithium from Chile, Argentina and Bolivia; Zabuye in China; Qinghai-Tibet plateau in China
Clays and mica	Clays in volcanic rocks with lake evaporates and deposits associated with volcanic calderas.	7%	Clays corresponding to minerals such as emectite; micas as zinwaldita	State of Nevada in the USA, Sonora in Mexico; Call in Chile; Zinwald in Germany
Brines in Geothermal field	Aquifers formed by hot waters circulating through fractures and pores of the crust genetically linked to subvolcanic magmatic conditions	3%	ions in underground saline solutions at high to medium temperature	California Border - Mexico, Rhine Graben in Germany, Northern Chile
Zeolites	Jadarita layers corresponding to a silicate of the zeolite family	3%	Jadarite formed under lake evaporative conditions	Jadar in Serbia

Source: Modified from COCHILCO (2020) based on various market sources

The data in Table 1 above will constantly be changing depending on the exploration capacity and production of Australian pegmatites, as well as the exploration and production of the other countries participating in this market.

Chile, Argentina and Bolivia together have about 65% of the world's metal resources. Chile has the largest reserves of Lithium, approximately 42% of the total reserves in the world, and is the second world producer with 26% of production after Australia with 55% of world production in 2022. At the global level, it is estimated that the main lithium resources and reserves are distributed mainly in the countries shown in figure 2 below.

Figure 2: Countries with the world's main resources and reserves sorted from major to lowest resource.

Source: Own production based on various sources.

Mineral Reserve is understood as the economically exploitable part of a measured or indicated Mineral Resource. It includes material dilution and loss tolerances that may occur when the material is removed, as well as the impact of various modifying factors.

According to the graph above, there is a significant disparity between the availability of resources and reserves in different countries, except Chile and Australia, where the available tonnage is similar for resources and reserves. In the case of Bolivia, for example, despite being the country with the most considerable lithium resources on the planet, it does not reflect this as a reserve, which is an indicator of an essential productive potential in the long term rather than in the short or medium term.

In the case of Chile, more recent records published by Cabello (2022) indicate even total reserves for Chile of up to 10,879,000 tons of Li, thus raising Chile to 64% of the World Reserves, based on the available background on the brine deposits located in the Atacama and Maricunga salt flats to which resources are added by 3,335,100 tons of Lithium, identified in 9 other Andean and Pre-Andean salt flats. There is also information about lithium-bearing brines in 13 other salt flats and 36 identified prospective areas that still need to be studied. (Cabello, 2022).

In the case of the Chilean salt flats, it is also necessary to investigate productive routes for brines whose ionic composition is not productive with the current processes, as well as it is essential to determine the topography of the bottom of the Atacama Salt Flat and understand that physicochemical factors control the enrichment of Li in the brine, all of which can increase its resources and reserves as well as its productive life.

On the other hand, Australia has reserves slightly higher than its resources supported by pegmatitic deposits with spodumene ($\text{LiAlSi}_2\text{O}_6$) as the predominant ore, as in the open pit mine Greenbushes (Mindat, 2022). Although it is the current world's largest producer with fewer resources and reserves than Chile, which indicates that in order to remain the world's largest producer in the long term, it must increase its exploration efforts to increase its resources, having to pass resources on to reserves in order to maintain their production rate.

Regarding the USA, the latest news indicates the intention to increase its production based on the investment of General Motors for the exploitation of the Thacker Pass open pit mine of Lithium Americas, consisting of an important resource of lithium-rich clays formed in a geological context of a paleo volcanic caldera. This productive impulse depends on several legal and environmental

conditions (SWI, 2023) (Lithium Americas, 2023). Also, in this country, the generation of Li from geothermal fluids is being explored, for which the technology for extracting and exploiting energy already exists.

Most of China's lithium resources are concentrated in the salt lakes of the Qinghai-Tibet, where poor mining conditions converge, insufficient transport and energy infrastructure, along with proximity to ecologically sensitive areas. Deposits of lithium spodumene ore have also been detected in provinces such as Sichuan. Although it is not one of the largest producers, nor does it have the most significant reservations, China's participation in the lithium industry in the world is increasing. The strengthening of its mining companies in the industry and its preponderant role in manufacturing batteries position it as the most critical actor along the entire lithium value chain (Morales, 2022).

Increasing China's participation in new mining projects, both inside and outside China, seeks to reduce its international dependence within the framework of the so-called "dual circulation strategy" promoted by the Chinese government and according to which China will look inward to take advantage of its massive market of 1.4 billion domestic consumers, boosting local innovation to boost growth and depend less on external markets, while simultaneously balancing its dependence, boosting both national and international circulation. This strategy seeks to place greater emphasis on the internal market (internal circulation), without neglecting exports (external circulation), with a view to gradually playing a more dominant role in the new internal circulation model (Morales, 2022).

In the case of Canada, Lithium, present in pegmatitic deposits of spodumene (Rowe, 1954) and brine, is one of the resources identified as a priority in its new strategy of critical minerals of the federal government, which aims to make the country a world power for metals used in the electric vehicle industry (Government of Canada, 2023), which allows a boost in the development of lithium mining projects for this country (Morales, 2022).

Germany and Mexico are on the extreme right chart with fewer resources and few to no reserves. Germany bases its resources on the Zinwald Project, supported by the presence of the mineral zinwaldita, a potassium mica with compositional variation from Fe to Li (Graupner, 2019) for which an effective recovery of Li of the order of half of the Li content of the mineral spodumene is indicated which is relevant in the case of Australian pegmatitic deposits. On the other hand, Mexico has lithium clay in Sonora, which could enter production in 2024, provided that the projections made in that country are fulfilled, although the recent process of nationalization of this resource may delay those expectations, depending on the outcome of the revisions being made by the Mexican government, of the current lithium concessions (BNAmericas, 2022).

IV. THE SOUTH AMERICAN LITHIUM TRIANGLE

Bolivia, Argentina and Chile's lithium reserves and resources constitute the "Lithium triangle regionally" since these three countries are the largest proven reserves of Lithium on the planet, whose geographical distribution is shown in figure 6, where the salt flats of Atacama, Uyuni and Hombre Muerto respectively gather 75% of these reserves and resources.

Figure 3: General location of the "Lithium Triangle" in South America based on the distribution of salt flats with the main resources and reserves of Li in brines.



Source: Modified from The Economist (2017).

When comparing the lithium content of some salt flats with that of Atacama, it is observed that the lithium content of the latter is substantially higher than that of Maricunga and Pedernales in Chile and that of Hombre Muerto in Argentina, as seen in Figure 4, and is one of the highest Li brine salt flats in the world, with a medium to high Mg content.

Figure 4: Lithium and magnesium content in brine aquifers of selected salt flats in Chile (orange) and the world (grey).



Source: COCHILCO (2020) based on Roskill and geological reports from different countries.

The Andean and Pre-Andean Chilean Salt Flats are located from North to South, Bordering the eastern border of the country, from the Surire Salt Flat, in the Arica - Parinacota Region to the Maricunga Salt Flat in the Atacama Region, including the gigantic Atacama Salt Flat, thus covering a North-South strip of approximately 900 km, which includes 23 salt flats as shown in Figure 5 (Cabello, 2022). These salt flats correspond to saline deposits in endorheic basins, mostly of tectonic origin. Its regional geological evolution includes the placement of magmatic arcs, currently manifested

on the surface as an active N-S volcanic arc, in a context of extensional tectonic evolution with intercalations of relatively short contractional episodes and the generation of regional faults (Charrier et al., 2007).

The composition of the brine of some of these salts is shown in Table 2, where in addition to Li, the presence of ions of Na, K, Mg, Ca, I, SO₄, HCO₃ and B is observed. The composition of Li in these brine samples varies from 52 to 1,570 (ppm), presenting the Salar de Atacama with the highest concentration.

Figure 5: Andean and pre-Andean salt flats of Chile.



Source: Cabello (2022).

Table 2: Composition of lithium-rich brines in salt flats in northern Chile (ppm).

Salar	pH	Dissolved solids	Na	K	Mg	Ca	Li	Cl	SO ₄	HCO ₃	B
Aguas Calientes	7.7	81,436	25,460	1183	1361	2538	152	46,690	3154	0	474
Ascoton	7.8	153,600	45,000	3500	5125	920	186	70,000	25,000	2900	783
		47,022	13,870	1670	827	1195	82	24,000	4693	0	595
Atacama	6.6	370,000	91,000	23,600	9650	450	1570	189,500	15,900	230	440
		310,000	85,800	13,000	6350	1100	940	163,900	8540	280	360
		190,000	45,100	9000	5330	900	520	83,780	18,170	240	360
		73,000	18,220	4220	1810	360	290	36,750	3430	320	100
		62,000	14,840	2900	1930	1080	190	27,500	7900	100	88
		40,100	10,280	1690	750	1160	130	20,300	2160	92	61
Bellavista, Pintados	10.4	170,300	50,000	5403	3665	5935	85	100,600	2720	178	225
Huasco	6.0	150,100	38,000	10,000	1750	840	130	83,600	13,600	—	2200
Lugunas	6.8	390,000	126,800	14,280	3630	110	412	176,600	47,770	406	979
Punta Negra	7.1	271,900	86,000	10,000	2620	2080	320	164,500	4480	—	2230
Pujsa	8.6	89,298	28,500	1295	653	375	137	27,660	28,110	0	675
San Martin	—	102,138	28,160	2614	6252	1566	187	60,050	2490	625	426
Surire	7.5	167,200	54,000	8700	1250	750	340	79,800	20,300	90	1820
Hot Springs ^a	7.8	4357	1210	200	28	135	8.3	1905	534	150	47
Rivers ^b	7.7	152	23	2.8	4.3	1.0	0.1	22	20	33	0.7
Soil ^c	—	—	2.2	0.3	1.8	13.5	65	1.2	22.9	3.1 CO ₃	3.1

^a SiO₂ 129, NO₃ 7.4.

^b SiO₃ 45.

^c South center beach with average depth of 6 m, also 158 ppm.

Source: Garrett (2004).

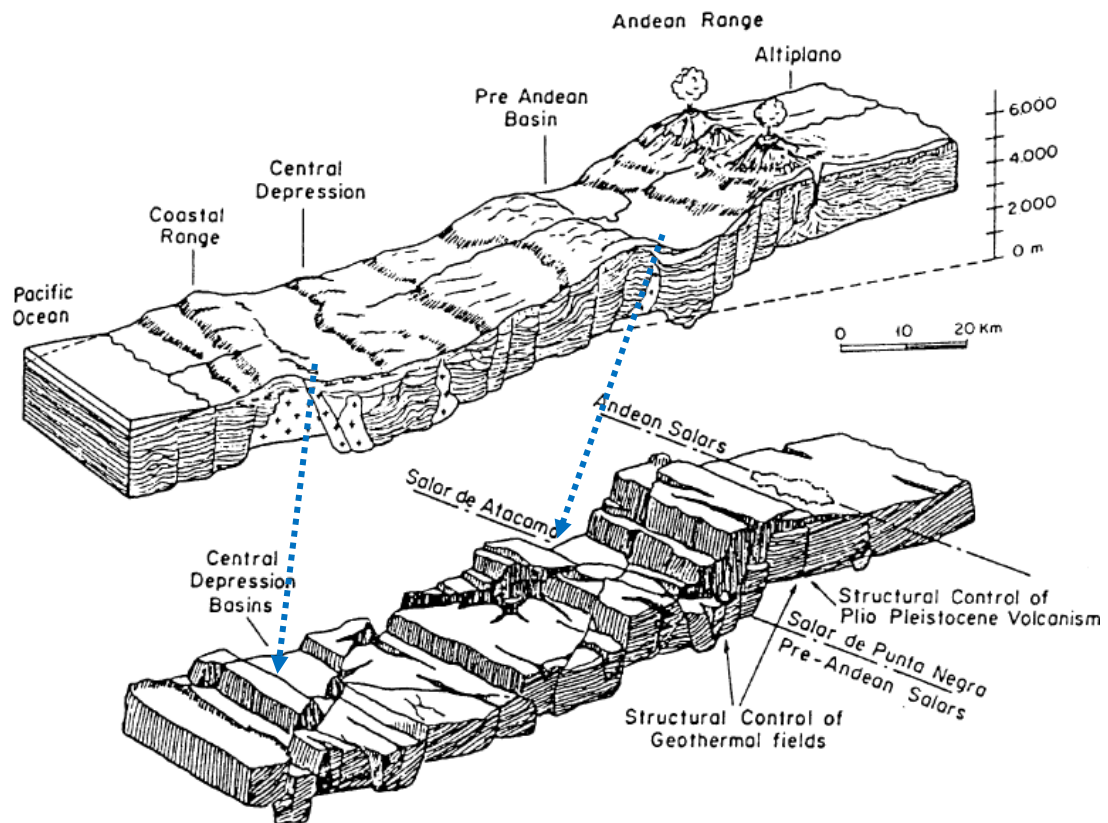
V. CHARACTERISTICS OF THE ATACAMA SALT FLAT, CHILE

The Salar de Atacama is located in northern Chile 200 km from the city of Antofagasta (Figure 3; Figure 5), in an upper endorheic basin that is 85 km long and a maximum width of 50 km, while in its southern central section is 1700km² salt, and its drainage basin area is approximately 11,800km² CORFO (1985).

The Domeyko mountain range with its extensive tertiary outcrops of gypsum and halite, known regionally as the Salt Range, borders the salt flat to the west while the high mountains of the Andean plateau border its east side and both geographical features narrow their distance to the north closing the basin of the salt flat.

30 to 50 km to the east of the Salar de Atacama there are also some volcanoes such as Camarachi, Acamarachi, Lascar, Aguas Calientes, Puntas Negras and Miñiques. The Lascar volcano with its crater at 5200 meters above sea level frequently emits fumaroles from the top of its cone.

