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Investigation of the Relationship Between Financial Development and CO2 Emissions: The Case of Turkey and Cyprus *

Finansal Gelişme İle Co^2 Emisyonları Arasındaki İlişkinin İncelenmesi: Türkiye Ve Kıbrıs Örneği

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ABSTRACT

Small and medium-sized businesses (SMEs) can thrive with the assistance of the financial industry by having access to financing. Generally speaking, SMEs employ more people and generate more employment than huge corporations. In addition, the emergence of new financial instruments and services offers new opportunities to both investors and savers and enables growth to be self-feeding. Financial developments affect many areas, especially today, when financialization has gained a global dimension and the effectiveness of neo-liberal policies has started to increase again. One of these areas is the environment. With financial development, the use of industry and fossil fuels has intensified. This situation brings about environmental pollution and an increase in greenhouse gas emissions. Greenhouse gas compounds contain Carbon Dioxide (CO2), which can reach 26%. This study looked at the connection between financial growth and carbon dioxide emissions in this environment. The results of Toda and Yamamoto's causality analysis demonstrate that there is no causal connection between the series of Turkey and Cyprus. In this context, we can say that industrialization and financial development have not yet produced negative consequences for these countries regarding CO2 emission.

Keywords: Financial Development, CO2 emission, Toda and Yamamoto's causality.

ÖZET

Finans sektörünün gelişimi, finansmana erişim sağlayarak küçük ve orta ölçekli işletmelerin (KOBİ'ler) büyümesine yardımcı olmaktadır. KOBİ'lerde genellikle emek yoğundur ve büyük firmalardan daha fazla iş yaratmaktadırlar. Ayrıca yeni finansal araç ve hizmetlerin ortaya çıkması hem yatırımcılara hem de tasarruf sahiplerine yeni fırsatlar sunmakta ve büyümenin kendi kendini beslemesini sağlamaktadır. Finansal gelişmeler, özellikle finansallaşmanın küresel bir boyut kazandığı ve neo-liberal politikaların etkinliğinin yeniden artmaya başladığı günümüzde birçok alanı etkilemektedir. Bu alanlardan biri de çevredir. Finansal gelişme ile birlikte sanayi ve fosil yakıtların kullanımı yoğunlaşmıştır. Bu durum çevre kirliliğini ve sera gazı emisyonlarında artışı beraberinde getirmektedir. Sera gazı bileşikleri, %26'ya ulaşabilen Karbondioksit (CO2) içerir. Bu bağlamda, bu çalışmada finansal gelişme ile karbondioksit salınımı arasındaki ilişki incelenmiştir. Toda ve Yamamoto nedensellik bulguları, Türkiye ve Kıbrıs verileri arasında herhangi bir nedensellik ilişkisi olmadığını göstermektedir. Bu bağlamda sanayileşme ve finansal gelişmenin CO2 emisyonu açısından bu ülkeler için henüz olumsuz sonuçlar doğurmadığını söyleyebilmekteyiz.

Anahtar Kelimeler: Finansal Gelişmişlik, CO2 emisyonu, Toda ve Yamamoto nedensellik

1. INTRODUCTION

There is a close relationship between urbanization and financial development due to the accumulation of material, intellectual and human capital. The efficiency and efficacy of financial institutions are increased along with innovation in the provision of financial services thanks to a well-established and developed financial system. It also decreases information costs, makes investments more profitable, and advances technology. The monetary transmission system has been strengthened by financial liberalization, which in turn promotes savings and investment and accelerates economic growth. With globalization, the need for funds of individuals and companies has increased. Therefore, a developed financial structure is needed to meet the funding requirement. When the needed structure is provided, development takes place. The literature generally demonstrates that financial market deregulation promotes economic expansion.

After the industrial revolution that took place in the 19th century, the increase in production and mechanization brought industrialization. It is an undeniable fact that industrialization causes environmental destruction. Especially since the 20th century, industrialization has led to the pollution of the environment and its rapid change. In developing countries where the industrialization process continues, a rapid growth is experienced in the economy with the contribution of rapid population growth. The increase in carbon emissions caused by the growing economy and demand has brought research into the agenda of the relationship between carbon emissions and institutional variables, which will contribute to policy development in preventing carbon emissions problem. The answers to the questions whether growth of financial system will cause more damage to

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the environment or whether increasing income and wealth will contribute to the improvement of ecological problems are of critical importance in determining the development strategies of the underdeveloped countries.

