

CHAPTER 9

ANALYSING OF THE FISCAL DECENTRALIZATION EFFECTIVENESS OF SUBNATIONAL GOVERNMENTS IN THE SELECTED COUNTRIES BETWEEN TWO DEVASTATING CRISIS

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ABSTRACT

Fiscal decentralization, one of the main issues in economic research in recent decades, is believed that the management of public financial resources and the service delivery by local governments would be carried out more effectively than central governments. This study aims to determine the fiscal decentralization effectiveness of subnational governments in the 32 countries, divided into two categories as, the unitary states and the federal states, from 2010 to 2019, and to compare the effectiveness levels in the period between the Global Finance Crisis and the COVID-19 Crisis. To calculate the fiscal decentralization efficiency of the selected countries with the data envelopment analysis method, inputs and outputs determined within the scope of different studies in the field of fiscal decentralization are used together. In this study, which is essential in terms of calculating the relative efficiency scores of the countries in the period between the two crises, it is detected that most of the countries analyzed reached high effectiveness scores after the Global Finance Crisis.

Keywords: Fiscal Decentralization, Effectiveness, Subnational Governments, Countries Comparison, DEA

1. Introduction

There have been rapid developments in public sector reforms, including performance monitoring, deregulation, commercialization, corporatization, contracting, since the 1990s (Worthington & Dollery, 2000), and recent years have witnessed a growing emphasis on the effectiveness of the public sector. This improvement process has accentuated the relationship between sub-national governments (SNGs) and the increasing decentralization of administration. Decentralization emerged in the most developed countries and then spread to Latin America and Asia-Pacific (De Mello & Jalles, 2020a). It has been a central concept in all the areas cited and has gained a pivotal role in fostering performance based on effectiveness. The common conviction is that the division of responsibilities between central and regional administrations may improve the effectiveness (Lago, Lago-Peñas & Martínez-Vázquez, 2020). These suggest that effectiveness at the SNG level is based on scale economies, and fiscal and administrative responsibilities move from the central governments to SNGs to increase effectiveness (Storto, 2013) that enjoys potential benefit from decentralization (Geys & Moesen, 2009).

Decentralization, transferring power and responsibility for public services from the central government to SNGs, has been a significant research item in recent scholarship (Martínez, Arzoz & Apeztequia, 2018). Most unitary states have mainly relied on decentralization for more effectiveness. Decentralization on political, administrative, and fiscal levels differs within a federal and a unitary system in terms of structure and aim. While a federal system includes the decentralization of responsibility and authority to precisely constituted governments at the regional level, in a unitary system, local governments do not necessarily have to be mentioned in the constitution and represented in the national legislature. In addition, an aim of a federal system can be to ease tensions between distinct groups in a diverse society. However, a unitary country is less interested in satisfying regional autonomy and focuses on improving the effectiveness of public services at the local or municipal level (Choudhry et al., 2014).

The general tendency in the public sector in several developed countries is to allow broad authorities to the SNGs administers, also backed by international agreements and instruments. In particular, the European Charter of Local Self Government of 1985 remains a very effective tool for establishing a decentralized Europe; Article 9 of the Charter specifically emphasizes the importance of the financial decentralization of SNGs. Thus, it is safe to argue that fiscal decentralization is significant as it improves government effectiveness and promotes the economic development of a country (Oates, 1993). Due to

some economic, political, and fiscal crises, central governments have decided to transfer some control to the SNGs, which has several effects on intergovernmental relations. The Global Finance Crisis (GFC), one such crisis, affected intergovernmental relations in different ways within the various countries in terms of specific fiscal, financial, and institutional characteristics of public finance (De Mello & Jalles, 2020a). The countries experienced the repercussions of the crisis from various political and institutional arrangements, one being the decentralization of fiscal policymaking (Beramendi & Rogers, 2020). These are why some focus has been paid to the consequences of decentralization on public sector efficiency and performance during the crisis (Lago et al., 2020).

The crisis led to institutional reforms in intergovernmental fiscal administration in support of medium-term fiscal consolidation programs (De Mello & Jalles, 2020b). Many agreements, including European Semester (2011), the Six-Pack (2011), Two-Pack (2013), and the Fiscal Compact (2013), entered into force to improve the managerial efficiency and bargaining power of SNGs administrations in terms of autonomy and fiscal matters (De Mello & Jalles, 2020a). While there are several studies on fiscal decentralization focusing on various countries for the period before the GFC (Martinez et al., 2018; Bartolini, Sacchi & Santolini, 2018; Jilek, 2018; Arzaghi & Balthrop, 2018; Alexeev & Mamedov, 2017; Kyriacou, Muinelogallo & Roca-Sagalés, 2016; Jametti & Joanis, 2016; Adam, Delis & Kammas 2014; Sacchi, & Salotti, 2014; Choudhry et al., 2014; Canavire-Bacarreza & Martines-Vazque, 2012; Dziobek, Mangas & Kufa, 2011; Stegarescu, 2006 and 2009; Ebel & Yilmaz, 2002), there are no sufficient researches that analyse the notion for the period between two major crises, the GFC and COVID-19 (Lago-Peñas, Martinez-Vazquez & Sacchi, 2020; De Mello & Jalles, 2020a; Malička & Martinková, 2018).

Fiscal decentralization scholarship is generally divided into two sections in terms of methodology. The first type of scholarship employs econometric or statistics models with dependent variables such as tax and expenditure decentralization and independent variables such as economic growth, corruption, public sector size, culture, historical data, and population. (Adam et al., 2014; Dziobek et al., 2011; Akai & Sakata, 2002; Ebel & Yilmaz, 2002). The second type of scholarship, fiscal decentralization effectiveness, is also calculated within the scope of SNG's public services in the sample countries through non-parametric tests such as the deterministic frontier approach (DFA), and stochastic frontier approach (SFA), and data envelop analysis (DEA). In these studies, inputs consist of current, capital, health expenditures (Tirtosuharto, 2017; Ghani, Grewal, Ahmed & Noor, 2017; Geys & Moesen, 2009), urban waste management, public transportation, general consumption (Storto,

2013) and recreational facilities, roads infrastructure, pavements (Doumpos & Cohen, 2014). Outputs are often pointed out as tax and expenditure decentralization of local governments. This study reflects the combination of the current literature by using the DEA method. While inputs consist of comprise institutional factors, total population, urban population, GDP growth ratio, GDP per capita, and Gini coefficient, outputs consist of revenue decentralization, expenditure decentralization, tax decentralization, and taxing power. The importance of the study stems from using the combination of the inputs and outputs determined in the scope of the different studies in the realm of fiscal decentralization and calculating the relative effectiveness scores of country by country through the process of two crises.