Figure 6: Sequence of elevations of the Andean and Pre-Andean salt flats and their plateaus with their respective faults.



Source: Garrett (2004).

Figure 7: Typical salt surface of the central section of the Salar de Atacama



Source: Garrett (2004)

The brine is saturated with salt and contains varying concentrations of Lithium, potassium, magnesium, sulfate and borate in different parts of the Salar. The lithium concentration varies from about 1,000 to 4,000 ppm and averages more than 1,500 ppm for the two commercial operations in the salt flat.

Table 3 shows the composition of brines in the Atacama salt flat according to several authors, showing an average Li content of 1,500 to 2,420 ppm in the brine, with up to 60,000 to 63,000 ppm in the product, or approximately 6%, corresponding to a brine obtained after successive evaporation sequences with precipitation of various salts based on the other elements. The variations in these values are explained based on a distribution of the Li content in the brine, which varies generating zones in the 1,000, 1,500, 2,000, 3,000 and 4,000 ppm of Li by weight in the brine, with a core concentration exceeding 4,000 ppm, as shown on the map in figure 8, following table 3 of concentrations of Li and other isotopes (CORFO, 1985).

The distribution of depths of the Salar de Atacama is data that requires more research, being relevant to determine its resources and reserves better since current calculations are usually made based on a depth at which it is indeed possible to extract brine, but that is not necessarily the maximum depth at which the brine extraction can develop.

Table 3: Various brine analyses in the Atacama Salt Flat, % by weight and ppm (*).

	Minsal ^a	Garrett (1998)	CORFO (1981)	Vergara-Edwards and Parada-Frederick (1983) ^b	Brown and Beckerman (1990) ^c		Orrego <i>et al.</i> (1994) ^d product
					Brine	Product	
Na	6.50	9.10	8.00	7.60	7.17	770*	570*
K	3.13	2.36	1.84	1.79	1.85	190*	160*
Mg	1.30	0.965	0.93	1.00	0.96	1.29	1.92
Li*	2420	1570	1500	1600	1500	63,000	60,000
Ca*	530	450	300	245	310	530	—
Cl	17.30	18.95	15.90	15.66	16.04	34.46	35.10
SO ₄	0.80	1.59	1.70	1.90	1.46	166*	220*
B*	556	440	600	685	400	7300	6270
Br*	—	—	—	—	50	—	—
HCO ₃ *	600	230	—	—	—	—	—
Density	1.227	—	—	1.226	—	1.250	1.252
pH	—	—	—	—	—	6.50	—

^a Dear

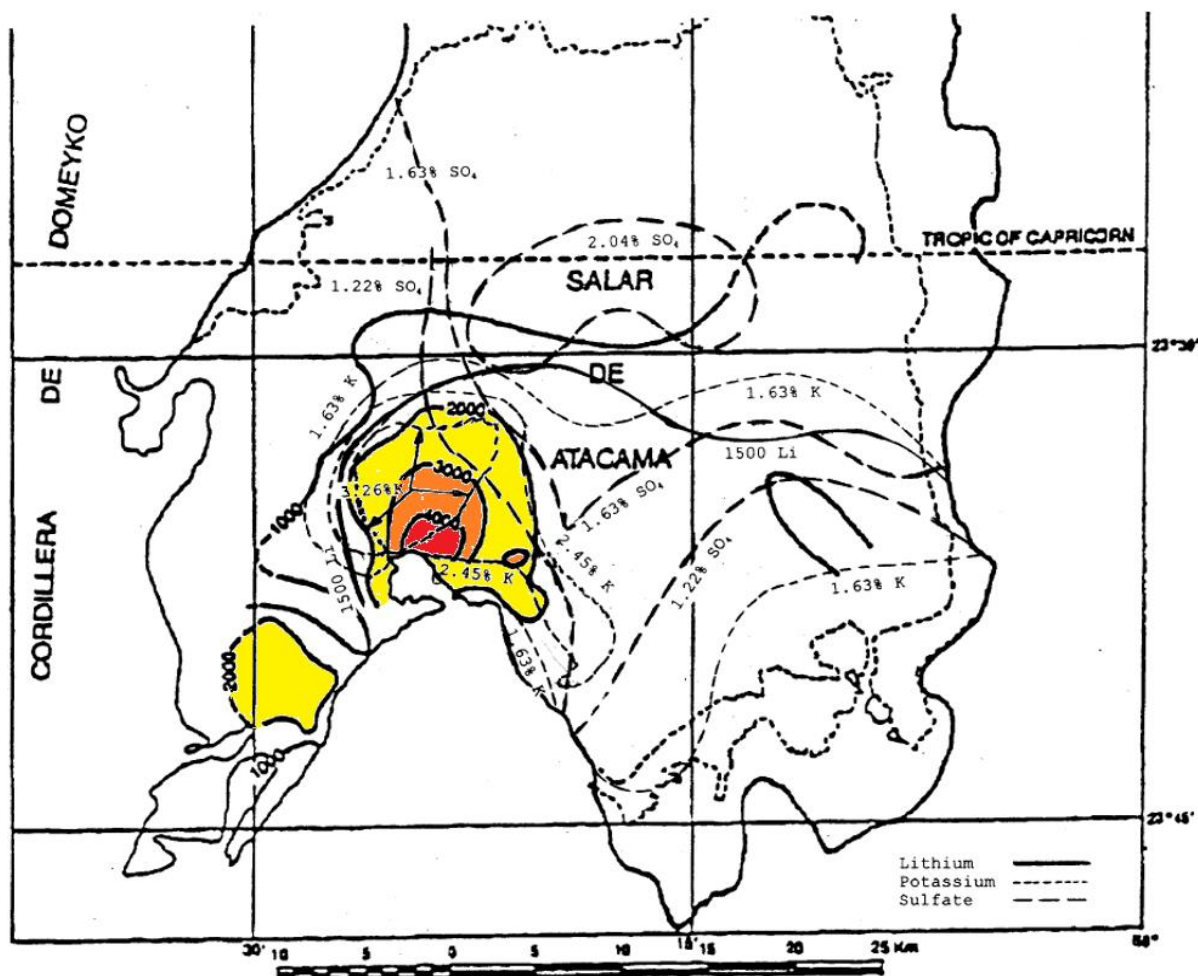
^b Brine km- 20

^c Patent transferred to Foote

^d Final brine from the solar pool.

Source: Garrett (2004).

Figure 8: Map of concentrations of Li, K and sulfate in the Salar de Atacama. In yellow colour, concentrations are between 2,000 and 3,000 ppm of Li; in orange, concentrations are between 3,000 and 4,000 ppm of Li and in red, concentrations of about 4,000 ppm of Li by weight in the brine.



Source: Modified from CORFO (1985).

The maximum temperatures in the geographical location of the Salar de Atacama vary approximately between 20°C and 32°C while the minimums oscillate approximately between 3°C and 14°C for the year 2019, according to data of the Directorate General of Waters of Chile, DGA. In addition, the humidity of the air varies between 67% and 73%, being these data of importance for the design of solar pools since they are variables of interest in the evaporation of the brine.

VI. PRODUCTION OF LITHIUM FROM PEGMATITES AND BRINE IN SALT FLATS

There are currently two predominant process routes for obtaining the different lithium products, which are commercially used worldwide and are profitable for the process. These routes share stages that seek the same objective; however, they can be differentiated in the form of extraction (González, 2000), where the route for pegmatite is based on the extraction and processing of lithium minerals, while for the brine contained in salt flats, Li is initially obtained through precipitation stages.

While in pegmatites, the initial lithium oxide content goes 0.5% - 2.5% by weight, on the other hand, brines have average concentration levels of Lithium in a range ranging from 250 ppm and 2,000 ppm (COCHILCO, 2018), and even with point values over that range.

- **Metallurgical processing from lithium ore minerals:**

The stages of the process for the extraction of Lithium to obtain a Li mineral concentrate with 85% to 95% spodumene are, in general terms: Crushing - Grinding - Classification - Concentration of Li ore by flotation - Cleaning - Drying (911Metallurgist, 2023). The Li Mineral Concentrate is then transferred to a chemical plant, where lithium products are obtained through a sequence of Roasting - Leaching - Purification - Lithium carbonate precipitation - Li_2CO_3 Centrifugation (Bazaes, 1984).

- **Metallurgical processing from Atacama Salt Flats:**

The brines of the Salar de Atacama have a high concentration of Lithium with an average of 0.15% of Li, with historically obtained maximum values of up to 0.4% of Li by weight (CORFO, 1985) and a moderate ratio of Mg/Li, compared to other salt flats, either in operation or in an advanced project state, in addition to an important co-production of K salts and high-quality reserves.

Other advantages are its high radiation rate as well as wind conditions and air dryness, comparatively favourable compared to other Lithium producing salt, which favours solar evaporation. There are also sporadic rains due to the Bolivian winter, so the dilution of the brine in the solar pools is low. In the region where the Salar de Atacama is located, there is good infrastructure for road access and easy access to ports.

Thus, the production costs of the process of obtaining concentrated pickles in Lithium are low for the Atacama Salt Flat when compared to processes that require energy sources other than solar or as in pegmatites where energy is consumed in the process of mineral comminution, as in the case of the production of the spur of Australian industry.

In the production process of the Atacama Salt Flat, brine is pumped from extraction wells to a solar evaporation pool system, where the brines increase their concentration in a continuous process and successive stages throughout 14 to 15 months, from approximately 0.2% lithium to about 6% lithium by weight. During concentration, impurities such as sodium, potassium and magnesium salts are removed. These impurities crystallize in ponds sequentially using sylvinites to produce potassium chloride.

Feeding to the ponds is a mixture of brines such that it allows to avoid or minimize the precipitation of lithium salts; said brine concentrated in Lithium is a solution of lithium chloride with certain remaining impurities. This brine, enriched in Li, is transported to a chemical plant near Antofagasta for further final purification removing boron by solvent extraction and then eliminating magnesium in two stages, such as magnesium carbonate and magnesium hydroxide.

Finally, the purified brine is treated with a sodium carbonate solution, where hot lithium carbonate is produced by precipitation, which is filtered, washed and dried. The product must be marketed mainly in the form of granules with a minimum purity of 99.2%, with a battery grade of 99.5%.

Rockwood, currently Albemarle, also produces lithium chloride, obtaining a high-purity product from recrystallized lithium carbonate and another technical grade directly from the refined brine, whereas SQM also obtains lithium monohydrate hydroxide from a fraction of lithium carbonate.

In general, Lithium generated in Chile, in the Atacama Salt Flats, and Argentina, in the Dead Man Flats, has low production costs compared to brines generated in other latitudes; however, the acquisition time is much longer since solar evaporation is a process of obtaining "free" but slow energy. These evaporative processes allow to obtain the product in one to two years while a chemical-

mining plant, for example, associated with Pegmatita does so in one to two months, which gives Australia a greater capacity to increase its production since it is based on this type of resource and that has allowed it to surpass Chile and position itself in the world's first productive place.

As previously explained in detail, the brine, after evaporation and fractional precipitation processes, manages to concentrate up to 6-7% by weight in Lithium in solar pools, to subsequently produce lithium carbonate or hydroxide in chemical plants.

It is necessary to emphasize that Atacama brines have different compositions of Lithium and other species in solution, such as sodium, potassium, magnesium, chlorine and sulfate ions, among others, some of which add value to the business, such as K and B giving rise to other products of which K's salts were relevant for several years. The brine is provided by a large number of productive wells, which provide some brine flow and a certain composition in each case. This brine must be combined in such a way as to satisfy the compositional ranges of each ion if production by solar evaporation route is desired. That is, the brine restrictions in their composition so that they can go into the production process and therefore not just any brine to use if proper processing is desired conducive to producing Lithium.

If brines are used, for example, rich in sulphate, one of the ions present in solution, the solar pools do not provide the desired evaporation route; that is, they precipitate other salts in the pools that do not allow to obtain Lithium in this way, generating challenges in the productive process. The Salar de Atacama has an appreciable amount of brines with wells high in sulfate so when resources and reserves are calculated, it is not so direct to establish how much of that brine, using these processes, can be conducive to lithium production.

VII. WORLDWIDE LITHIUM USES AND MARKET

The reason why the demand and price of the Li have increased in recent years is the manufacture of electric rechargeable batteries for electromobility, whose main applications in this line are in the design of light and heavy vehicles, e-bikes, and scooters, among others. Electrical devices such as laptops, tablets, and telephones, among others, also require light, rechargeable and portable batteries.

Also, the Li has other applications, such as the manufacture of glasses and ceramics, giving it mechanical properties and avoiding the fracture of the glass with heat. When incorporating Lithium in the composition of the glasses, these present a lower thermal expansion and lower fire temperature. Li is also used as an additive in greases and lubricants, allowing applications at varying temperatures and conditions, as well as for air conditioning devices, the aluminium industry, chemical and metallurgy, lifejackets, pharmaceuticals and the manufacture of plastics and polymers. Another use that is considered strategic in Chile's Mining Code is the use of one of its isotopes in nuclear power production processes.