The IPAT theory was one of the first to attempt to describe how human activity affects the environment. Ehrlich and Holdren (2001) developed the model, which outlines how population growth affects the ecosystem. The model continues to be widely used as a framework for analyzing the determinants of environmental pollution. It is assumed that each factor has the same proportional effects on the environment. As seen in the equation, the relationships between human activities and the environment are predicted. In the model, factors affecting the environment are classified under three headings: Population (P), economic development (A) represented by consumption or production patterns, and technologic development (T) represented by technology level of country. It is used not only for quantitative analysis of effects, but also to easily analyze the main drivers of the anthropogenic environment (Chen et al., 2013: 2). In order for policy makers to formulate effective policies on global warming, they should address the phenomena of population, income and technology together. In addition, the application of direct taxes to reduce emissions of CO2 and other greenhouse gas compounds can be added to the model as a new variable (Devarajan et al., 2009). Countries with a mature banking sector and capital markets will be able to achieve technological advances that bring high efficiency more quickly. It is known that a well-functioning banking system supports investors financially by financing the technological innovations required to produce new products in the most effective and efficient way (Cetin, 2004). With the development of the financial system, system provides improvements in issues such as efficient distribution of resources and reduction of uncertainties. In addition to the public and real sector, financial system facilitates the poor people to borrow from the system, and enables the poor individuals who have the idea of the project to create highly productive sectors. The increase in productivity enables the economy to grow faster than expected. The rapidly growing industry and economy harms the environment. According to Efeoğlu (2022), financial development can reduce environmental pollution through environmentally friendly technologies by encouraging foreign direct investment and research and development expenditures through increasing economic growth. Financial development encourages developing countries to use new technology and encourages them to make environmentally friendly and clean production. Furthermore, financial growth may lessen damage to the environment by increasing the number of low-cost financing options available, such environmental investment initiatives. Financial development has been linked to climate change, according to recent studies (Wang et al., 2020; Shen et al., 2020; Fang et al., 2020).

2- LITERATURE

The basis of the studies investigating the environmental effects of economic developments is based on the studies of Grosman and Kruger (1991). This study, which is described as the birth of the EKC hypothesis, is a report that investigating the environmental impact of trade agreements. There are many studies examining the environmental impacts of economic developments. Financial development has been a less researched topic.

Financial development in studies is determined over different variables. Domestic credit to the private sector and the financial development index are the two most often cited financial development variables in the literature.

As we mentioned before, in most of the studies in the literature, domestic credit to private sector has been used for the financial development variable (Al Mulali et al., 2015; Boutabba, 2014; Cetin and Ecevit, 2017; Dogan and Turkekul, 2015; Dogan and Sekeri, 2016; Farhani and Ozturk, 2015; Gokmenoglu et al., 2015; Javid and Sharif, 2016; Omri et al., 2015; Ozturk and Acaravci, 2013; Shahbaz et al., 2013; Shen et al., 2020). Causation research is done in the Gokmenoglu et al. (2015) study, and a one-way causation link towards carbon dioxide emission is seen. Most studies that employed domestic financing to the private sector as a financial development strategy found a favorable impact on carbon dioxide emissions (Boutabba, 2014; Cetin and Ecevit, 2017; Dogan and Turkekul, 2015; Farhani and Ozturk, 2015; Javid and Sharif, 2016; Ozturk and Acaravci, 2013; Shen et al., 2020). As a different finding, a negative effect was observed in other studies (Dogan and Sekeri, 2016; Omri et al., 2015; Shahbaz et al., 2013). According to income levels, each country were separated by Al Mulali et al. (2015). Lower middle income, higher middle income, and high income countries all saw a negative impact, whereas the effect was positive in low income economies.

In studies Acheampong et al. (2020) and Wang et al. (2020), the IMF index was used to determine the level of financial development. Acheampong et al. (2020) clarified that in frontier financial economies have greater carbon dioxide emissions intensity because they have more efficient financial markets and increased acess to them. According to Wang et al. (2020), financial development has causality relationship with CO2 emissions.

Using the ARDL model, Fang et al. (2020) investigated the relationship between financial development (deposits and loans) and carbon dioxide emissions in China between 1990 and 2016. Their findings demonstrate the detrimental impact of financial development on carbon dioxide emissions. According to Jalil, Feridun, and Zhang (2011) in a separate research on China, the degree of financial growth lowers carbon dioxide emissions. Using data from Turkey from the years 1960 to 2011, Gokmenoglu and Sadeghieh (2019) looked into the impact of bank loan to bank deposit on carbon dioxide emissions. According to Gokmenoglu and Sadeghieh (2019), financial growth has a detrimental impact on carbon dioxide emissions. On the other hand, bank loan to bank deposit will increase carbon dioxide emissions, according to Nasir et al. (2019).