Fiscal decentralization attached to SNGs often enhances fiscal performance (Lago-Peñas et al., 2020). This study seeks to determine the relative effectiveness scores of fiscal decentralization levels in different countries regarding second-generation theory. The effectiveness of fiscal decentralization is measured under a constant return to scale (the CCR model) and a variable return to scale (the BCC model) by considering the output-oriented DEA method in 32 countries from 2010 to 2019. The data used in the analysis is retrieved from various sources, including the International Money Fund (IMF), the Organization for Economic Co-Operation and Development (OECD), the World Bank Development Indicators, and Worldwide Governance Indicators (WGI).

In line with the overall objective of the study, the following research questions are formulated:

- i. How did changes in the effectiveness scores of fiscal decentralization in the selected unitary states between 2010 and 2019 under both constant returns to scale (the CCR Model) and variable return to scale (the BCC Model) occur?
- ii. How did changes in the effectiveness scores of fiscal decentralization in the selected federal states between 2010 and 2019 under both constant returns to scale (the CCR Model) and variable return to scale (the BCC Model) occur?
- iii. Which countries reached the most effective level in the analyzed period?
- iv. What reasons could be cited for the countries that reached a minor effectiveness level in the analyzed period?
- v. How did the GFC affect fiscal decentralization in the SNGs in fiscal terms?

2. Theoretical Framework

The term ‘fiscal federalism’ was introduced by Richard Musgrave in 1959 and popularised by Wallace E Oates in the 1970s in his book, ‘Fiscal Federalism. The word fiscal usually refers to government finance, while the latter, ‘federalism,’ in fiscal federalism appears to mean both ‘federal’ and ‘unitary’ political system (Jha, 2013). As a sub-field of public finance, fiscal federalism addresses the economics of multi-level government, including the economic roles of different levels of government and the financial instruments they employ (Oates, 2011). The field of fiscal federalism gained popularity in the early 1990s with a clear worldwide trend toward fiscal decentralization (Ter-Minassian, 1997).

The concept of fiscal decentralization and the formation of the content have been provided by the theory of fiscal federalism. Towards the middle of the 20th century, Hayek (1945), Tiebout (1956), Musgrave (1959), and Oates (1972) developed the “theory of fiscal federalism” in the context of public economics based on neoclassical economics. Its idea originated from the concept of the first-generation theory (FGT) of fiscal federalism (Ouyang & Li, 2021). According to the FGT, financial resources and responsibilities were transferred from the central government to the local government, so establishing a more effective structure in the public economy would be possible. Because of this process, also called “financial decentralization,” it was believed that the management of public financial resources and the service delivery by local governments would be carried out more effectively than central governments.

Hayek 1945; Musgrave 1959; Oates 1972, and Tiebout 1956, referred to as the first generation supporting the idea of local governments having more significant tax and expenditure power. According to them, the FGT could alleviate the problem of asymmetric information and increase intergovernmental fiscal competition, thus improving social welfare and providing better public services to residents.

By combining the advantages of local and central governments, the FGT provided the guidelines on which functions should be placed at the level of the federal government and which should be placed at the decentralized levels of government or sub-national levels of government. The functions of the public sector could be divided into three branches (i) allocation of resources such as provision of public goods and services, (ii) redistribution of income, and (iii) macro-economic stabilization- (Musgrave, 1959; Musgrave & Musgrave, 1984). The theory argues that the federal government should have primary responsibilities for macro-economic stabilization and income redistribution. The FGT, favours the decentralization

of allocated functions. Additionally, the FGT recognizes that decentralized and centralized governments have advantages and disadvantages in performing these tasks (Jha, 2015).

More recently, others developed a new approach in the field of fiscal federalism, known as the second generation of the fiscal federalism theory that was first affirmed by Qian & Weingast (1997). The second-generation theory (SGT) describes how fiscal decentralization affects government behavior from the perspective of public-choice theory; in this theory, public decision makers are assumed to be utilitarian. They maximize their objective functions. (Qian & Weingast, 1997; Oates, 2005; Weingast, 2009). The utility maximizations of local administrators and local individuals may not converge all the time. Since, in case of conflict of interest between local administrators and residents, local administrators, taking advantage of the asymmetric information and opportunities such as financial incentives, may rely on options that contradict the interests of citizens and pay greater attention to their benefits (Oates, 2005).

A review of the literature reveals that while the FGT studies the performance of decentralized systems under the assumption of benevolent social planners, and emphasizes correcting vertical and horizontal equity, the SGT, emerging from the FGT, examines the fiscal and political incentives facing sub-national officials. Additionally, SGT extends the FGT approaches by showing how non-linear transfer systems can produce both equalization and high marginal fiscal incentives to produce local economic growth (Oates, 2005; Weingast, 2009; Weingast, 2014). The FGT emphasizes the importance of fiscal incentives for producing local economic prosperity (Weingast, 2009).

3. Methodology

Effectiveness is crucial for a country to avoid wasting resources by using fewer inputs in given output production or many outputs in each input. Technical effectiveness appears when input is used to get from a given output level or maximum output to a given input level. Its analysis can be oriented to output maximization or input minimization (Martinez et al., 2018). The parametric techniques that utilize statistical regression through single input-multiple outputs or single output-multiple inputs are used to measure comparative performance within technical effectiveness. Non-parametric analyses are also preferred as another option (Tirtosuharto, 2017). Deterministic frontier approach (DFA) and stochastic frontier approach (SFA) attempt to determine the absolute effectiveness of DMUs contrary to some given benchmark of effectiveness, and data envelopment analysis (DEA), which calculates the relative technical effectiveness of DMUs, are non-parametric methods

(Worthington & Dollery, 2000). In the study, the DEA method has been preferred to calculate the fiscal decentralization effectiveness of selected countries.