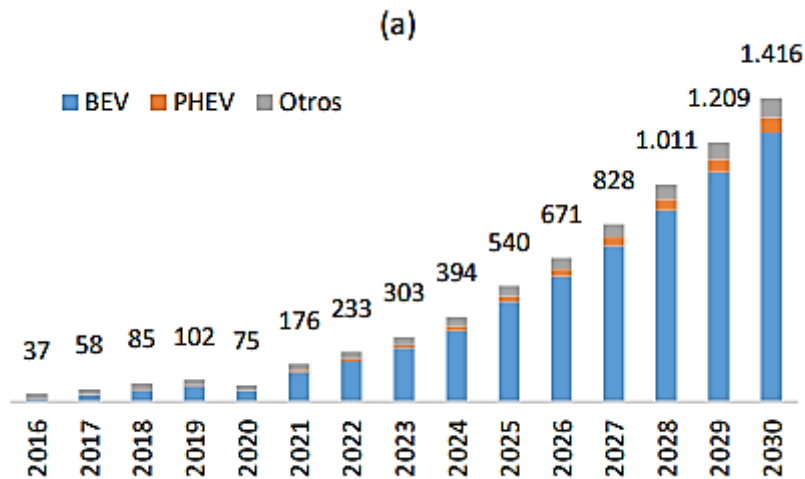
The main mining product in Chile remains copper. Lithium, despite being called "white gold" represented for years a minor mining market compared to the "red metal" in Chile, which had a significant change in the period 2021-2022. Li acquired significant importance for the Economy of the country due to the increase in the price of Lithium. As the market for Li batteries and electric cars grew, prices of lithium carbonate transported by sea increased by 440% since the beginning of 2021, while lithium hydroxide prices have risen by about 250% during the same period, although they have shown a decline between November 2022 and February 2023 from a maximum value of almost 600,000 CNY/tm to almost 470,000 CNY/tm of lithium carbonate (Trading Economics, 2023).

Increasing demand for Lithium is estimated over the next ten years, with increasing values of lithium hydroxide than lithium carbonate. Figure 9 presents, in agreement with the Chilean Copper Commission, COCHILCO, the demand for Lithium for electric vehicles and the expected scenario

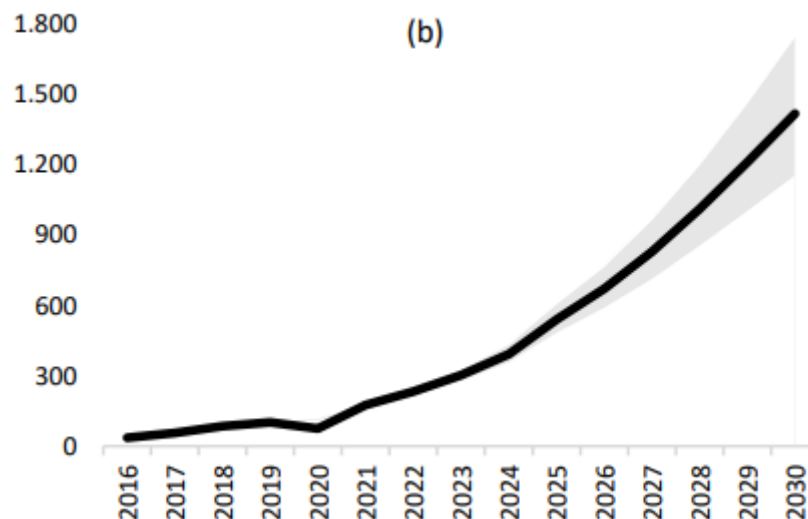
projected with its maximum and minimum, a study carried out in 2020. Figure 10 presents demands that are not associated with the electric vehicle, such as electronic devices.

Figure 9: Worldwide lithium demand, where BEV=All-electric cars; PHEV=Hybrid cars

(a) Lithium demand for electric vehicles in thousands of tons in lithium carbonate equivalent (kt.LCE).

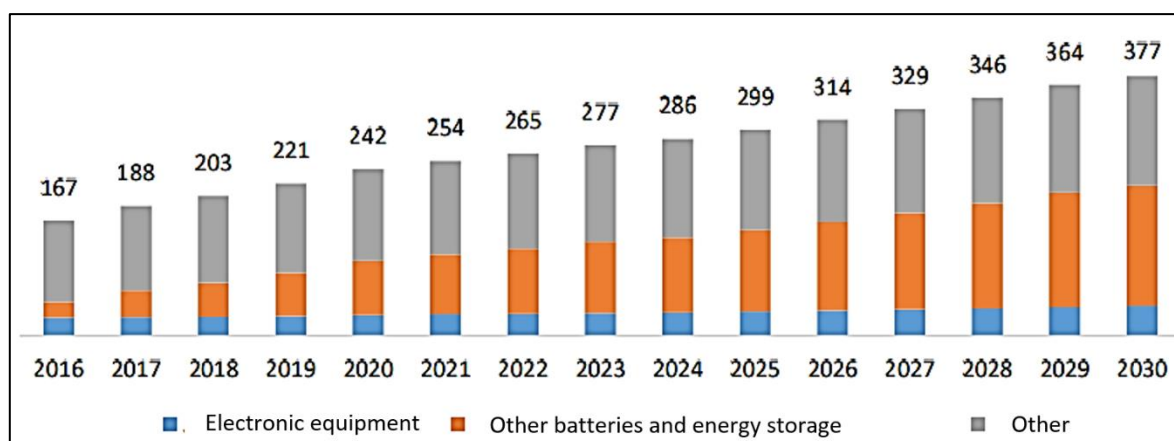


(b) Demand with expected, maximum and minimum scenarios in thousands of tons of lithium carbonate equivalent (kt.LCE).



Source: COCHILCO (2020)

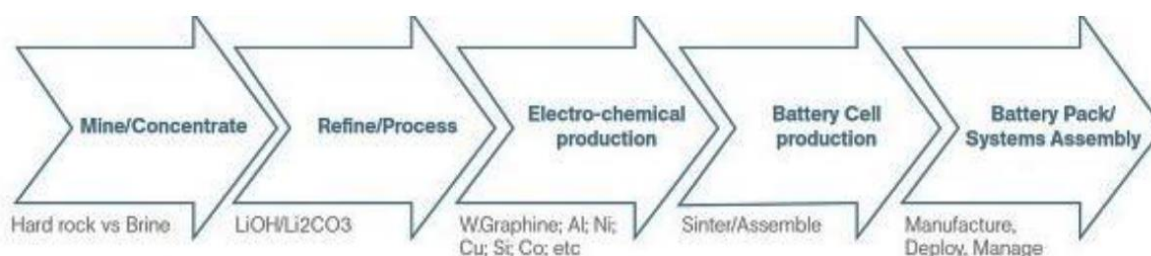
As can be seen, in a scene towards 2030, lithium demand associated with electromobility would reach 1,416 kt of LCE.

Figure 10: Lithium demand not associated with electric cars (kt. LCE)

Source: COCHILCO (2020) based on HSBC, Roskill and other market sources.

In the graph above, markets such as cellular telephony or laptops, grouped under the category "Electronic equipment", as well as the market for relatively traditional Lithium use, grouped under the category "Other", are considered mature markets, so they have a lower growth projection than the battery market indicated in the chart as "Other batteries and energy storage", which includes the case of electric cars and whose production has been steadily increasing over time.

These lithium demand projections are framed within the Lithium added value chain in the context of battery production for the electromobility market, which is composed of five stages: raw material extraction - refining/processing - electrochemical production - production of battery cells - assembly systems/ battery pack, illustrated below.

Figure 11: "Lithium Value Chain" flow.

Source: Morales (2022).

A possible threat to the growing lithium market is the development of sodium batteries, currently under investigation; metal is much more abundant than Lithium, but it may take several years to achieve mass production of this kind of battery, and until that is achieved, it is reasonable to project a growing market for Lithium for the next ten years.

VIII. Lithium production in Chile in the medium term

In the short and medium term, Australia will continue to produce Lithium from its minerals and has greater production capacity than Chile, as Australia has been attracting even foreign investment. Lithium production in Chile could grow in the short term if the private companies that currently own the resource expand their production or if new resources enter the scene. Given that the State of Chile is promoting a plan aimed at developing a national lithium company, there are uncertainties that can curb potential new private investments since, according to this new approach, the Chilean National

Mining Company, ENAMI, would promote the production of lithium salts, nitrates and their derivatives.

Apart from the Atacama Salar, there are other smaller salt flats in Chile, such as Maricunga and Pedernales, whose resources and reserves of Lithium are smaller. The Salar de Maricunga was investigated by different private and State companies for its exploitation some years ago, including with environmental impact studies presented to the Servicio de Evaluación Ambiental de Chile, SEA and approved with its corresponding Resolution of Environmental Qualification, RCA.

In the Salar de Atacama, the current production is in the hands of private companies, SQM and Albemarle, which have the potential to change Chile's position in the world market if they increase their productive capacity. SQM and the Corporación Chilena del Cobre, CORFO, have already agreed, via CEOL, the production of Lithium until 2030, where it was agreed that the company SQM increase its capacity from 45 thousand tons per year to 150 kt.LCE. Albemarle recently inaugurated its new chemical conversion plant La Negra III, which has the capacity to double its lithium production. Thus, these companies can expand Chile's lithium production.

In 2016 and 2018, the Chilean State, through CORFO, negotiated new contracts with Rockwood, current Albemarle, and SQM, establishing royalties through a progressive and marginal staggered commission rate, from 6.8% to 40%, for lithium carbonate and hydroxide, as shown in Table 4. Conditions were also established for other products, such as potassium chloride, magnesium chloride, sodium chloride, boric acid and others.

CORFO's estimates for 2018 indicated that the new contracts would generate additional resources for Chile, which between 2018 and 2030 would be more than USD 12 billion, distributed in:

- USD 10.9 billion for the State in taxes and royalty
- USD 981 million for the Antofagasta region
- an R&D contribution of USD 352 million.

If the incremental values of the Albemarle contract for the period 2031 to 2043 are added, Corfo's projection indicates that a total of approximately USD 16 billion would be reached.

Table 4: Commission rate per sale of lithium compounds, based on contracts of Albemarle (2016) and SQM (2018), according to price range of Li carbonate and Li hydroxide, in US dollars per metric ton of such products.

Price Range (USD/TM)		Staggered, Progressive and Marginal Commission Rates (%)
Lithium Carbonate (Albemarle and SQM) Lithium Hydroxide (Albemarle)	Lithium hydroxide (SQM)	
0 – 4,000	0 – 5,000	6,8
> 4,000 – 5,000	5,000 – 6,000	8
> 5,000 – 6,000	6,000 – 7,000	10
> 6,000 – 7,000	7,000 – 10,000	17
> 7,000 – 10,000	> 10,000 – 12,000	25
> 10,000	> 12,000	40

Source: García (2021), Poveda (2020) and CORFO (2018) based on contracts with Albemarle (2016) and SQM (2018).

The value for lithium carbonate, on which the Chilean State charges a 40% commission rate, is 10,000 USD/tm, a value that a few years ago was very high, but that already the year 2022 was exceeded by reaching values of the order of 75,000 USD/tm (World Energy Trade, 2022), although this price could fall in the period 2023-2024 if all Li production projects are realized worldwide and provided that supply can comfortably meet the growing demand for this product.

In the case of SQM, it reports that in 2018 it contributed to the State of Chile by way of taxation (royalty) of rent for the exploitation of mining belongings administered by CORFO, an amount equivalent to USD 85,165,000 which is 640% higher than the USD 11,452,000 contributed to the Chilean Treasury in 2016, while for the period 2001 - 2020, the amount for this item amounts to USD 361,961,000 (García, 2021).

In addition, the new contractual conditions indicate, among other conditions, the following (García, 2021) and CORFO (2018):

- The new LME quotas are subject to the condition of building a new battery-grade lithium product plant. In the case of Albemarle, the plant must be 24 million metric tons of Li_2CO_3 in Region II, with an estimated investment of USD 300 million and to be built until December 2022, while the SQM of 50,000 million metric tons, to be built until January 2023. In the event of default, Albemarle was required to reduce the term of the contract and the new lithium quota, whereas SQM only the reduction of the new quota.
- Unilateral and irrevocable contribution of annual financial resources for technological R&D entities oriented to innovation in solar energy, lithium salts, or products of the Atacama Salt Flat and in metallic or non-metallic mining.
- Preferential prices of lithium products to domestic producers to promote the establishment of specialized producers of high-added value in the country, marketing low value-added products was prohibited (raw, concentrated and/or refined brine or any degree of concentration) since this was a problem that had occurred previously.
- Access to operational, financial and environmental information.
- Anti-corruption rules are to be adopted by companies since this problem had occurred previously.

These agreements have had a positive result for Chile, but nevertheless, in its current political context, there is the possibility of the total nationalization of production. CODELCO is in Chile a state-owned company with an important participation in the copper market nationally and internationally, being a successful company that has nourished the fiscal coffers of the Chilean State for almost five decades. CODELCO has been a success, and one of its subsidiaries, MOLYB, processes Molybdenum and Renio, products subordinated to copper, in which Chile has had important worldwide participation for some years. CODELCO is thus a benchmark that allows, in a first approximation, to think that if Chile has managed to develop a successful state enterprise in the copper market, then it could also replicate such a model for lithium resources.

However, there are significant differences between the production of these two resources since the copper industry is generally open and easily accessible, with many professionals who know their processes and tasks in Chile, with growing but affordable environmental and energy challenges, while the lithium industry is hermetic, with little information and few professionals who know the production processes, several of which have developed research and advances in process control, but under conditions of confidentiality. Lithium mining in Chile is not trivial, and its processes are not related to conventional metal mining since it is based on salt and brine separation, which is very different from the extraction of minerals seen in copper mining.

Thus a possible nationalization of lithium production in Chile poses a greater challenge than that faced by CODELCO in the case of copper since its processes are different from those of conventional metal mining and the critical know-how is still in the hands of private companies, although the contracts developed by CORFO in 2018 include options to public access such knowledge.

On December 30, 2022, through the Compañía Nacional de Minería, ENAMI, the current government of Chile has constituted in the real estate conservative of Santiago the society "ENAMI LITIO SpA", as a simile of CODELCO the state copper company, but in this case for Lithium. The question, in this sense, is whether the State can perform the task of producing Lithium more efficiently than the private companies currently in operation and whether this alternative will generate more benefits for the country.

The answer to questions arising from previous situations is not trivial. In recent times the private sector has increased its tax contribution to the Chilean State by exploiting the non-renewable lithium reserves of the Chilean territory, which obviously cannot be free, especially if it generates environmental impact and can affect communities, thus requiring appropriate environmental rating processes, according to current regulations in Chile.