The research done by Tamazian et al. (2002) provides insight into the connection between numerous economic factors and carbon dioxide emissions in different economies. The results point to the importance of the stock market value added, foreign direct investment (FDI) stock, deposit money bank assets/GDP, capital account convertibility, financial liberalization, and financial openness in lowering carbon dioxide emissions. The authors make the case that financial liberalization and development strategies, such as rising stock market values and FDI inflows, may damage environmentally friendly economic growth. The results show that every variable has a sizable detrimental impact on carbon dioxide emission.

The link between the carbon dioxide emission, stock market development index, and banking development index (BDI) is examined by Zafar et al. (2019). Improvements in banking BDI result in lower carbon dioxide emissions in the seven biggest economies but higher emissions in N11 countries, according to Zafar et al. (2019). Improvements in the stock market development index, in contrast to the BDI, result in lower carbon dioxide emissions in N11 countries but higher emissions in G7 nations.

In summary, a review of the literature reveals that the consequences of financial development might vary based on the type of data used and the variable content.

3. DATA AND METHODOLOGY

3.1 Data

In this study, it is aimed to investigate the relationship between the carbon dioxide emission of Cyprus and the financial development index between the years of 1973-2015. World Bank CO2 emissions (metric tons per capita) for carbon dioxide emission data, arithmetic averaged from the World Bank Financial Structure data pool for the financial development index; liquid liabilities to GDP, deposit money bank assets to GDP, private credit by deposit money banks and other financial institutions to GDP and financial system deposits to GDP data were used.

3.2 Methodology

The research used the ADF and PP unit root tests to ascertain the stationarity of the variables, the Johansen (1988) test to ascertain if a long-term link exists between the variables, and the Granger (1969) test to elucidate the causal relationship between the variables.

3.2.1 Unit Root Tests

Dickey-Fuller test is a test used to determine whether the unit root exists in the observed series. The equation for the Dickey-Fuller test is shown below:

$$y_t = \Phi y_{t-1} + \varepsilon_t \quad (1)$$

Dickey-Fuller test may give biased results in cases where autocorrelation is observed. Therefore, Augmented Dickey-Fuller test was introduced by developing the Dickey-Fuller test.

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

The Phillips-Perron test acknowledged the weak dependency and heterogeneous distribution of the abandoned error factors.

3.2.2 Cointegration and Causality Tests

In order to have a co-integrated relationship, this relationship must be long-lasting and strong. The prerequisite of Engle-Granger method is that the variables to be used in the analysis are not stationary in the level values.

The Granger (1988) test is run to ascertain the relationship's direction if cointegration is observed. Granger causality's findings show whether a link is bidirectional, one-way, or has no direction at all.

$$X_t = \sum_{j0\,1}^{m} a_j X_{t-j} + \sum_{j0\,1}^{m} b_j Y_{t-j} + \varepsilon_t \quad (3)$$

$$Y_t = \sum_{j0\,1}^{m} a_j X_{t-j} + \sum_{j0\,1}^{m} b_j Y_{t-j} + \eta_t \quad (4)$$

The Toda-Yamamoto method does not deal with the degree of stationarity of the variables and the cointegrated relationship. Because it is a very useful and adaptable test that can be quickly applied to variables that are stationary to varying degrees, it is therefore chosen. The Toda-Yamamoto approach does not need stationary variables, which eliminates data loss. It is required to verify the variables using unit root tests and establish the maximum level of integration before applying this strategy. Studies on discrimination have gained importance in recent years. Studies on credit restrictions can be examined under two headings as Becker-type discrimination and statistically based discrimination model. These models can be distinguished from each other by their causes, nature and economic effects. Becker-type discrimination is also called the taste-based preference model (Becker, 2010:16). The taste-based preference model suggests that discrimination stems from a personal bias or taste toward certain individuals or groups. Therefore, individuals who enjoy discrimination against a particular class do not hesitate to pay a financial price to avoid interacting with that class. In the context of the lending market, this can lead to the consequences of not lending or lending at high interest rates.

4. FINDINGS

To start, the stationarities of the series are assessed using the ADF and PP unit root tests. The unit root test findings for Turkey's data show that all variables are stationary at the first differences level. For Cyprus, only CO2 is stationary at the first differences level.

Table 1. Unit Root Tests

Cyprus			Turkey		
Variables	ADF	PP	Variables	ADF	PP
FD	-3.222663***	-2.879533	FD	-1.129344	-0.699047
IND	-3.411096***	-4.263515*	IND	-2.012212	-1.998573
CO^2	-0.559514	-0.559514	CO2	-3.035751	-3.037813
ΔFD	-7.890376*	-7.875070*	ΔFD	-6.684583*	-6.909387*
ΔIND	-4.274448*	-4.624318*	ΔIND	-6.362954*	-6.362600*
ΔCO^2	-4.061658**	-4.666697*	ΔCO2	-5.545326*	-9.053701*

Note: Significance is showed by 1, 5, and 10% indicated through *, ** and *** respectively.