3.1. The Theory of Data Envelopment Analysis

Data envelopment analysis (DEA), a non-parametric method, is one of the practical measurement approaches that help to determine the technical effectiveness relative performance of decisions making units (DMU) (Ghani et al., 2017). DEA is also a deterministic mathematical programming technique that includes multi-inputs and outputs and also adopts transforming inputs into outputs for each DMU (Storto, 2013). In other words, it calculates the technical effectiveness of a DMU relative to the performance by comparing other DMUs using the same inputs and producing the same outputs (Worthington & Dollery, 2000). DEA means that it envelops observations to determine a preferred frontier by aiming to assess DMUs representing the performances of all the entities to be evaluated (Manavgat & Demirci, 2020; Cooper, Seiford & Tone, 2006). DEA techniques construct an efficient production frontier from several inputs and outputs, and it is agreed that all inputs and outputs are achieved in the same production function. Therefore, an efficient production frontier shows the optimum effectiveness in the model. All DMUs, known as an envelope, are accepted to be fully efficient and given the highest effectiveness score (Tirtosuharto, 2017).

DEA was developed by Charnes, Cooper & Rhodes in 1978, based on Farrell's study, which proposed estimation of the effectiveness by front-end analysis method in 1957 (Zhou, Kong & Zhang, 2020), and it became part of the literature as the CCR model. In 1984, Banker, Charnes, and Cooper improved the CCR model in consideration of the variable return to scale; the new model later became to be known as the BCC model in the literature, which assumes that the scale of the economy changes as the size of the service facility increases (Manavgat & Demirci, 2020). Each DMU controls the decision to transform inputs into outputs to reach technical efficiency (Tirtosuharto, 2017).

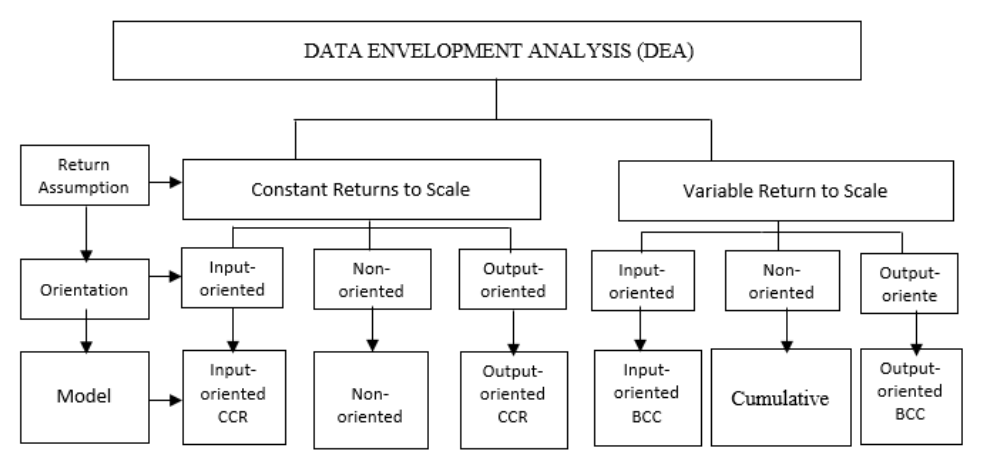


Figure 1: Data Envelopment Analysis Types and Models.
 Source: Ozden, 2008.

The most important advantage of a DEA model is that it does not require any assumption about the function form and makes it especially suitable for analyzing multiple inputs and outputs production calculations. DEA assesses the relative performance effectiveness of a DMU by comparing a set of other DMUs on a particular scale [varies between 0 and 1 or 0 and 100], and every DMU is free to specify its input-output weights to maximize its performance (Droumpos & Cohen, 2014). While 0 refers to the inefficient DMU, 1 or 100 means the most efficient DMU, and the efficient DMUs generate the central elements of the best practices frontier (Geys & Moesen, 2009). By reaching these scores, DEA determines sources and amounts of ineffectiveness in each input and output for every DMU (Manavgat & Demirci, 2020; Cooper et al., 2006). The model detects the optimal input and output weight set, which maximizes the effectiveness score for every DMU (Storto, 2013).

Additionally, the weights of all indicators are automatically calculated through the data based on a group constituted by specific inputs and outputs (Zhou et al., 2020). DEA weighs various input and output values together linearly. Therefore, the weighted total input that shows the weighted linear sum of the organization inputs is calculated as follows:

$$\text{Weighted Total Input} = \sum_{i=1}^m v_i x_i \tag{1}$$

In the formula, v_i refers to the weight specified for x_i input at the conjugation time. DMU's weighted total output is calculated by the linear weighted aggregate of all outputs.

$$\text{Weighted Total Output} = \sum_{j=1}^n u_j y_j \quad (2)$$

In the second equation, u_j is the weight specified for the y_j output. The effectiveness of weighted total inputs and outputs and the effectiveness of DMUs, which convert inputs to outputs, is defined as the ratio of inputs to outputs, and it is formulated below (Ramanathan, 2003):

Effectiveness Weighted Total Output/Weighted Total Input

$$\text{Effectiveness} = \frac{\sum_{j=1}^n u_j y_j}{\sum_{i=1}^m v_i x_i} \quad (3)$$

As the DMU with the best performance will obtain a value of 1, 0 [or 100], the following limits should be added to the formula.

$$\frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^s v_i x_{ij}} \leq 1 \quad j = 1, 2, \dots, n \quad (4)$$

$$u_r, v_i \geq 0, \quad r = 1, \dots, s, \quad i = 1, \dots, m$$

y_{rj} and x_{ij} being positive, present j^{th} KVB's input and output amount. In a similar matter, $u_r, v_i \geq 0$ equation shows the weights of these inputs and outputs (Bakirci, Yakut, Demirci & Gunduz, 2014). While DEA measures relative effectiveness, each DMU is expected to have enough units with absolute technical effectiveness. In addition, DEA analysis is considered to be able to continually improve DMUs' performance (Ghani et al., 2017; Thanassoulis, 2001). It is especially preferred to determine the effectiveness of public services such as health, education, environment, and finance (Kutlar, Bakirci & Yuksel, 2012).