SQM's contributions to the State of Chile reached US\$3.6 billion in the third quarter of 2022 and exceeded CODELCO's transfers. SQM reported historic results, with profits of over US\$2.7 billion, ten times more than the previous year, 2021, which was reflected in an unprecedented growth in the contribution to the Treasury due also to the renegotiation of the contracts signed in 2018 by the exploitation of the Atacama Salt Flat (Emol, 2023).

IX. FEASIBILITY OF PRODUCING LITHIUM-BASED TECHNOLOGICAL PRODUCTS IN CHILE

Regarding the possibility of producing lithium batteries in Chile, it should be noted that the country generally possesses its lithium know-how in productive enterprises, mainly of lithium carbonate, rather than in the scientific academy, but it has virtually no experience or industrial infrastructure to produce lithium batteries and their components.

The manufacture of lithium batteries requires approximately 7% Li while it requires approximately 83% of other components, and the assembly of a battery is done by several companies that generate these components based on steel, plastic, aluminium, copper, graphite and cobalt including their final assembly, as for example in China. Producing batteries in Chile means competing with China and other emerging Asian manufacturers, which have a developed and experienced industry already being very competitive, given its learning curve over time. It has always been possible to manufacture lithium batteries in Chile with the right investment; the issue is at what cost and if its quality can compete with that of batteries produced in Asia.

In this area and sector, the competitiveness is extremely demanding, and everything indicates that at the country level, Chile is at a marked disadvantage to enter to participate in the market of lithium batteries. Although there are national incentives to development projects funded by the Agencia Nacional de Investigación y Desarrollo Chilena, ANID, the research groups dedicated to Lithium are currently small, and in particular, those dedicated to the study of lithium batteries do not reflect a critical mass that allows establishing even the bases to build a competitive industry.

The proposal to manufacture batteries in Chile requires an explanation of how it would be possible to develop the industry of these goods competitively. In Chile, there is no industry associated with the manufacture of lithium battery components or assembly. Nor does Chile have all the raw materials for Li's batteries since, in addition to copper that it has in abundance, Chile only has natural resources of cobalt, which are being re-explored and specific occurrences of graphite with low level of exploration. It lacks natural resources of aluminum but this metal has a well-established market from Brazil close to Chile. Large Chilean mining traditionally concentrates on metallic minerals and produces metals, acting as a supplier of raw materials and in that it owns a world-class industry.

In view of the above, it is not trivial that groups of entrepreneurs bet and invest in the development of lithium batteries, given that competition with countries and economies of great volume carries high risks. To make all of this a reality, from a state industry, the initial bet should be to form alliances with companies that have that experience. In 2018, the State, through CORFO, made an effort, and although there were stakeholders such as Samsung SDI - POSCO and the Chinese company Fulin group, that tender did not prosper. The private company Molymet, which in Chile is a producer of products subordinated to copper such as Renio and Molybdenum, is the company that has shown interest in generating lithium battery components and could move in this direction, as a CORFO tender was awarded in 2019 allowing it to manufacture Lithium from Albemarle.

According to COCHILCO in its report "Lithium supply and demand towards 2030" (2020), four disadvantages can be distinguished from the objective of producing lithium batteries in Chile:

- **Location of battery producers:**

There is already an established production chain in Northeast Asia. As a result, the possibility for an Asian manufacturer to seek supply and demand of Lithium by 2030 to settle totally or partially in Chile would cause a geographical disruption in its production chain, which would increase its costs and time.

- **Location of consumers:**

They are mainly the largest economies in the northern hemisphere, including China. Then, the establishment of a manufacturing centre in Chile would imply greater transfer times of final and intermediate products.

- **The primary lithium product type:**

Producers progressively prefer lithium hydroxide over carbonate. However, Chilean manufacture consists mainly of this second type.

- **Production costs:**

For a standard lithium-ion battery, the cathode value represents 31% of the total cost and the lithium value 8% (COCHILCO, 2018). That is to say that 2018 was not a dominant cost, and therefore purchasing companies of lithium carbonate and hydroxide could accept price variations in this input, but currently, the price has risen significantly, so Lithium now has a bigger share in the cost of battery materials.

Within an electric vehicle as a final product, the proportion of the cost of the primary lithium product is logically even lower. By way of reference, estimates have been made that a decrease or increase in the price of lithium carbonate of one thousand dollars a ton would represent a saving of only 50 dollars or equal additional value respectively per unit, based on a Tesla Model 3 car, with 50kWh battery at 2018 prices (COCHILCO, 2018).

X. RECYCLING OF CAR LITHIUM BATTERIES

From an environmental perspective, the challenge of battery recycling also arises. The Battery Stewardship Council (BSC), created in Australia to oversee the recycling of used batteries, as otherwise, this would be too costly for private industry, at least in its initial stage, indicates that recycling will become a pressing problem by the end of the decade as batteries in electric vehicles begin to reach the end of their life. Most of the materials that make up Li batteries, such as steel, plastic, aluminium and copper, are easily recoverable. The rest, the so-called "black mass", which includes Lithium, graphite and cobalt, has more difficult processes for its recovery, being cobalt one of the constituents with a high potential for contamination (Kurmellov, 2022).

It is advisable to follow closely the recycling model developed in Australia for a possible extension to other countries, especially if Australia manages to build the appropriate infrastructure and methodology to avoid this problem, particularly because in a territory of continental size, distance is a challenge and having to collect, transport and classify materials in that context is difficult and costly.

Scalability may also be relevant, towards the recycling of Li batteries for electromobility, from experience gained in the recycling of batteries used for purposes other than electromobility and which has led to the secondary production of Lithium, an industry that has already developed some processing capacity. According to Roskill (2020), 53 lithium-ion battery recycling centres were counted in 2019, 24 in China, 9 in Europe, 8 in North America, 6 in South Korea and 6 in Japan. In Europe and the USA, most centres are separate businesses, while in Asia, they are relatively integrated. In China, in particular, they are connected to manufacturers of batteries and electric cars (COCHILCO, 2020).

Similarly, lead acid batteries used in conventional vehicles (diesel and gasoline) are now almost 100% recycled in Europe, Japan, the United States and other countries, becoming one of the products with the highest recycling rate in the world (Poveda, 2020).

If appropriate policies and methods are established, then in the future, the recycling of Li batteries used in electromobility, also called "Urban Mining", should appear as one of the secondary sources of Li and its other components.

XI. LITHIUM IN NUCLEAR ENERGY

The United States Department of Energy announced a major scientific breakthrough in nuclear fusion technology on Tuesday, December 13 2022. Researchers at the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory in California first achieved a "net energy gain" using nuclear fusion in a laboratory. " This is a historic milestone for researchers and staff at the National Ignition Facility, who have dedicated their careers to making nuclear fusion a reality, and this milestone will no doubt lead to more discoveries," said the US Secretary of Energy. UU., Jennifer M. Granholm. "In short, this is one of the most impressive scientific achievements of the 21st century" (Seisdedos, 2022), being this milestone good news for the lithium market because this will boost the need for energy storage.

Lithium isotopes are known to play a key role in nuclear fission and fusion processes. Lithium-7 is used in pressurized water fission reactors to control the chemistry of their circuits. Thus, in nuclear fusion, Tritium is generated, a rare element in nature, from Lithium that is more abundant than Tritium. Tritium and deuterium allow the nuclear reaction and thus obtain energy by forming helium.

However, the importance of Lithium for nuclear energy is rather strategic, given that its isotopes are used for specific purposes in the nuclear power production process, this being a smaller-scale business in terms of sales, lithium salts for productive enterprises.

Chile is unlikely to diversify its energy matrix by betting on nuclear energy since the country opted for Nonconventional Renewable Energies, NCRE, to increase its electricity supply; however, the Chilean Nuclear Energy Commission (CCHEN) is one of the Chilean public institutions that has historically had a technical opinion regarding the marketing and production permits of Li, so that the classification of Li as a strategic resource, based on its usefulness in stages of control of nuclear power generating processes, has been a dominant factor for its current production model.

XI. CONCLUSIONS

From the geological point of view, the Salar de Atacama is an important part of the South American Lithium Triangle and the Andean and Pre-Andean Salt Flats that border the eastern limit of Chile and constitutes a porous saline body with an important concentration of Li in its brines, located in an endorheic basin.

The occurrence to the east of this strip of an active volcanic chain indicates a potential for geothermal fields that could be contributing to the Salar de Atacama, along with the different ions that accompany this resource, such as K and B, which do not necessarily all come directly from the geothermal field, as there is also the possibility of interaction of underground fluids with rocks, through which they circulate before reaching the Salar, so these ions can also be brought to brines by natural underground leaching processes. In this sense, the participation of rainwater in the Bolivian highlands also plays an important role in its integration into groundwater and surface runoff.

There are factors that can positively affect the resources and reserves of salt flats in Chile. It will probably be necessary to modify processes in the future, adjusting them according to the abundance of the ions that compose the brines in these salt flats to expand the productive capacity, incorporating non-productive brines with the current processes. Similarly, the resources and reserves of the Atacama Salt Flat are defined for a specific extractive depth, but the detailed topography of the bottom of the Atacama Salt Flat requires further studies since if it is greater than what is considered in the extractive design, then this can increase your resources and reserves. On the other hand, a negative modifying factor for a recalculation of resources and reserves is the environmental impact on the ecosystems associated with the Salar de Atacama, given that the exploitation method is based on an anthropic increase in brine evaporation, which obviously should decrease the availability of water from the salt flat.

It is also important to know the historical evolution of salt flat and how it has responded to extractive processes over time in order to know the critical extractive conditions that undermine the productive capacity of the salt flat or that allow operating this mineral resource as a renewable one, or in order to extend its productive life to the maximum possible.

Therefore there are important questions to be solved to evaluate the annual productive capacity of the Salar de Atacama and its prolongation in time as a mineral resource of Li, such as the topography of the bottom of the Salar, the circulation of the brines before reaching the Salar de Atacama, its flow into the body of the salt flat and both the variables and the physicochemical processes that may be favouring a possible increase, or enrichment, of the concentrations of Li in the salt brine.

If the interest of the Chilean State is to position itself in the chain of the added value of Lithium as an active and permanent actor in time, then similar investigations are required for the various salt flats with the potential to obtain Li from their brines.

The impact of Li's production on the Chilean Economy has been significant, especially since 2018, thanks to the new contractual conditions with SQM and Albemarle and the significant increase in Li's price, as well as the increase in its production. The contribution made by the state-owned company CODELCO to the Chilean fiscal coffers is thanks to its production of copper, the metal that has also had a scenario of high prices.

Both lithium and copper resources position Chile as a relevant player in its global production, as well as in rhenium, molybdenum, iodine and natural nitrates. There are specific but favourable precedents in Chilean territory for the existence of other resources necessary for the manufacture of lithium batteries, such as cobalt and graphite, so further exploration and evaluation is needed for possible incorporation into a Li battery production model.

The intention of the Chilean State to incorporate Chile into the value-added chain of Lithium for the manufacture of batteries for electromobility means several challenges, among which are to achieve an appropriate transfer to the public sector, the knowledge needed for the extraction and production of Lithium in solar pools, which is currently in the hands of the private companies SQM and Albemarle.

Although the current contractual conditions via CEOL between the Chilean State and these companies are aimed at making progress in achieving this objective, relevant questions arise on this point and as a result of these reflections: (a) Is it possible that Chile, in a short time becomes a competitive country in the final lithium products industry? ; (b) Does Chile have groups with the appropriate experience in innovation, development and technology transfer to reduce the productivity gap with other lithium battery producing countries? For the Chilean State to be able at some point to give a positive answer to these questions, a strong investment in research, innovation and development is actually required.

The public expectation that Chile will transform itself into a competitive economy and generate added value is high, and there is consensus on this; however, everything suggests that in Chile, preparation is still required for an incursion into this large market.

There is considerable public and political controversy in Chile regarding the option of nationalizing the exploitation of Lithium, and everything points out that this uncertainty could affect private investment in the production of salts in the Salar de Atacama or in other projects, either in Salares or other types of sites to be explored.

If a nationalization process in Chile leads to the immediate expropriation of the mining companies that have the lithium rights agreed upon with the State, it is possible that national and international litigation may arise, further curbing the potential inflow of private investment capital into the exploration and exploitation of Lithium, and curbing options for transferring knowledge from the private to the state sector, unless private companies do not comply with such agreements, which would facilitate the option of statization. However, the profits obtained in 2022 by private companies operating in the Atacama salt flat were significant, so they should not face economic restrictions to comply with these agreements.

Another option for the development of the Li industry in Chile is to generate a model similar to copper where public and private companies participate, which, in the case of Li, private companies would participate parallel to State companies via CEOL. This would make it easier for projects in Chile to move forward and not create unnecessary obstacles. Thus the State can start lithium production activities, for example, in the Maricunga Salt Flat, where CODELCO also has mining property, learning from the Li's productive business and strengthening state production capacity. In Salar de Atacama, the SQM concession expires in 2030, and the next discussion is whether there will be a tender or whether the State will directly fulfil this role of exploitation and marketing.

In general, drastic changes in industrial production models tend to lead to productive breakdowns, as new management and operating systems may not achieve adequate production conditions because they lack the necessary experience. The productive models require time to assimilate the transformations, and the analysis of the decisions to be taken by the Chilean State must consider the necessary times for a successful adaptation.

In addition, in Chile, there are still open options for exploration for new Li resources, both in Salares and in other possible types of deposits, and experience indicates that mining exploration of a resource in a territory is more likely to succeed if different actors with different concepts, models and exploration techniques participate in such a challenge.

The latter is a plus point for the option of maintaining a public-private model in Chile, similar to copper, but with specific conditions for the exploitation of the Li, where private and State companies that adequately comply with these conditions participate, in which specialized Chilean public institutions such as COCHILCO, CORFO, CCHEN, SERNAGEOMIN and DGA continue to participate, among others, contributing knowledge to the technical-economic analysis of this challenge.