The lag length is set at 1 for both countries.

Table 2. Lag Length Selection

	Lag	LogL	LR	FPE	AIC	SC	HQ
TURKEY	0	-237.856	-	129.971	13.3809	13.5128	13.4269
	1	-117.186	214.524*	0.26346*	7.17702*	7.70486*	7.36125*
	2	-111.614	8.97711	0.32267	7.36747	8.29118	7.68987
	3	-104.302	10.5622	0.36515	7.46122	8.78082	7.92180
	4	-95.6455	11.0612	0.39415	7.48030	9.19578	8.07905
	5	-93.2086	2.70756	0.62573	7.84492	9.95628	8.58184
CYPRUS	0	-316.177	-	10081.6	17.7320	17.8640	17.7781
	1	-188.963	226.157*	14.2077*	11.1646*	11.6924*	11.3488*
	2	-181.330	12.2986	15.5176	11.2405	12.1642	11.5629
	3	-173.443	11.3914	17.0094	11.3024	12.6220	11.7630
	4	-163.139	13.1661	16.7545	11.2299	12.9454	11.8287
	5	-156.962	6.86423	21.6069	11.3867	13.4981	12.1237

Note: * denotes optimal lag selection.

Table 3.Engle-Granger Cointegration

Variable	Z-Statistic	Prob.
FD	-29.80334	0.0048*
IND	-42.71983	0.000*
CO2	-46.92905	0.000*

Note: Significance is showed by 1, 5, and 10% indicated through *, ** and *** respectively.

Table 4. Causality Tests

Country	Method		Country	Method	
Turkey	Granger		Turkey	Toda and Yamamoto	
	F Statistic	Probability		Chi-sq	Probability
FD->IND	0.00000	0.9940	FD->IND	0.071576	0.7891
IND->FD	0.35085	0.5573	IND->FD	0.973416	0.3238
CO^2->IND	0.26820	0.6077	CO^2->IND	0.697439	0.4036
IND->CO^2	1.45681	0.2353	IND->CO^2	1.006742	0.3127
CO^2->FD	0.17839	0.6753	CO2->FD	0.625625	0.4290
FD->CO^2	3.28329	0.0783***	FD->CO^2	0.371656	0.5421

Country	Method	
Cyprus	Toda and Yamamoto	
	Chi-sq	Probability
FD->IND	2.122483	0.1452
IND->FD	0.004210	0.9483
CO^2->IND	0.087455	0.7674
IND->CO^2	0.366506	0.5449
CO^2->FD	0.630088	0.4273
FD->CO^2	0.095214	0.7577

Note: Significance is showed by 1, 5, and 10% indicated through *, ** and *** respectively.

The Engle-Granger Cointegration test is only used on data from Turkey because of the series' stationarity. The presence of long-term associations between variables is ascertained using the Engle-Granger Cointegration test.

Different tests are used for Turkey and Cyprus. According to the suitability of the data, we used Toda and Yamamoto causality test and Granger causality test. No significant relationship is found in the Toda and Yamamoto causality tests. In Granger causality findings, the causality relationship from financial development to CO2 emission is determined. In other words, financial development granger causes CO2 emission.

5. CONCLUSION

Experts have recently focused on the connection amongst the degradation of the environment, global warming, and climate change and national economic growth. Around the world, there is an expanding contradiction between the need to conserve nature and the world's expanding energy need (Sun et al., 2024). Sustainable practices and polluting elements have been studied as a means of protecting the environment. Nature provides humanity with a wealth of resources for production, but these resources also emit trash and carbon dioxide that damage the environment, both during the manufacturing process and as a result of numerous human activities (Oncu and Ozdemir, 2020).

The development of finance is the proliferation of an economy experienced its financial markets. Financial growth is indicated by the expansion in the variety of products, organizations, and services utilized in the financial markets as well as by their increased utilization.

Research on the association between financial development and carbon dioxide emissions has shown that a boost in the financial development index is linked to lower CO2 emissions (Dogan and Sekeri, 2016; Gokmenoglu et al., 2015; Omri et al., 2015; Shahbaz et al., 2013); on the other hand, a decline within the financial development index is linked to higher CO2 emissions (Boutabba, 2014; Cetin and Ecevit, 2017; Farhani and Ozturk, 2015; Javid and Sharif, 2016; Ozturk and Acaravci, 2013; Shen et al., 2020).

Regarding causation, Zhang (2011) and Gokmenoglu et al. (2011) found a causal association between financial development and CO2 emissions. In this study, while no relationship is found according to Toda and Yamamoto results, according to Granger causality findings, financial development is the granger cause of CO2 emission.

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