3.2. Variable Selection and Data

Choosing inputs and outputs is a significant problem in efficiency measurement (Geys & Moesen, 2009). For this reason, we reviewed the literature for the proper indicators to select inputs and outputs in the analysis. Board literature focuses on searching the relationship

between fiscal decentralization and macroeconomic indicators. The GDP growth ratio is associated with the demand for public expenditures that cause expansion and decentralization of the public sector (Malicka & Martinková, 2018). Panizee (1999) also analyzed the relation of the GDP, country size, income per capita, ethnic fractionalization, democracy level, and fiscal decentralization by using IMF government finance statistics. In this study, it is found that the selected indicators had positive effects on fiscal decentralization. Akai and Sakata (2002) examined the relationship between fiscal decentralization and economic growth and determined a positive correlation between them. In the cases of Martinez et al., 2018; Sobel, Dutta & Roy 2013; Blöchliger & Égert, 2013; Lin & Liu 2000, a positive relationship was also detected.

Malicka & Martinková (2018); Jilek (2018); Arzaghi & Baltrop (2018); Kyriacou et al. (2016), Jametti & Joanis (2016), and Treisman (2006) used income per capita indicators to determine the factors that affected fiscal decentralization. In terms of population effect on fiscal decentralization, Oates (1972); Wallis & Oates (1988); Arzaghi & Hendersuon (2005); Letelier (2005); Bodman & Hodge (2010); Garrett & Rodden (2006); Jametti & Joanis (2016); Alexeev & Mamedov (2017), and Malicka & Martinková (2018); Arzaghi & Baltrop (2018) analysed population indicator as an explanatory variable. In the cases of the studies by Pommerehne (1976); Wallis & Oates (1988); Letelier (2005); Stegarescu (2006; 2009); Sacchi & Salotti (2014); Arney & McNab (2018), and Jilek (2018), urbanization was included to represent a geographic distribution of the population. De Mello & Jalles (2020a); Canavire-Bacarreza & Martinez-Vazquez (2012); Kyriacou et al., (2016); Jilek (2018), included institutional factors such as corruption, political rights, governance effectiveness, accountability, political stability and violence level in analyzing the determinants on the fiscal decentralization in their studies. Because when proper institutional arrangements are unavailable to support decentralization, it may not be served well with limited financial resources (Tirtosuharto, 2017). In addition, the Gini coefficient was examined as the effect of income inequality on fiscal decentralization in the studies by Pommerehne (1976), Bodman & Hodge (2010), and Alexeev & Mamedov (2017). In the light of this review, we decided to use the GDP ratios (annual), income per capita, total population, urbanization, institutional factors, and Gini coefficient as input indicators in the DEA.

Comparing the degree of fiscal decentralization between countries is a complex task that needs to identify SNG's autonomy and discretion on expenditure and revenue (Ebel & Yilmaz, 2002). It is vital to consider the devolution or the level of authority of the SNGs, but measuring the authority vested in the administration is complex. The widely accepted

approach to performing this is to use accounting indicators such as revenue and expenditure of SNGs (Akai & Sakata, 2002) because the revenue and expenditure structures of SNGs are effective in fiscal decentralization (Bercinturk, 2020). Expenditure decentralization is optimistic because of allowing the SNGs to bring in compliance with the policy administration (Beramendi & Rogers, 2020).

Revenue decentralization principally promotes fiscal solvency at the sub-national level (Ebel & Yilmaz, 2002) and allows jurisdictions to enable their preferred level of services (Oates, 1993). The taxing powering of SNGs is taken as a fiscal decentralization indicator, and making decisions about taxation may cause tax competition (Malička & Martinková, 2018). In the realm of revenue decentralizing, Wasylenko (1987) calculated the revenue decentralization of SNGs via their income except for transfer payments between administrations. Stegarescu (2006 and 2009) also analyzed the revenue decentralization with the own tax revenue of SNGs. According to Garrett & Rodden (2006), decentralization could be increase in the countries where the public sector is dominant in the economy and consider the public expenditure level to detect the effects of public sector volume on fiscal decentralization. It is doubtful to use a unique indicator that ultimately reflects the fiscal decentralization dimension (Akai & Sakata, 2002). In calculating fiscal decentralization, the sub-national share of total public expenditure and the sub-national share of total government tax revenue are standard gauges (Martinez et al., 2018). These relevant indicators are the conventional measures of fiscal decentralization. In addition, they help measure the effects of the GFC on the public finances, given the institutional fundamentals of intergovernmental relations in each country (De Mello & Jalles, 2020a). Accordingly, for a comprehensive review, this study uses the four fiscal decentralization indicators as outputs: (i) revenue decentralization, which means consolidated SNGs revenue as a percentage of total general government expenditure, (ii) expenditure decentralization which means consolidated sub-central expenditure as a percentage of total general government expenditure, (iii) Tax decentralization that means as tax revenue as a percentage of total general government tax revenue, and (iv) The taxing power of SNGs means the percentage of sub-central tax revenue in the GDP.