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DYNAMIC LINKAGES BETWEEN GREEN FINANCE, ENVIRONMENTAL RESPONSIBILITY, CLEAN ENERGY AND GREEN TECHNOLOGY: EVIDENCE FROM PARTIAL AND MULTIPLE WAVELET COHERENCE

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INTRODUCTION

In recent years, sustainable economic development has garnered significant attention, as it has become increasingly clear that environmental pollution is a critical consideration for achieving long-term economic growth and promoting the well-being of the population at large. Not only does pollution pose serious health risks for individuals, but it also exacerbates the depletion of natural resources and the frequency and severity of natural disasters caused by rapid climate change.

Green finance is a new concept that provides an alternative financing route for individuals, companies, and governments who are keen on investing in or financing green activities or low-carbon initiatives (Huang et al., 2019). Green finance promotes sustainability by providing financial resources and services to support environmentally friendly projects and activities and aligning financial systems and practices with environmental and social sustainability goals. Green finance is a broad and evolving field that seeks to align financial markets with sustainability goals while also promoting economic development and social responsibility. Green finance encompasses a wide range of sectors and financial products, which can be broadly categorized into three groups: infrastructure finance, financial support for industries and firms, and financial markets. Within the context of climate change, green finance can include investments in both mitigation and adaptation efforts.

Green finance can be defined from different perspectives. For instance, Höhne, Khosla, Fekete, and Gilbert (2012) define green finance as a broad term that encompasses various financial activities related to sustainable development projects, environmental products, and policies that promote a more sustainable economy. Green finance is not restricted to climate finance and encompasses a broader set of environmental objectives, including industrial pollution control, water sanitation, and biodiversity protection, in addition to climate change. Mitigation and adaptation finance, on the other hand, are specifically linked to activities related to climate change. According to Liu et al. (2020), green finance considers social responsibility and environmental protection as fundamental to its development. It has emerged as a new growth driver and a key contributor to advancing the green economy.

Green finance offers several benefits for both investors and the environment. First, green finance allows investors to support sustainable economic growth while generating financial returns. This is particularly important as more investors seek to align their investments with their environmental and social values (Li et al., 2021). Second, green finance provides a way for companies to finance green projects and improve their environmental credentials. This can help companies to attract environmentally conscious customers and investors, as well as improve their reputation (Tang &

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Zhang, 2020; Barber et al., 2021). Third, by financing green projects, green finance can help to reduce greenhouse gas emissions, promote clean energy development, and support sustainable economic growth. This is particularly important as the world faces the threat of climate change. Fourth, green finance can also help to reduce pollution and improve air and water quality.

This study aims to explore the relationship between green finance, environmental responsibility, clean energy, and green technology by implementing the Wavelet Coherence technique.

The research is organized in the following manner: Section 1 examines the relevant literature, while Section 2 presents the research methods, including data collection and analysis techniques. The study results are outlined in Section 3, and Section 4 concludes the research and discusses potential policy implications.

1. LITERATURE REVIEW

The literature review in this paper is structured into three main parts: a review of the relationship between green finance and environmental sustainability, a review of the relationship between green finance and clean energy, and a review of the relationship between green finance and green technology.

1.1. A Review of the Relationship Between Green Finance and Environmental Sustainability

Environmental sustainability refers to a state of balance, resilience, and interconnection, which allows human society to meet its requirements without causing harm to the ecosystems and biodiversity (Morelli, 2011; Rafiq et al., 2022). Green finance plays a critical role in promoting environmental sustainability. By providing financial support for sustainable development projects and initiatives, green finance helps to address environmental challenges such as climate change, biodiversity loss, and pollution. This includes financing investments in renewable energy, energy efficiency, sustainable agriculture, and other environmentally friendly activities. Moreover, green finance can also contribute to the development of a more sustainable economy by promoting the adoption of sustainable practices and technologies across various sectors. This can lead to increased resource efficiency, reduced waste and pollution, and improved environmental outcomes. In addition, green finance can help to mobilize private sector investment towards environmental sustainability, helping to bridge the financing gap for sustainable projects and initiatives.

There have been various studies conducted that explore the connection between green finance and environmental sustainability. For instance, Fu and Irfan (2022) investigate the relationship between green financing and environmental sustainability in the economies of the Association of Southeast Asian Nations (ASEAN). The study finds that green financing is positively associated with environmental sustainability but may come at the expense of economic growth. A study was conducted by Shahzad and Riaz (2022) to explore the impact of green finance on environmental sustainability in five regions. They use five variables to evaluate green finance, including GDP, investment in renewable energy sources, research and development for environment-friendly projects, renewable electricity output and public-private investment in energy. The findings show that the rise in renewable energy production, advancement in research and development, and the growth of public-private partnerships investing in renewable energy are reducing CO₂ emissions. However, achieving environmental sustainability requires the availability of green finance aimed explicitly at renewable energy sources. By applying panel-corrected standard errors and the feasible generalized most miniature squares model, Zakari and Khan (2022) analyze the impact of green finance on environmental sustainability for the top 11 financiers of environmental protection countries from 2006

to 2017. Their findings reveal that investments in green finance have been shown to positively impact environmental sustainability.

1.2. A Review of the Relationship Between Green Finance and Clean Energy

Clean energy refers to the energy produced from renewable sources, such as solar, wind, and hydropower, as well as low-carbon energy sources and has a minimal impact on the environment. Clean energy has become increasingly important as the world seeks to reduce greenhouse gas emissions and combat climate change.

Green finance and clean energy have become buzzwords in finance and economics. With the growing awareness of the negative impact of climate change, there is a need for a shift towards sustainable and green economic practices. Green finance has emerged as an effective way of financing clean energy projects and promoting sustainable development. In addition, green finance can provide the financial resources needed to develop and deploy clean energy technologies, while clean energy provides the environmental benefits that green finance seeks to achieve. Green finance can also help overcome some barriers that have hindered the deployment of clean energy technologies, such as lack of access to financing and high upfront costs. There are several ways in which green finance can support the deployment of clean energy technologies. For example, green bonds can fund renewable energy projects and other clean energy initiatives, such as energy efficiency improvements. Green loans can finance companies to invest in renewable energy and other clean energy technologies. In contrast, green funds can provide a diversified portfolio of investments in clean energy and other environmentally sustainable projects.

Several studies attempted to investigate the link between green finance and clean energy. For instance, Ghorbal and Belaïd (2021) examine the association between green finance and clean energy over the period July 2014 to June 2021 using Autoregressive Distributed Lag (ARDL) and Vector Error Correction (VECM) techniques. Findings indicate that bidirectional causal connections exist between green finance and clean energy over the long run. Madaleno et al. (2022) investigate the link between clean energy and green finance over the period July 31, 2014 – October 12, 2021, using the time-varying Granger causality test. The empirical results show a bidirectional causality between green finance and clean energy. In their study, Hammoudeh et al. (2020) explore the time-varying causal association between green finance and clean energy from 2016 to 2020, and they conclude that there exists a one-way causality running from the clean energy index to green finance while there is no causality ranging from green finance to clean energy index. On the other hand, Nyugen et al. (2021) analyze the inter-relationship between green finance and clean energy covering the period 2008-2019 and the findings indicate that there is a relatively high level of co-movement between green finance and clean energy.

1.3. A Review of the Relationship Between Green Finance and Green Technology

Green technology, on the other hand, involves the use of technology and innovation to reduce the negative impact of human activities on the environment. Green technology aims to promote sustainable development and environmental protection by reducing greenhouse gas emissions, conserving natural resources, and minimizing pollution and waste. It includes technologies that improve energy efficiency, utilize renewable energy sources, promote sustainable agriculture, and reduce the environmental impact of industrial processes.

Green finance and green technology are two key components of the transition to a more sustainable and environmentally-friendly global economy. Green finance plays a critical role in

supporting the development and adoption of green technology. By providing funding and investment opportunities for green technology projects, green finance can accelerate the pace of innovation and development in the field. At the same time, green technology can help to make green finance more attractive by reducing the perceived risks associated with environmental investments. Green technology can also help to enhance the environmental performance of green finance instruments by providing new solutions for measuring and managing environmental risks and impacts.

The relationship between green finance and green technology has been examined in numerous studies (Madaleno et al., 2022; Fang and Shao, 2022; Zhang et al., 2022; Sharif et al., 2022; Irfan et al., 2022; Cheng et al., 2023; Jiakui et al., 2023).

2. DATA AND METHODOLOGY

2.1. Data

For this study, we employ daily dataset for all variables obtained from the official website of S&P Dow Jones Indices (www.spglobal.com) running from January 1, 2013 to March 3, 2023. The study makes use of the S&P Global Clean Energy Index, S&P Green Bond Index, S&P Environmental and Social Responsibility Index, and S&P Renewable Energy & Clean Technology Index as substitutes for clean energy (CENE), green finance (GFIN), environmental responsibility (ERES), and green technology (GTEC), respectively.

Table 1 reports the descriptive statistical analysis of each variable. Over the study period, we observe that the green finance index has the lowest mean and variance, which suggests that green finance is comparatively less volatile than other variables. The kurtosis statistics for CENG and CTECH are higher than 3, which follows the leptokurtic distributions while the variables GFIN and ERES show the platykurtic distribution. Additionally, we note that the average maximum is recorded at ERES of 4384.020, while the average minimum value is recorded for CTECH.

Table 1. Statistical description of variables

	GFIN	ERES	CENG	CTECH
Mean	135.967	2449.607	817.731	146.755
Median	135.635	2298.025	660.905	136.275
Maximum	158.990	4384.020	2113.520	316.000
Minimum	109.800	1270.110	456.320	99.120
Std. Dev.	9.638	826.621	351.997	40.705
Kurtosis	2.926	2.283	3.572	4.801
Skewness	0.296	0.672	1.305	1.442

Figure 1 displays the time paths of the analyzed four variables. We observe that the clean energy (CENG) and the clean technology (CTECH) series show a similar evolution over the study period. Between 2013 and mid-2021, environmental responsibility (ERES) showed an overall upward trend, followed by a subsequent downward trend. Further, the green finance (GFIN) series demonstrates fluctuations throughout the study period.

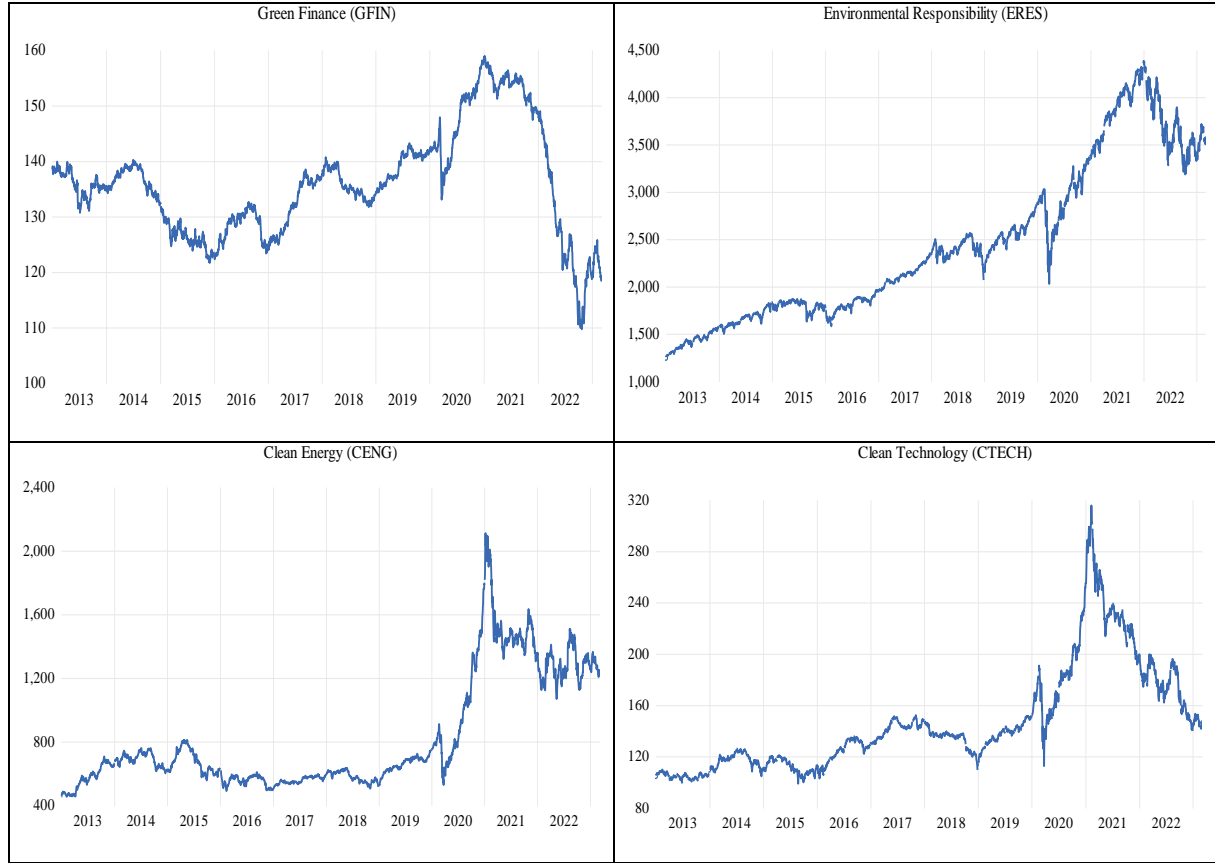


Figure 1. The evolution of the studied variables

2.2. Methodology

This study applies Wavelet Coherence approach to investigate the relationship between green finance, environmental sustainability, clean energy, and clean technology across the time scales. The wavelet model is a potent estimator that employs signal processing, providing a unique opportunity to explore co-movements between economic series across the time-frequency dimension. This model allows researchers to delve deeper into possible interdependence at scales beyond one or two, generating more comprehensive insights into the data dynamics. Ultimately, the wavelet model is a valuable tool for better understanding the relationships between economic series. Researchers frequently opt for continuous wavelet transform in the literature to extract economic time series characteristics and conduct correlation and causality analyses for a more comprehensive and reliable interpretation.