On the other hand, in determining fiscal decentralization, the level of local fiscal dependency, also called intergovernmental transfer payments, shows higher fiscal centralization. If intergovernmental transfer payments or dependency ratios are high, the degree of fiscal decentralization –expenditure and revenue- decreases (Cetinkaya, 2020). In other words, raising transfer payments by central governments has a reductive impact on fiscal decentralization (Malicka & Martinková, 2018). Thus, intergovernmental payments lead to

some additional technical ineffectiveness (Doumpou & Cohen, 2014; De Borger & Kerstens, 1994). As already mentioned, this study emphasizes the assumption of maximizing outputs in analyzing the fiscal decentralization in various countries and uses the output-oriented model for this objective. We deliberately omitted any transfer payment indicators in the analysis to remove the adverse effects of intergovernmental payments on fiscal decentralization effectiveness. If the intergovernmental transfer payments as output had been included in the analysis, the results could not have shown the effectiveness level of countries correctly. In a DZA analysis, the number of DMUs should be the sum of inputs and outputs over two or three times (Demirci, 2018). Therefore, we decided to use ten indicators, including all inputs and outputs, because the study covers 32 countries. In Table 1, we can see inputs and outputs.

Table 1. Data Definitions and Sources

Input / Output	Data Name	Description	Source
Input 1	Institutional Factors -WGI-	To measure the impact of institutional factors on fiscal decentralization effectiveness, Worldwide Governance Indicators (WGI) for six governance dimensions were averaged for every year by country as an input. WGI consists of six sub-indicators: Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption.	The Worldwide Governance Indicators (WGI) project by the World Bank reports aggregate and individual governance indicators for over 200 countries and territories from 1996 to 2019.
Input 2	Total Population -TP-	To measure the total population on fiscal decentralization effectiveness, the total population for all countries analyzed as an input was used in the study.	The World Development Indicators (2010-2019)
Input 3	Urban Population -UP-	To measure the regional distribution of the population on fiscal decentralization effectiveness, the urban population was used as urbanization input.	The World Development Indicators (2010-2019)
Input 4	GDP Growth Ratio -GDP-	To measure the economic growth on fiscal decentralization effectiveness, the GDP ratios (annual %) was used for all countries as an input.	The World Development Indicators (2010-2019)
Input 5	GDP Per Capita -PGDP-	To measure the per capita income on fiscal decentralization effectiveness, the data of GDP per capita (current US\$) was used for all countries as an input.	The World Development Indicators (2010-2019)
Input 6	Gini Coefficient -GINI-	To measure the income inequalities on fiscal decentralization effectiveness, Gini coefficients calculated by the World Bank were used as an input. Gini coefficients for some countries were not available in few years, so OECD income inequality data was used for incomplete years.	The World Development Indicators (2010-2019) and OECD income inequality data (2010-2019)

Output 1	Revenue Decentralization -RD-	Consolidated government revenue as a percentage of total general government revenue obtained from the OECD fiscal decentralization database was used as revenue decentralization output. The consolidated revenue of each level of government is defined as total revenue minus the intergovernmental transfer revenue of that government level. The data for some countries were not available in OECD database, so the incomplete data were provided by IMF fiscal decentralization database.	OECD Fiscal Decentralisation Database (2010-2018) and IMF fiscal decentralization dataset (2010-2019)
Output 2	Expenditure Decentralization -ED-	Consolidated government expenditure as a percentage of total general government expenditure was used as expenditure decentralization output from the OECD fiscal decentralization dataset. The consolidated expenditure of each level of government is defined as total spending minus the intergovernmental transfer spending of that government level. The data for some countries were unavailable in the OECD database, so the incomplete data were provided by the IMF fiscal decentralization database.	OECD Fiscal Decentralisation Database (2010-2018) and IMF fiscal decentralization dataset (2010-2019)
Output 3	Tax Decentralization -TR-	Consolidated SNGs tax revenue as a percentage of total general government tax revenue was used as tax decentralization output by OECD fiscal decentralization dataset. The data for some countries were not available so the incomplete data were provided by IMF fiscal decentralization database.	OECD Fiscal Decentralisation Database (2010-2018) and IMF fiscal decentralization dataset (2010-2019)
Output 4	Taxing Power -TP-	The taxing power that is calculated as the tax revenue of SNGs as a percentage of GDP was collected from OECD fiscal decentralization dataset from 2010 to 2018. The calculation is also a synonym for the tax authority of sub-central governments. The indicators of taxing power or tax autonomy are obtained from a survey of national administrations, who apply the OECD typology of tax autonomy, indicating the degree of tax autonomy of SNGs over different revenue sources, to data from the OECD Revenue Statistics publication. The 2019 data for all countries analyzed were not available in the OECD fiscal decentralization dataset, so the 2019 data were provided from IMF fiscal decentralization dataset.	OECD Fiscal Decentralisation Database (2010-2018) and IMF fiscal decentralization dataset (2019)
Source: Own Elaboration.			

3.3. Empirical Analysis

DEA models can be either input-oriented or output-oriented. While an input-oriented selection focuses on the proportional reductions of inputs, an output-oriented selection targets the proportional increase of outputs from a given set of inputs (Worthington & Dollery, 2000).

Under constant returns to scale, both input-oriented and output-oriented models show the same results, but it is not valid under variable returns to scale (Martinez et al., 2018). This study utilizes the output-oriented model where the production function is established by maximizing the possible proportional increase in output usage while inputs are fixed. The effectiveness of the fiscal decentralization of SNGs in selected countries has been analyzed in the CCR model, which assumes constant returns to scale, and the BCC model, which assumes variable returns to scale.

As Oates (1972) underlined, fiscal centralization is relatively low in countries with federal governments. In this context, the federal structure of countries is an influential factor in the localization of financial decisions. Additionally, states use their responsibilities as defined in the national division of powers within the government levels. Although in a unitary government, the constitution defines supreme authority attached to the central governments, the responsibilities in a federal government are generally divided equally between central and SNGs levels, which sometimes have more responsibilities than central levels in the supply of public service (Dziobek et al., 2011). Based on this distinction, in the study, the examined countries have been divided into two categories as, the unitary states and the federal states. Also, the analysis has been repeated every year from 2010 to 2019. Thus, DEA has been performed 40 times, 20 times for each category. Suppose the sample groups in the study were not separately analysed in terms of the administrative structure of countries. In that case, the findings could not precisely show the correct results since the fiscal decentralization proportion in a federal state is higher than in a unitary state. The fiscal decentralization indicators determined as outputs are weighted more in a federal state than in a unitary state. In determining the countries to be included in the study, some limitations were considered -particularly the lack of data for the SNGs of all countries that restricted the number of countries for which indicators can be computed-. In addition, the countries that have similar development levels in economic terms were included in the study; all except South Africa are members of the OECD.