2.2.1. Continuous Wavelet Transform (CWT)

The CWT $W_x(m, n)$ is the forecasting estimates of wavelet $\psi(\cdot)$ against time-series $x(t) \in L^2(\mathbb{R})$, i.e.

$$W_x(m, n) = \int_{-\infty}^{\infty} x(t) \frac{1}{\sqrt{n}} \psi\left(\frac{t-m}{N}\right) dt \quad (1)$$

The CWT is characterized by a significant feature wherein it separates the original time series and creates, as a result, a new seamlessly time series $x(t) \in L^2(\mathbb{R})$:

$$x(t) = \frac{1}{c_\psi} \int_0^\infty \left[\int_{-\infty}^\infty W_x(m, n) \psi_{m,n}(t) du \right] \frac{dn}{N^2}, N > 0 \quad (2)$$

In addition, the CWT maintains the ability to observe time series,

$$\|x\| = \frac{1}{c_\psi} \int_0^\infty \left[\int_{-\infty}^\infty |W_x(m, n)|^2 dm \right] \frac{dn}{N^2} \quad (3)$$

This study employs the wavelet technique that is adaptable to wavelet coherence, enabling the assessment of the correlation between two-time sequences using the bivariate approach.

3. Empirical Results

Wavelet transform analysis plays a crucial role in combining time and frequency analysis, but its explanation is not straightforward due to the varying resolution of frequency information at different stages. The "wavelets" methodology involves analyzing different time scales within time series datasets. Wavelet analysis considers non-stationarity as an inherent characteristic of time series rather than a problem that needs to be addressed through data preprocessing (Sharif et al., 2017). This section discusses the impact of green finance on environmental sustainability, clean energy, and clean technology.

The warmer colors (red) indicate significant co-movements between the series, while colder colors (blues) denote weaker co-movements. Wavelet coefficients beyond the cone of the black line are considered statistically insignificant at a 5% level of significance. The figures in this analysis depict lead/lag phase relationships between the series being examined, with arrows indicating directionality. If the arrow is directed towards the right (left), it indicates that the series is in-phase (out-of-phase). Arrows pointing right-down or left-up suggest that the second series is leading, whereas arrows pointing left-down or right-up imply that the first series is leading. We classify the periods on the y-axis into four bands: ~ 4 days scale, 4- to 8- days time scales, 8- to 16- days time scales, and 16- to 32- days time scales.

From the visual inspection of Figure 2, we find that about late 2013, arrows pointing to the right and upwards indicated that the series is in phase and ERES is leading GFIN; and about late 2016, with the 16-32 day timescale, the direction of the arrow is left and upward indicating that variables are out of phase, that is meaning GFIN is leading ERES. In addition, the majority of the arrows are the right-up between 12/12/2019 to 12/9/2020 show the time series, which is ERES is leading (lagging) GFIN. Further, for a scale of 4 to 16 (early 2019), arrows are left and upward, indicating that variables are out of phase, that is meaning ERES is leading GFIN.

WTC: GFIN – ERES

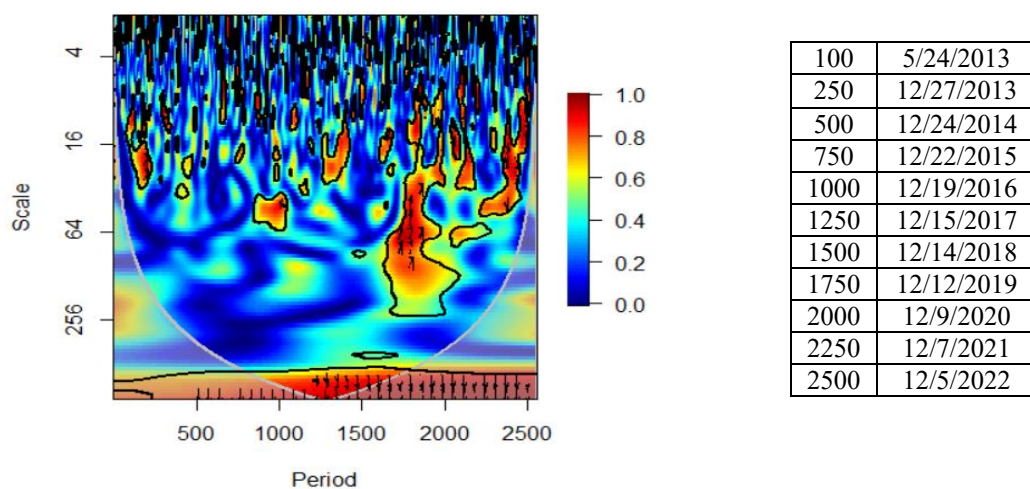


Figure 2. Wavelet Coherence power spectra of GFIN-ERES.

Note: The thick black contour represents the 5% significance level against the dark noise.

Figure 3 depicts the wavelet coherence and phase difference between GFIN and CENG, respectively. As can be seen, the plots of wavelet coherence and phase difference level indicate some typical islands between GFIN and CENG over the time period studied. From the wavelet coherence graph, we observe that the direction of arrows changes from period to period. From 12/15/2017 to 12/14/2018, in the frequency band of 4-16 days of scale, the direction of arrows points towards the right, which identifies a strong positive relationship between the series and they move together in the phase. Additionally, we observe different results across time scales. For example, on a scale of 16-64 days, the majority of the arrows are the right-up between 12/12/2019 to 12/9/2020, show the time series, which is CENG is leading (lagging) GFIN and the variables are in-phase (positive correlation); we observe that for scales of 13 to 16, arrows pointing right-down at early 12/27/2013 indicating that variables are in-phase and BICI is leading; and about late April to mid-May, we find that for scales of ~ 4 days, arrows pointing to the right that means the variables are in phase and strong relationship.

WTC: GFIN - CENG

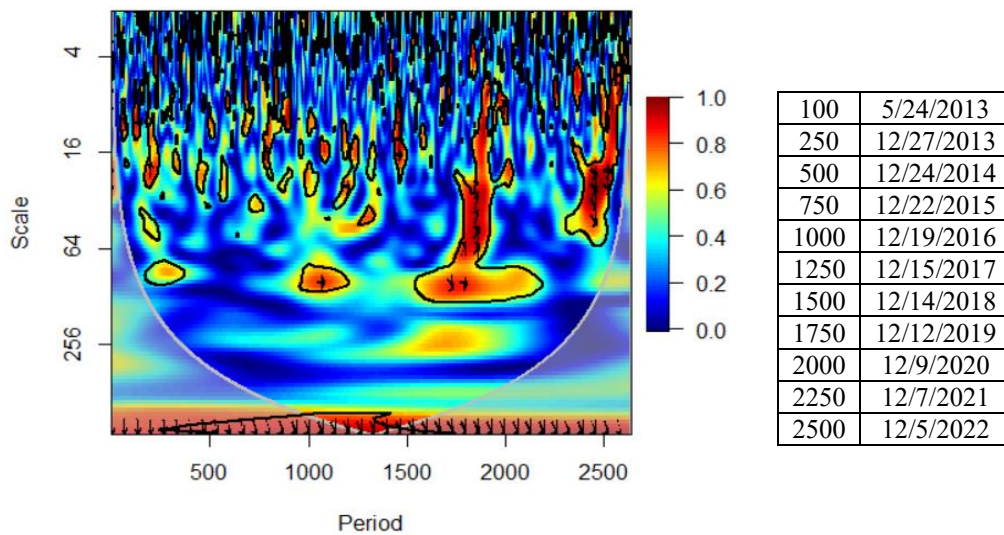
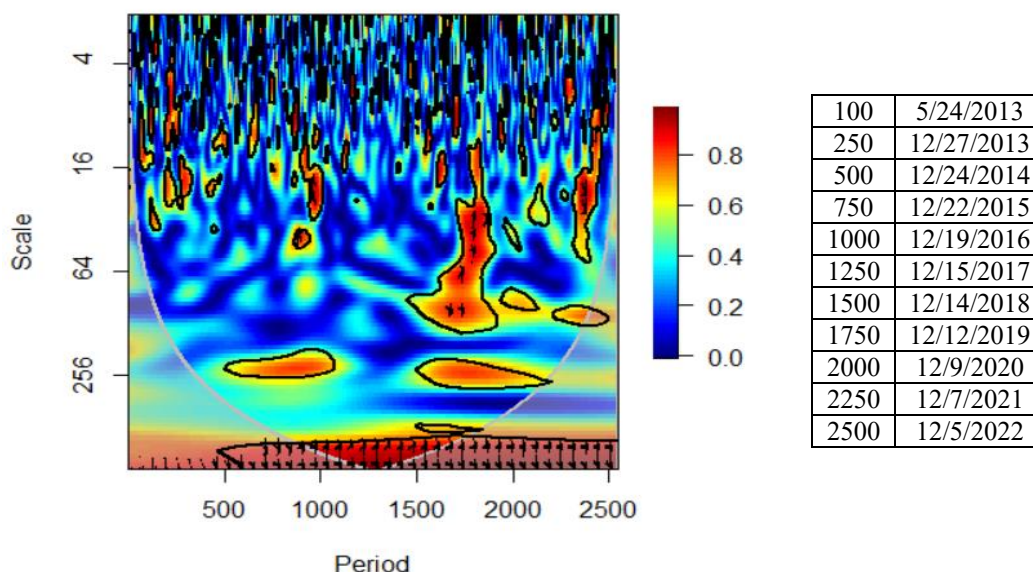


Figure 3. Wavelet Coherence power spectra of GFIN-CENG.

Note: The thick black contour represents the 5% significance level against the dark noise.

Figure 4 exhibits the outcomes of the continuous wavelet transform for GFIN and CTECH. In the medium run (medium frequency), about late 2016, the arrows are straight down, which means that there is no causal relationship between variables. Additionally, between 12/12/2019 to 12/9/2020, the majority of the arrows to the right-upward indicating that variables are in-phase situation where CTECH has a leading impact on GFIN.

WTC: GFIN - CTECH**4. CONCLUSION AND POLICY IMPLICATIONS**

Green finance, environmental sustainability, clean energy, and clean technology are interconnected and crucial to achieving a sustainable future. Green finance can mobilize capital towards environmentally sustainable activities such as clean energy and clean technology, which can reduce carbon emissions and promote environmental sustainability. Green finance also supports the transition to a low-carbon economy by promoting the development and adoption of sustainable technologies and practices that reduce greenhouse gas emissions and environmental degradation. It provides financial support for the development of new technologies and innovative solutions that can help address environmental challenges, such as air and water pollution, waste management, and biodiversity conservation.

The deterioration of the environment has emerged as a significant global concern, prompting policymakers in developing nations to strive towards meeting environmental standards. Presently, economies are switching from non-renewable to renewable energy sources, but the expenses involved in this transition are considerable. It is undeniable that the financial sector is also playing an effective role in promoting such sustainable practices.

Based on the findings obtained from the empirical analysis, the study makes the following policy recommendations: (1) promoting green finance include enhancing transparency and disclosure requirements for green financial products, providing incentives for green investments, and strengthening the regulatory framework to ensure that environmental and social risks are adequately assessed and managed. (2) Governments can also play a significant role in promoting green finance by establishing green investment funds, providing tax incentives for green projects, and encouraging the development of green bond markets. (3) it is essential to recognize that green finance alone is not sufficient to achieve environmental sustainability. To achieve a sustainable future, it is necessary to adopt a holistic approach that encompasses not only financial considerations but also social and environmental factors. In this regard, policymakers should encourage a transition towards a circular economy that minimizes waste and maximizes resource efficiency.

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LONG TERM IMPACT OF COVID-19 ON TURKISH IMPORTS: AN ARDL BOUND TEST APPROACH

Erdem BULUT¹

ABSTRACT

The Covid-19 pandemic, which deeply affected world trade, had a negative impact on Turkey's foreign trade, as well. However, whether the adverse effect of the Covid-19 on imports is lasting or not is an important subject worth studying. Employing quarterly data for the period 2013: q1-2022q1, this paper aims to analyze the long-term effects of the Covid-19 on Turkey's imports via the ARDL bound test approach. No long-term significant relationship was found between Covid-19 and imports in the paper in which the dummy variable, cumulative number of cases and deaths, number of new cases and deaths, number of stay at home requirements, and the average number of days off work were applied. The results show that, although imports showed a significant breakdown due to the measures taken at the beginning of Covid-19, the long-term effect became insignificant with the relaxation of the measures in the later stages of the pandemic, the end of the panic atmosphere, the reversal of pessimistic expectations and the shift to remote work. In addition, it is concluded that the demand postponed at the beginning of the pandemic, combined with high inflation in the following periods, turned to panic purchases, breaking the connection between Covid-19 and imports.

Keywords: Covid-19, import, ARDL bound test

INTRODUCTION

The first Covid-19 case, which deeply affected world trade, was reported from Wuhan, China on November 17, 2019 and soon turned into a pandemic threatening the whole world. Countries trying to take the epidemic and its rate of spread under control adopted various measures simultaneously. Among them were the social distance rule, the obligation to wear a mask, the quarantine measure, the curfew, and the closing of the borders to human crossings and goods trade. The impact of these practices on the world economy and trade became devastating in the first stage. Global trade decreased by 17% in the January-May 2020 period compared to the same period of 2019 (ECLAC, 2020). Global production contracted by approximately 3.5%, whereas global trade decreased by approximately 9% in 2020 (Arriola, et al. 2021).