4. Results and Discussion

The research seeks to analyze the relative effectiveness of fiscal decentralization in the selected countries and to compare the differences in their effectiveness scores in the years between Global Finance Crises and the COVID -19 Crisis. The Frontier Analyst Professional package program was used for DEA measurement in the CCR and BCC models to achieve these goals. The countries with an effectiveness score of 100% are considered efficient and stand on the efficient frontier, and a higher score implies a higher effectiveness level. In other

words, the relevant countries reached the relative effectiveness score based on determined inputs and outputs of fiscal decentralization.

4.1. The Analysing of Fiscal Decentralization Effectiveness in the Unitary States

Table 2 shows the results of fiscal decentralization effectiveness in the selected unitary states under constant returns to scale between 2010 and 2019. We did not analyze the data for 2020 because the determined inputs and outputs have not been shared publicly yet. It is possible to compare the effectiveness level of one country with other countries in one period and to analyze its performance in all periods.

Table 2. The Relative Effectiveness Results of Fiscal Decentralization Effectiveness of SNGs in the Selected Unitary States (the CCR Model)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Czech Republic	100	100	100	100	100	100	100	100	100	100
Denmark	100	100	100	100	100	100	100	100	100	100
Finland	100	99.8	100	100	100	100	100	100	100	100
France	56.6	61.9	62.3	62.8	64.8	68.2	72.9	64.9	67.4	52.7
Greece	54.59	86.8	58.9	51.8	55.7	100	100	55.1	40.9	27.7
Hungary	100	100	100	89.1	88.4	73.6	76.9	66.8	78.8	69.2
Iceland	100	100	100	100	100	100	100	100	100	100
Ireland	22.1	65.9	100	23.4	20.1	18.5	23.9	22	21.7	22.8
Israel	98.5	70.8	70.9	56.2	65.5	56.1	56.4	60	67	34.2
Italy	84.3	100	100	100	100	100	100	100	100	100
Japan	100	100	98.7	95.5	100	95.1	100	97.7	100	100
Korea, Republic	100	100	100	100	100	100	100	100	94.8	75.2
Luxembourg	44.7	32.2	100	35.5	30	33.5	47.5	65.3	39	31.4
Netherlands	67.6	55	72.5	75.7	54.8	56.4	61.9	53.5	53.1	51.2
New Zealand	100	42.3	42.3	39.1	42.3	43.1	43	42.3	46.1	37.1
Norway	95.9	73.4	67.2	63.7	61.4	64.8	100	73.4	90.2	87.2
Poland	100	100	100	100	100	100	100	100	100	100
Portugal	58.1	100	74.3	77.4	68.7	66.6	68.5	66.2	63.5	61.8
South Africa	100	100	100	100	100	100	100	100	100	100
Sweden	100	100	100	100	100	100	100	100	100	100
Turkiye	100	100	100	100	100	100	100	100	100	100
The United Kingdom	51.4	51.8	47.1	45.2	43	41.1	46.3	47.7	45.1	25.3

Note: The Gini Coefficient was not used as input in the 2019 analysis due to the lack of data on income inequality in many countries in the table. **Source:** Own elaboration by using the DEA results

As shown in Table 2, the findings reveal the production technology with constant returns to scale, and most of the countries in the table have reached the scale efficient level in terms of fiscal decentralization. Czech Republic, Denmark, Iceland, Poland, South Africa, Sweden, and Turkey feature 100% effectiveness in all years analysed. However, Israel, Netherlands, Norway, and the United Kingdom did not perform efficiently in the investigated period. Table 3 shows the results of fiscal decentralization effectiveness in the selected unitary states under variable returns to scale.

Table 3. The Relative Effectiveness Results of Fiscal Decentralization of SNGs in the Selected Unitary States (the BCC Method)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Czech Republic	100	100	100	100	100	100	100	100	100	100
Denmark	100	100	100	100	100	100	100	100	100	100
Finland	100	100	100	100	100	100	100	100	100	100
France	58.63	62.6	62.3	63.1	65.1	68.8	81.7	72.1	69.4	58.2
Greece	100	100	100	100	100	100	100	100	100	100
Hungary	100	100	100	100	100	100	100	100	100	100
Iceland	100	100	100	100	100	100	100	100	100	100
Ireland	24.53	100	100	100	20.1	18.7	31.4	22.9	24.1	27.1
Israel	100	100	90.4	100	80	63	65.1	67.6	83.9	43.9
Italy	100	100	100	100	100	100	100	100	100	100
Japan	100	100	100	95.9	100	95.6	100	100	100	100
Korea, Republic	100	100	100	100	100	100	100	100	97.2	90
Luxembourg	47.62	37	100	100	33.3	100	100	100	100	33.8
Netherlands	68.27	56	72.5	75.7	55.6	60.1	72.3	63.9	54.2	54.5
New Zealand	100	42.7	42.8	39.4	42.6	51	100	100	100	100
Norway	98.02	100	100	100	100	69.4	100	100	100	100
Poland	100	100	100	100	100	100	100	100	100	100
Portugal	58.84	100	77.8	100	100	100	100	100	100	100
South Africa	100	100	100	100	100	100	100	100	100	100
Sweden	100	100	100	100	100	100	100	100	100	100
Turkey	100	100	100	100	100	100	100	100	100	100
The United Kingdom	51.53	54.8	47.6	45.6	44.8	41.2	47	66.3	46.1	39.7

Note: The Gini Coefficient was not used as input in the 2019 analysis due to the lack of data on income inequality in many countries in the table. **Source:** Own elaboration by using the DEA results.

Table 3 confirms that the number of countries that have attained perfect decentralization increases compared to the results in Table 1. In other words, the number of inefficient countries has decreased within the scope of the BCC model. While 12 out of 23 countries reached the

perfect effectiveness level within the BCC model, only four countries were efficient under the CCR model. It stems from the flexibility provided by the model in weighting inputs and output in the case of variable return to scale (Demirci, 2018).