The economic depression caused by Covid-19 is different from other economic crises that the world has ever witnessed. This stems from the fact that the crisis did not emerge with a deterioration in expectations, a crisis of confidence or a financial bottleneck, but with a planned and deliberate cessation of economic activity. The cessation of economic activity affected all sectors immediately. Substantial financial aid and protection packages were announced to mitigate the social impact of the crisis. The supply of medical equipment and food security came to the fore as priority issues (OECD, 2020). Even though the global trade volume declined sharply due to the strict measures that stopped the economic activity right away, it recovered before long. In fact, this is one of the points that

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distinguishes the economic crisis caused by Covid-19 from others. The global trade volume is shown in Figure 1.

Figure 1: Global Trade Volume (2005-2022) (2005=100)



Source: World Trade Organization Database

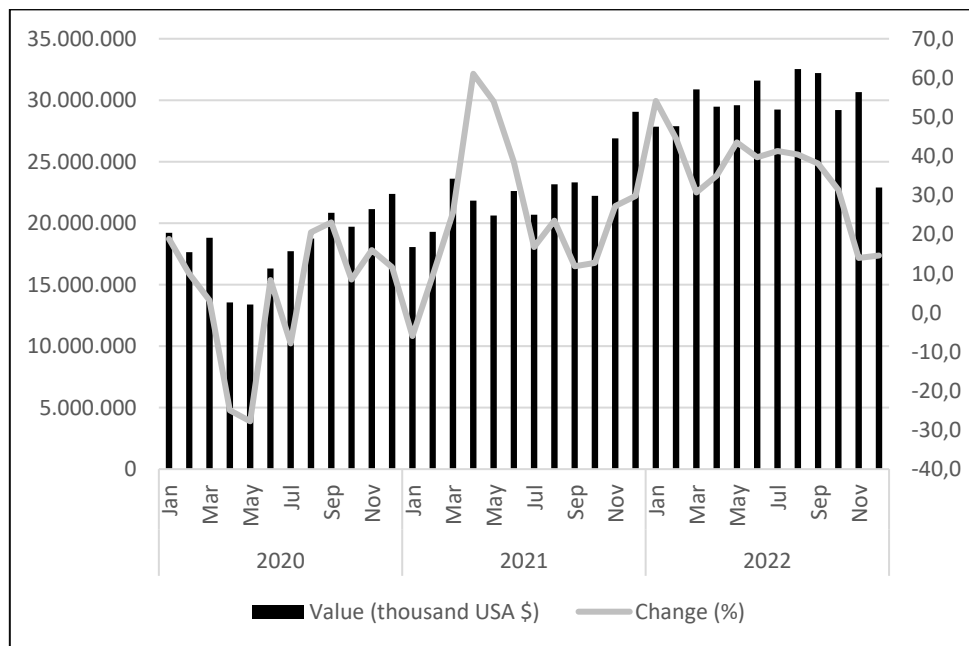
As can be seen in Figure 1, world trade has faced two separate negative shocks in recent years. While one of them is the global financial crisis in 2008, the other is Covid-19. However, while global trade went through a relatively gradual and long recovery process under the effect of the financial crisis, it went a sharp decline and a sharp recovery in the case of Covid-19. In the literature, this situation is phrased as a “U” and “V” shaped recovery trend (Barrett, et al. 2021). On the other hand, the factor leading the negative impact of Covid-19 on global trade to increase exponentially is the break in the supply chain. China’s measures at the very beginning of the pandemic brought about the suspension of input imports in several sectors, particularly in automotive, electronics and medical equipment. Therefore, production came to a standstill in many countries of the world, especially in developed countries, as there was no alternative supplier. In the later stage, although China and other supplier countries took various steps towards normalization, the strict measures taken in the rest of the world caused a supply shock as well as a demand shock (ECLAC, 2020).

The main reason for the demand shock caused by Covid-19 is the curfew and quarantine measures. Moreover, the resulting unemployment gave rise to a long-term decline in demand. Though the governments implemented extensive support programs in this period, the pessimistic weather caused by the pandemic suppressed the demand to a large extent. Deferrable durable consumer goods were most affected by this situation. From the supply side, supply shocks have a knock-on effect that causes demand shocks in importing countries. Namely, the decrease in production in sub-sectors due to Covid-19 is also reducing the demand for imported products to be used in the following stages of production. This effect was primarily seen in such areas as automotive, electronic devices and chemical products, where the production network is closely interconnected (Hayakawa and Mukunoki, 2021).

Turkey is one of the countries whose economy has been deeply affected by the Covid-19 pandemic. The first Covid-19 case in Turkey was detected on March 11, 2020, and pandemic measures began to be adopted as of February. Among these were closing the borders to countries where the pandemic is intense, especially China, and quarantining passengers from other countries.

These measures were followed by those involving the citizens of the country such as quarantine measures, curfews, suspension of education and closures of workplaces. While minimizing social mobility, these practices also directly affected economic activity, as a result of which the Turkish economy contracted by more than 10% in the second quarter of 2020. As both the cause and the result of the contraction in production, a significant decrease in imports was experienced in the same period. Data on Turkey's imports in this period are shown in Figure 2.

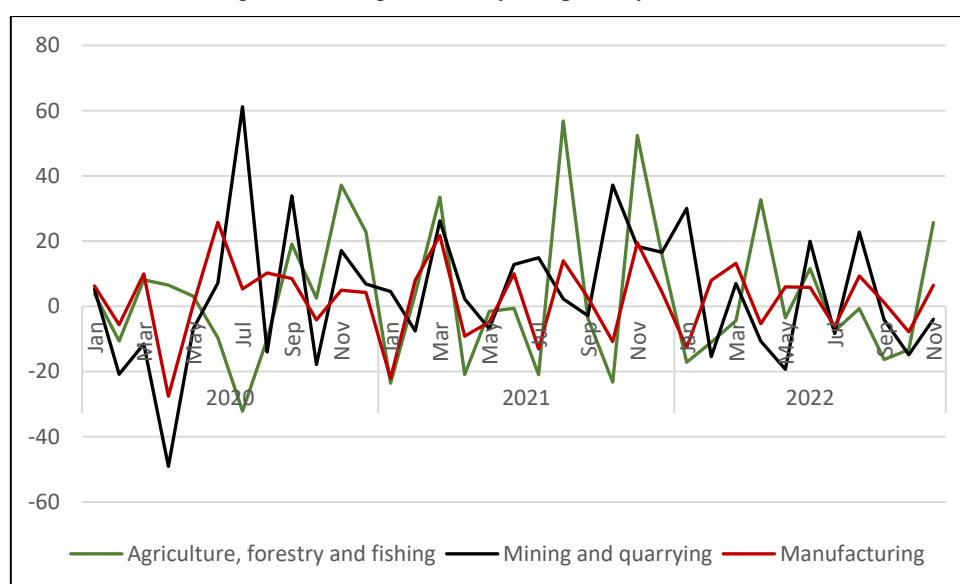
Figure 2: Turkey's Import Data



Source: TUIK

As can be seen in Figure 2, starting to contract in February 2020, imports decreased significantly in March, April and May, when the first quarantine measures were implemented in Turkey. Although imports caught up with their last performance in the following period, it followed a fluctuating course according to the severity of the pandemic and the measures taken. On a sectoral basis, the mining sector was most affected at the beginning of the pandemic, followed by the manufacturing sector, while the agriculture sector followed a relatively stable course. Accordingly, Turkey's mineral imports decreased by 49.07% in April 2020 and manufacturing industry imports by 27.56%. In the following period, as can be seen from Figure 3, Turkey's imports followed a fluctuating course due to the pandemic measures adopted. As a matter of fact, as of 2022, the degree of volatility decreased significantly.

Figure 2: Change in Turkey's Imports by Sector (%)



Source: TUIK

The break and fluctuation in Turkey's imports can be explained in terms of supply and demand during the Covid-19 pandemic period. Unlike the other crises, the economic depression created by the pandemic suppressed both demand and supply immediately and simultaneously. Accordingly, the impact of the crisis increased its intensity. In fact, the causes of this situation can be summarized as follows: The interruption of the supply of intermediate goods and investment goods due to the fact that the pandemic measures taken abroad broke the supply chain, the stoppage of production and, therefore, of imports considerably due to the pandemic measures taken within the country, contraction in demand with the pessimistic atmosphere and uncertainty at home and abroad, shifting of consumer demand from durable goods to essential needs such as food (Brenton, et al. 2022).

This paper aims to empirically analyze the long-term impact of Covid-19 on Turkey's imports. To this end, seven different models were formed, and a separate Covid-19 variable was employed in each model. These variables consist of the cumulative number of cases and deaths, the number of new cases and deaths, the number of stay at home requirements, the average number of days off work, and the dummy variable. This paper will contribute to the literature in many ways. Firstly, this study empirically tests the impact of Covid-19 on imports for the first time. Since the analysis was conducted with seven different Covid-19 variables, this study stands out in terms of showing both the robustness of the model and which variable imports are more sensitive to. This paper also retrospectively tries to suggest long-term results in today's conditions when the Covid-19 ended. While the study provides policymakers with an important assessment tool regarding imports, it provides a basis for academics to investigate the further effects of Covid-19 on a sectoral basis.

1. LITERATURE REVIEW

Berthou and Stumpner (2022) focused on the impact of quarantine practices on global trade. The analysis results showed that world trade strongly reacted to quarantine practices in the early stages of Covid-19. The lockdown policies applied by the importing countries had the most effect on international trade. Nevertheless, it was concluded that the quarantine measures taken by third countries negatively affected world trade in an indirect way through the supply chain. Hayakawa and Mukunoki (2020) in their study, in which they examined 186 countries for the first quarter of 2020, showed that though Covid-19 negatively affected imports, its effects on exports remained less severe.

In another study, Hayakawa and Mukunoki (2021) discussed the foreign trade of 34 countries to 173 countries during the Covid-19 period. In their analysis, they concluded that Covid-19 negatively affected importing countries. However, it was also determined that the negative impact on the importing countries decreased over time after the first effects of Covid-19 lessened.

Kezjar et al. (2021), in their paper on European Union (EU) countries, dwelled on the impact of Covid-19 on the global supply chain and its consequences on foreign trade. The results of the analysis showed that the decrease in import demand affected exports immediately and the importing country became more sensitive to the severity of Covid-19 in another country in the future. It has been concluded that the breaks in the global supply chain act as a transmission mechanism in the spread and intensification of the said negative effect. Caporale et al. (2022) came to a similar conclusion and showed that Covid-19 had a negative impact on EU exports and imports in the short and long term. However, it has been concluded that new technologies and e-commerce that enable remote working limited the negative impact of Covid-19 on foreign trade.

Zhang, et al. (2022) analyzed the relationship between the imports of the USA and China and the number of Covid-19 cases and the number of deaths, reaching the following conclusions: While there was a one-way and negative causality from the number of deaths to imports in China, this was not true for the number of cases. On the other hand, it has been shown that there was a unidirectional and negative causality relationship between the number of deaths, cases and imports in the USA. Liu, et al. (2021) investigated the effects of Covid-19 deaths and quarantine practices on imports from China. Accordingly, death cases and quarantine practices within the country significantly reduced imports from China. In other words, the negative impact of demand is greater than that of the supply side. Another considerable finding of the study is that deaths in previous periods and quarantine restrictions increased imports from China in the current period, which is essential in terms of showing that the imports have not been stopped but partially postponed.

Wei, et al. (2021) examined the effect of Covid-19 on foreign trade of South Korea, Japan and China. The results of the time series analysis made on a country basis are as follows: As the severity of the Covid-19 pandemic increased, Japan's imports showed a decreasing trend. The reason for this was the decrease in intermediate goods production in countries where the epidemic worsened. On the other hand, the results of the panel data analysis, in which the three countries were evaluated together, are as follows: The effect of Covid-19 on the total imports of the countries in the region was statistically insignificant. The increase in the Covid-19 outbreak in the main trade partners adversely affected the imports of the three countries. In contrast, government subsidies positively affected the imports of these countries. In their study on South Korea, Yoo, et al. (2020) shed that although Covid-19 negatively affected foreign trade and supply chain, the New Southern Policy implemented by South Korea lessened the negative effect.

Hayakawa and Ando (2022) in their paper, in which they investigated the effect of Covid-19 on service trade for 146 countries, stated that service trade was more negatively affected than goods trade due to Covid-19. They also concluded that the import side of the service trade was more negatively affected by Covid-19, which resulted from the travel restrictions that reduce human mobility. Arenas, et al. (2022), in their study where they analyzed the impact of quarantine measures on the Philippines' foreign trade, indicated that the quarantine measures implemented by the Philippines' trading partners had a negative impact on the Philippines' imports. On the other hand, no significant result was found that the measures implemented by the Philippines affected the imports of the Philippines. Ing and Vadila (2022) concluded that for Indonesia, Covid-19 was more effective on imports than exports. Accordingly, the negative impact of Covid-19 on imports was approximately 17%, while its negative impact on exports was 10.7%.

According to Yaya et al., (2020), the closure of borders due to the concerns caused by Covid-19 gave rise to protectionist policies in trade, which decreased substantially. The countries most affected by this situation were African countries in terms of employment and poverty. This is because of the fact that the majority of African countries' exports are heavily dependent on oil, natural gas and agricultural products. However, falling oil prices and decreasing demand for the African market worsened the situation. In this context, Mold and Mvenge (2020) in their research on Kenya and West African countries for the first half of 2020, showed that Kenyan exports were not affected by Covid-19, but imports decreased significantly, which played an important role in closing the foreign trade deficit.

It seems that there aren't enough empirical studies on the impact of Covid-19 on Turkey's imports. In their study on the interpretation of secondary data, Çakmaklı et al. (2021) claimed that the exchange rate increases in the Covid-19 period prevented the production in Turkey from being negatively affected due to foreign demand. Evaluating the subject from an export perspective, Turkmen and Ertugut (2022) stated that exports to Germany, England and Iraq decreased, while those to Italy and the USA followed a fluctuating course. In a similar study, Pelit and Irmak (2022) and Oran and Gökmen (2021) found that exports and imports decreased remarkably in Turkey in the early stages of the pandemic.

2. MODEL AND DATA

2.1. Model

In this paper, the ARDL bound test method was used, which allows to see the long-term effects of the independent variables on the dependent variable. Covid-19 variables were also added to the model numbered (1), created by considering the classical foreign trade theory.

$$LRIM_t = \beta_0 + \beta_1 L_GDP_t + \beta_2 L_RER_t + \beta_3 Covid_t + \varepsilon_t \quad (1)$$

$LRIM_t$ in equation (1) is the dependent variable of the model and represents Turkey's real imports. L_GDP_t , one of the independent variables of the model, shows Turkey's real gross domestic product, L_RER_t the real exchange rate and $Covid_t$ the Covid-19 variable. Seven different Covid-19 variants were determined to represent Covid-19 in the paper. The first of these is the dummy variable (L_DM_t), which is given a value of "1" for the period 2020:q1-2022q1 to represent the period with Covid-19, and "0" for the remaining period. Other variables are the cumulative number of cases (L_CC_t), the cumulative number of deaths (L_CD_t), the number of new cases (L_NC_t), the number of new deaths (L_ND_t), the average number of days off work (L_DQ_t), and number of stay at home requirements (L_SH_t) while ε_t represents the error term.

According to the classical economic theory, the increase in domestic income is expected to affect imports positively with the increase in the purchasing power of the household. Yet, an increase in the real exchange rate means that the price of imported is cheaper products in national currency. In this case, theoretically, increases in the real exchange rate will affect imports positively. On the other hand, the Covid-19 pandemic, which directly interrupted economic activity and increased uncertainty, is expected to affect imports adversely, at least in the short term (Aslan and Acikgoz, 2021). Based on this, it is expected that the coefficient of real gross domestic product β_1 and the coefficient of the real exchange rate variable β_2 are expected to be positive, while the coefficient of the $Covid_t$ variable β_3 is expected to be negative.

2.2. Data

The study takes the period 2013:q1 - 2022:q1 as the analysis period and makes estimates with quarterly time series data. The real import variable is calculated by dividing the nominal import series by the import unit price index based on 2015=100. Both series were obtained from TUIK databases and adjusted in accordance with seasonal and calendar effects. The consumer price index-based real exchange rate series was taken from the Central Bank of the Republic of Turkey Electronic Data Distribution System database. The Real Gross Domestic Income series was obtained from the TURKSTAT database. Finally, the variables representing Covid-19 were taken from the Oxford University database, and all variables employed in the analysis, except for the Covid-19 dummy variable, were subjected to logarithmic transformation.

3. EMPIRICAL FINDINGS

3.1. ARDL Bound Testing Approach

Various cointegration tests are used in the literature to test the concept of cointegration, which states that there is a stationary combination of at least two series that are not stationary at their levels. Nevertheless, most of the cointegration tests assume that the variables are stationary at the same level. This prerequisite, which constitutes an important constraint for the studies, was eliminated by Pesaran et al. (2001) with the cointegration analysis they introduced to the literature. Accordingly, there are two basic conditions that must be met so that the ARDL model can be applied. The first of these conditions is all variables in the model must be stationary at the level or their first difference. The second condition is that there must be a cointegration relationship between the variables of the model. In this context, unit root test is applied for stationarity and F-boundary tests for cointegration control (McNown, et al. 2016).

3.2. Unit Root Testing

The degree of stationarity of the variables is determined by unit root tests. Stationarity refers to the situation where the series is not in a trend effect, the variance and mean are constant, and the covariance depends on the difference between the periods. The results of the Extended Augmented Dickey Fuller (ADF) unit root test (Dickey & Fuller, 1981), one of the methods used for stationarity testing, are shown in Table 1.

Table 1: ADF Unit Root Test Results

Stationary		Constant	Constant and Trend	Variable		Constant	Constant and Trend
LRIM	Test s.	-3.0408	-3.2854	Δ LRIM	Test s.	-7.0592	-6.9545
	p-value	0.0405	0.0849		p-value	0.0000	0.0000
L_GDP	Test s.	-0.2599	-3.5921	Δ L_GDP	Test s.	-8.9689	-8.8470
	p-value	0.9210	0.0447		p-value	0.0000	0.0000
L_RER	Test s.	0.4655	-2.3981	Δ L_RER	Test s.	-7.1058	-7.1963
	p-value	0.9830	0.3743		p-value	0.0000	0.0000
L_DM	Test s.	-0.5290	-1.7692	Δ L_DM	Test s.	-5.9161	-5.9722
	p-value	0.8738	0.6986		p-value	0.0000	0.0001
L_CC	Test s.	-0.4968	-1.5849	Δ L_CC	Test s.	-2.2172	-3.9988
	p-value	0.8795	0.7773		p-value	0.2043	0.0183
L_NC	Test s.	0.8190	-0.8318	Δ L_NC	Test s.	-4.8988	-5.3299
	p-value	0.9930	0.9529		p-value	0.0003	0.0006
L_CD	Test s.	-0.1528	-1.4023	Δ L_CD	Test s.	-3.7140	-3.9675
	p-value	0.9354	0.8427		p-value	0.0081	0.0194
L_ND	Test s.	0.3933	-1.0739	Δ L_ND	Test s.	-2.8109	-6.0222
	p-value	0.9799	0.9197		p-value	0.0673	0.0001
L_DQ	Test s.	-2.2982	-2.7953	Δ L_DQ	Test s.	-3.9130	-3.8786
	p-value	0.1781	0.2083		p-value	0.0049	0.0238
L_SH	Test s.	-1.8159	-1.9953	Δ L_DQ	Test s.	-2.8930	-2.5167
	p-value	0.1236	0.1926		p-value	0.0067	0.0627

Note: The maximum delay length is taken as 4 and the optimum delay is decided according to the AIC.

As can be seen from the ADF unit root test results in Table 1, the $LRIM_t$ variable is stationary at both the constant and the constant and trend level. The variable L_GDP_t , on the other hand, is constant when the constant is unit rooted and trend stationary. If the first difference of the variable L_GDP_t is taken, the constant becomes stationary. While all of the other variables are unit rooted at the level, they become stationary in the first difference. In summary, according to the results in Table 1, all variables in the model are stationary at either level or first order difference, showing that the first condition required for the implementation of the ARDL model is met.

3.3. ARDL Bound Test Model Results

Seven different models were estimated by using different Covid-19 variables in this paper, in which the long-term effects of Covid-19 on Turkey's imports were examined. In this regard, while the Covid-19 dummy variable was used as a variable in the first model, the total number of cases, the number of new cases, the total number of deaths, the number of new deaths, the average number of days off work, and the number of stay at home requirements were employed respectively in the later models.

As can be seen in Table 2, containing long-term ARDL results, the F bounds test shows that there is a cointegration relationship in all seven models. That's why, the cointegration condition required for the ARDL model is also met. In other words, both the unit root test results and the F bounds test results indicate that the ARDL Model can be used to estimate the long-term import equation.

Table 2: Long-Term ARDL Bound Test Model Results

Dependent Variable (LRIM)	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
L_GDP	1.2873*** [0.0001]	1.0649*** [0.0010]	1.1792*** [0.0006]	1.1319*** [0.0005]	1.2623*** [0.0005]	1.0341*** [0.0036]	1.1568*** [0.0019]
L_RER	0.6661*** [0.0007]	0.5497*** [0.0058]	0.6700*** [0.0021]	0.5658*** [0.0040]	0.6826*** [0.0023]	0.4297** [0.0267]	0.5768*** [0.0077]
L_DM	0.07236 [0.1347]	- -	- -	- -	- -	- -	- -
L_CC	- -	0.0051 [0.1464]	- -	- -	- -	- -	- -
L_NC	- -	- -	0.0082 [0.1789]	- -	- -	- -	- -
L_CD	- -	- -	- -	0.0032 [0.5552]	- -	- -	- -
L_ND	- -	- -	- -	- -	0.0130 [0.2893]	- -	- -
L_DQ	- -	- -	- -	- -	- -	0.0145 [0.7475]	- -
L_SH	- -	- -	- -	- -	- -	- -	0.0208 [0.8267]
Constant	-7.0357 [0.1129]	-3.7402 [0.3971]	-5.7203 [0.2282]	-4.6695 [0.2901]	-6.8193 [0.1730]	-2.8110 [0.5667]	-3.5472 [0.4085]
Observation	35	35	35	35	35	35	35
F Stat (ARDL Bound)	6.1170***	5.1479***	5.4912***	5.5142***	4.8288***	4.4646**	5.4781***

Note: *, ** and *** indicate 10%, 5% and 1% significance level, respectively. The brackets [] indicate standard errors.

According to the long-term ARDL results in Table 3, the domestic income coefficient is positive in all models, varying between 1.0341 and 1.2873. The results show that for every 1% increase in income, its long-term effect on imports is over 1%. There is a similar situation for the real exchange rate variable, its coefficient being positive in all models. Its coefficient value varies between 0.4297 and 0.6826. Thus, a 1% rise in the real exchange rate increases imports between 0.42% and 0.68% in the long term. The results show that import demand is elastic vis-à-vis income in the long term, while it is firm vis-à-vis the real exchange rate. To sum up, income and exchange rate variables are in line with economic theory and expectations.

Although Covid-19 negatively affects Turkey and world trade, it seems that this effect will disappear for Turkey in the long term. This is because the coefficients of the Covid-19 variable in all seven models are positive but statistically insignificant. The fact that the variables in each model give the same results in different situations means that the model is robust and consistent. Accordingly, even though the cessation of economic activity due to the shock decisions adopted worldwide significantly reduced the demand for imports, the results show that this effect will disappear in the long term. Considering the long-term impact of Covid-19, the studies carried out by Hayakawa and Mukunoki (2021), Caporale, et al. (2022) and Arenas et al. (2022) are in line with the results of this study. Indeed, Liu et al. (2021) emphasized that imports did not actually stop during the Covid-19 period, but were only postponed. However, unlike the other crises, the economic crisis created by Covid-19 showed a rapid "V"-shaped recovery in foreign trade, showing that the short-term shock did not affect the long-term (Barrett, et al. 2021).

4. CONCLUSION

Foreign trade is one of the areas most affected by Covid-19, which shook the whole world deeply. This stems from the fact that the measures taken quickly suspended economic activity and foreign trade dropped significantly in the following period. Although these days the rate of spread and impact of Covid-19 has decreased, the long-term effect of Covid-19 on foreign trade remains an important unknown. This is because most of the studies on the effect of Covid-19 were carried out during the period when the Covid-19 was raging. In this paper, the long-term effect of Covid-19 on Turkey's imports was analyzed using the ARDL bound test approach, using quarterly data for the period 2013:q1-2022q1. Seven different Covid-19 variables and seven different models were used in the study so as to evaluate the impact of Covid-19 on Turkey's imports in the broadest possible framework.

Findings reveal that increases in domestic income level and real exchange rate affect Turkey's imports positively. Still, income level has a greater effect on imports. There is no long-term relationship found between Turkey's imports and the dummy variable, the total number of cases, the number of daily cases, the total number of deaths, the number of deaths per day, the average number of days off work, and the number of stay at home requirements, which were used to represent Covid-19. The fact that the seven models give similar results for all variables is important in terms of showing that the models formed give strong and consistent results. Accordingly, the results show that the negative effect of the measures taken in the initial period of Covid-19 on foreign trade is not valid in the long term.

Although the strict measures taken in the first period of Covid-19 had a negative effect on imports, this negative effect seems no longer the case in the long term. The first reason is that the strict measures taken at the beginning of the pandemic were loosened in the later stages of the pandemic, first producing its effect with the revival of economic activity and thus imports. The second reason is that the panic situation that dominated the economic units at the beginning of the pandemic and the pessimistic atmosphere as a result of this started to dim in the later stages of Covid-19. The third reason is the remote working, which has become widespread with Covid-19. The labor force confined to home due to the curfew and social distance measures prevented the sharp decline in production and trade from continuing in the long term with remote working methods.

Consumer behavior is likely to be another reason explaining the statistically insignificant impact of Covid-19 on imports, as the consumer confidence index decreased significantly at the beginning of the pandemic. As a result, consumers postponed their purchase requests, causing a significant decrease in import demand but this was reversed in the following periods, although the Covid-19 epidemic continued. With the adaptation of consumers to the new life, the deferred demand turned into the actual demand and the demand returned to its old level. However, after the panic atmosphere dissipated, the high inflation experienced especially in Turkey led economic units to panic purchases and, thus, an increase in imports.

Finally, it should be noted that Turkey's import demand doesn't directly stems from the pandemic conditions in Turkey. The pandemic measures taken by Turkey's leading trade partners are also likely to have had some impact on overseas production. In addition, export bans, especially in the first period of Covid-19, may have had an impact on imports. This situation, which was mainly seen in food products and health equipment in the initial period of the pandemic, spread over time to other products that were considered strategically. As a matter of fact, such measures are expected to have an impact on the import volume. However, stronger evidence and studies are needed to see the effects of Covid-19 cases, Covid-19 measures or trade policies in Turkey's major trading partners on Turkey's imports.

Although the results show that there is no long-term relationship between the Covid-19 variable and Turkey's imports, the sectoral impact of Covid-19 is an important study subject to be explained. Depending on the pandemic, countries have adopted different trade policies in different sectors. Health equipment and food products are at the forefront of these. Export bans and additional protection measures on the products in question have limited the trade of these products considerably. Hence, for Turkey, empirical analyzes to be made on a sectoral basis will offer important opportunities to see the effects of Covid-19 on a sectoral basis and to produce policies within this framework.

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