Notably, France, the Netherlands, and the United Kingdom have never reached the perfect effectiveness level both the CCR and the BCC models in the examined period. This result is consistent with the previous study that was conducted by Martinez et al. in 2018. Who examined the fiscal decentralization in OECD countries between 2009 and 2018 and found that the United Kingdom was at the lower end of the scale (Martinez et al., 2018). This result may be explained by the privatization implementations in the country where an intense program of privatization was put into practice in the 80s. Civil services were significantly restructured, thereby resulting in the public services at the level of central and local governments being served through private firms (Worthington & Dollery, 2000). Additionally, the limited fiscal decentralization in the country is more about the fiscal policy that has been almost exclusively controlled by the central government and local administrations that have had minimal control over their budgets, mainly sustained by block grants from the government. During the great recession, the crisis caused a decline in revenues and increases in expenditure as a share of the GDP, and the high centralization provided that the UK government cut public expenditures, especially on local services (Lago-Peñas et al., 2020).

Although France has the three-level local governance regions, departments, and municipalities (Malicka & Martinková, 2018), it is a somewhat centralized country that offers limited authority to SNGs in terms of taxation and expenditure (European Committee of the Regions, 2021). The central government is responsible for nearly 90% of all government spending in France (Boschmann, 2009). In the Netherlands, government activities are primarily centralized, and the ability of local administrations to increase their resources is minimal too. Local administrations are almost wholly dependent upon central government transfers (The European Committee of the Regions, 2021).

Table 4. The Ranking of Countries in Terms of the DEA Results

	Average of the CCR Model Results	Ranking with the CCR Model Results	Average of the BCC Model Results	Ranking with the BCC Model Results
Czech Republic	100	1	100	1
Denmark	100	1	100	1
Finland	99,9	2	100	1
France	63,5	10	66,2	9
Greece	63,2	11	100	1

Hungary	84,3	6	100	1
Iceland	100	1	100	1
Ireland	34,0	15	46,9	12
Israel	63,6	9	79,4	6
Italy	98,4	4	100	1
Japan	98,7	3	99,2	2
Korea, Republic	97	5	98,7	3
Luxembourg	45,9	14	75,2	7
Netherlands	60,2	12	63,3	10
New Zealand	47,8	13	71,9	8
Norway	77,7	7	96,7	4
Poland	100	1	100	1
Portugal	70,5	8	93,5	5
South Africa	100	1	100	1
Sweden	100	1	100	1
Turkiye	100	1	100	1
The United Kingdom	44,4	14	48,5	11

Source: Prepared through the results in Tables 2 and 3.

As can be seen from Table 4, the Czech Republic, Denmark, Finland, Iceland, Japan, Poland, South Africa, Sweden, and Turkey are the most fiscal decentralization efficient countries within both constant returns to scale and variable returns to scale. Surprisingly, while Greece has been one country with less fiscal decentralization effective in the CCR model, it has reached a country that performed the most fiscal decentralization effective in the BCC model. The impact on public finance of short-period decentralization was available aftermath of the GFC, and also post-crisis reforms, such as in Finland and Greece, focused on improving the administrative effectiveness of SNGs and providing cost-effective services to the population under fiscal pressure (De Mello & Jalles, 2020b).

On the other side, Ireland, Netherlands, France, and the United Kingdom rank as countries that are the less fiscal decentralization effective countries. Most European countries have put into force fiscal decentralization reforms since the mid-1990s by assigning more expenditure functions to SNGs. However, Ireland followed the opposite path with the ratio of local expenditure within the general government expenditure falling from about 40% to 10% from 2004 to 2010 (European Commission, 2013). Even though the government of Ireland planned to establish regional self-government in the middle of the 2010s, the plan failed (Malicka & Martinková, 2018). Additionally, revenue autonomy at the local level in Ireland was below

Spain	100	100	100	100	100	100	100	100	100	100
Switzerland	100	100	100	100	100	100	100	100	100	100
USA	100	100	88.3	91.1	83	82.4	90.7	86.7	88.3	86.5
Note: The Gini Coefficient was not used as input in the 2019 analysis due to the lack of data on income inequality in many countries in the table. Source: Own elaboration by using the DEA results.										

A review of the findings in Table 6 reveals that the number of countries with fiscal solid decentralization effectiveness increases within the scope of the BCC model based on the flexibility the model provides compared to the CCR model provides. The US, however, is the country that has reached the least decentralized effectiveness score within the two models. A possible explanation is that, according to Sorens (2011, p. 228), “the growth of the central government in the United States over the nineteenth and twentieth centuries entailed a corresponding decline in the effective autonomy of state governments because they could no longer choose to have way, a different kind of Social Security, a lower-than-federal minimum wage, or a different antitrust policy, even though the states’ formal competencies remained the same.”

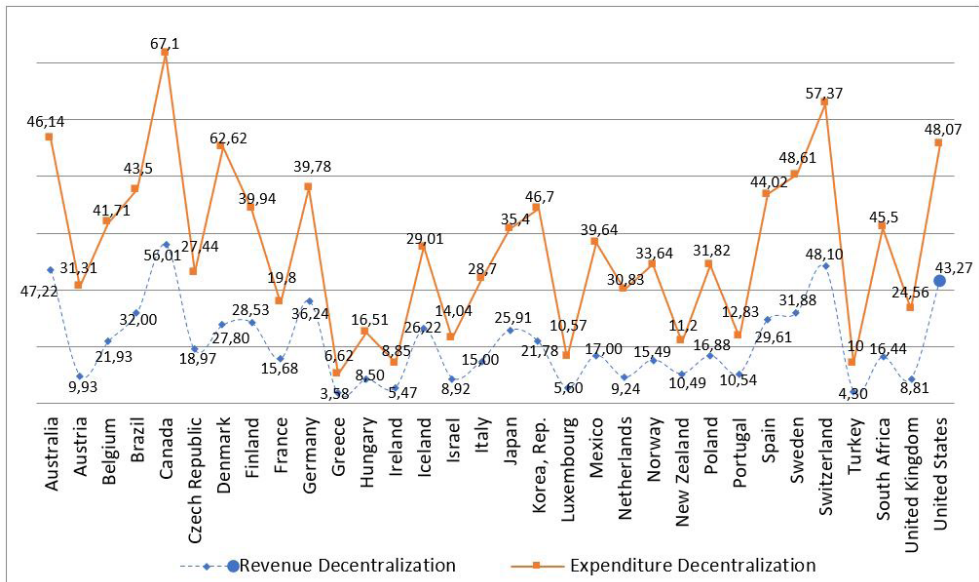
Privatization policy may also be cited as another reason. The scope of privatization in the US only mildly expanded from 1992 to 1997, even shrank in 2002 with no change until 2007. In advance of the Global Finance Crises (GFC), the volume of privatization in the US economy boomed, and most US states have imposed taxes and expenditure limitations on local governments, which have increased since the GFC (Warner, Aldag & Kim, 2021).

Table 7. The Ranking of Countries in Terms of DEA Results

	Average of the CCR Model Results	Ranking with the CCR Model Results	Average of the BCC Model Results	Ranking with the BCC Model Results
Australia	95,9	4	98,0	2
Austria	89,9	5	100	1
Belgium	98,9	3	100	1
Brazil	100	1	100	1
Canada	100	1	100	1
Germany	90,8	6	97,3	3
Mexico	100	1	100	1
Spain	99,1	2	100	1
Switzerland	100	1	100	1
USA	83,8	7	89,7	4
Source: Prepared through the results in Tables 5 and 6.				

Table 7 shows that Brazil, Canada, Switzerland, and Mexico are the countries that have achieved the most fiscal decentralization effectiveness score within both constant returns to

scale and variable return to scale. Interestingly, under the BCC model, Austria has ranged from lower order to a higher order and stood as one of the perfectly adequate countries. It stems from the flexibility provided by the model in weighting inputs and output in the case of variable return to scale (Demirci, 2018). However, it cannot be said that decentralized states are more fiscally unstable than unitary states in advance of the GFC (Lago et al., 2020). In more centralized and decentralized countries, the central governments preferred interruptions in intergovernmental payments to sub-level units. They struggled with the effects of the crisis by creating more tax revenue autonomy at the sub-national level to provide fiscal discipline. Even institutional and structural reforms -the consolidation of local governments, implementation of strict budget rules, and creation of new financial oversight institutions- came into effect following the start of the crisis (Lago-Peñas et al., 2020).



Graph 1: The Average of Revenue and Expenditure Decentralization in Various Countries between 2010 and 2019

Source: Prepared by using data from the OECD Database (2010-2018) and the IMF database (2010-2019).

Graph 1 shows the total revenue and expenditure decentralization of the analyzed countries. According to the graph, the decentralization level is predictably higher in federal ones than unitary ones in general. On the other hand, in all countries, including federal and unitary countries, expenditure decentralization actualized higher than revenue decentralization.

5. Conclusions

The study aims to analyze the fiscal decentralization effectiveness of SNGs in the selected countries between two crises, the GFC and COVID-19. Additionally, the current study seeks to compare the relative effectiveness scores of these countries in terms of the unitary and federal governing structures, respectively. This research contributes to the debates on fiscal decentralization and its effectiveness in various countries. The main findings suggest that the number of influential countries analyzed in two categories significantly increased under the BCC model because of the flexibility provided by the variable return to scale.

The level of fiscal decentralization varies by the governing structure, political environment, history, culture, and economic development. Higher fiscal decentralization provides that SNGs administrations could have more responsibility to generate their revenues and decide their expenditures by taking into consideration local citizens' requests. It is also vital to reduce corruption and to advance the incentives in providing the market that enhances public goods, as stated in the second generation of fiscal federalism theory (Ghani et al., 2017; Weingast, 2009). The second-generation theory is focused on encouraging government authorities to be in good behaviors, and it highlights the decentralization's significance in the expansion of the public sector and provision of incentives for private market activities. Therefore, the findings in the study are essential in determining incentives for countries in search of higher effectiveness levels regarding fiscal issues.

As a consequence of DEA performed by the CCR method under the constant return to scale with data subject to the analysis between 2010 and 2019, the Czech Republic, Brazil, Canada, Denmark, Finland, Iceland, Mexico, Poland, South Africa, Sweden, Switzerland, and Turkey were determined to be influential countries in all years. When the analysis was repeated with the BCC method under hypothesis variable return to scale, Austria, Belgium, Brazil, Canada, Czech Republic, Denmark, Finland, Greece, Hungary, Iceland, Italy, Mexico, Poland, South Africa, Sweden, Switzerland, Spain, South Africa, and Turkey reached total effectiveness scores.

It is known that all federal states are not equally decentralized and unitary states with one or multi sub-levels are not similar. This is the main reason why the results obtained differ in the same research groups. The average effectiveness scores of most of the countries in the study were calculated relatively highly under the CCR Model or BCC Model. A good part of the unitary states, except for France, Ireland, Israel, Luxemburg, Netherlands, New Zealand, and the UK, reached the effectiveness level of 90% and more within the two models. The results

may regard the growing increase in investment expenditures of sub-national governments, parallel with rising expenditures and indebtedness of the general government post-crisis. Thus, all these developments caused an increase in the decentralization level within the income and expenditure shares of SNGs. In addition, the study finds that expenditure decentralization is higher in all analyzed countries. Therefore, the central governments should primarily support SNGs so that they have sufficient sources of revenue of their own that may facilitate more excellent service for local citizens.

In conclusion, even though fiscal decentralization may vary by country or territory-specific factors, the results suggest that most of the countries analyzed in the study reached high effectiveness scores in the aftermath of the crisis. However, this study does not investigate the impacts of COVID-19 on fiscal decentralization effectiveness because of the lack of data. Therefore, the relationship between COVID-19 and fiscal decentralization will require further research.

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