Should Unified Korea Choose Fiscal Decentralization for Education? Testing the Decentralization Theory on Education Finance with Cross-country Analysis for Korean Unification

Seulgi Kang
Teachers College, Columbia University

The unification of South Korea and North Korea is a plausible idea yet it requires a comprehensive preparation in advance. As a method to achieve fiscal efficiency in public services, decentralization theory[1] is consistently applied. However, the current literature and political reality argue that decentralization does not always hold its efficiency. Therefore, this paper focuses on finding an ideal education finance model for post-unification Korea by studying how one country's academic/economic status is related to their education finance model. This paper conducts the OLS linear regression analysis with 40 OECD and its partner countries' information on GDP per capita, Gini Index, PISA mathematics score, and the form of education finance system. The main findings of this research are that the political and fiscal decentralization are different ideas, and fiscal decentralization does not always hold its efficiency as the decentralization theory states. Among the types of decentralization, the optimal education finance model for academic and economic improvement is deconcentration – which is a combination of fiscal centralization and political, or administrative, decentralization to empower regional autonomy.

Keywords: Decentralization Theory, Fiscal Decentralization, Education Finance, Korean Unification, Economics of Education, Cross-country Analysis

Introduction

During more than 70 years of Korean peninsula's division, Korea transformed into two radically different communities – South Korea and North Korea. In 2019, the Gross Domestic Product (GDP) of South Korea was 88 times more than of North Korea (UN Statistics Division, 2020a). North Korea ranked the lowest in the Democracy Index among 167 countries, while South Korea was listed as 22nd, which was a higher rank than Japan and France (Economist Intelligence Unit, 2016). Following a 'failing state' of North Korea, a survey to North Korean refugees even showed a dramatic result that 99.2 percent of North Koreans they knew in North Korea wanted unification (Park et al., 2011). Moreover, considering current international conflicts that North Korea faces with world's leading countries, such as the United States, Japan, and China, as well as with South Korea, unification of Korea is only a matter of time that no one knows when it will happen (Shin, 2013). Therefore, it is necessary to plan ahead and prepare how essential public services such as education should efficiently function to close not only the achievement gap but also the socioeconomic gap in the era of post-unification with limited resources.

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[1] Decentralization Theory: a political theory that believes smaller governments are more efficient in providing public services and therefore encourages local autonomy in public services.

As one of the approaches to fiscal efficiency in public services, fiscal decentralization receives significant attention from many nations. Fiscal decentralization is a theory that believes it is always efficient for local governments to provide public services (Oates, 2008) and thus should provide more budget autonomy as well as taxing power to local governments (Welsh and McGinn, 1999). This idea received attention with the movement of political democratization in the 1980s (Welsh and McGinn, 1999) and has also been applied in education. In fact, many European countries and the United States are pursuing the fiscal decentralization of education, and they believe in its efficiency by allowing a chance for choice nearer to people (DeBoer, 2012). However, existing literature also reports that several countries are recently coming back to centralization from decentralization in administering their public service budget. While the global trend of decentralization exists, recentralization also implies some uncertainty of the effectiveness of fiscal decentralization (Gershberg, 1995; Hanushek et al., 2011).

This paper therefore aims to identify whether fiscal decentralization of education is effective in closing achievement and/or socioeconomic gap between two different socio-economic communities, with the concrete example of a future scenario for post-unification of South Korea and North Korea. With a clear example of two different communities in terms of education, politics, economics, and culture, this research would initiate further research on the school finance model of Unified Korea, but it may also activate more definite conversations and help devise a new approach to education policies around social desegregation beyond Korean peninsula.

First, this paper will provide the background of two Koreas' education systems and how North and South Koreans perceive the concept of unification. The literature review on the validity of (de)centralization in school finance and the kinds of fiscal (de)centralized models will then follow. For the data analysis, this paper will provide: a) the descriptive analysis and b) the Ordinary Least Squared (OLS) regression on 40 different countries' education and economic data. This data analysis will identify the ideal school finance model from the cross-country analysis of 40 OECD countries and suggesting policy recommendations of Unified Korea based on the analysis.

Background
How Education Systems Function in Two Koreas
Education has played a significant role in both Koreas although its goal was completely different in two countries. Borrowing from Labaree's (1997) interpretations of the educational goals to explain this difference, there are three goals of education – democratic equality, social efficiency, and social mobility. Democratic equality of education is when education is used for preparing students as effective and responsible citizens. This includes teaching students what their rights as citizens, as well as providing them a uniform learning experience as a citizen of one nation. Another educational goal is social efficiency, stating that education is primarily for training workers that meet the needs of the society. Lastly, social mobility argues that education is to help students climb the social ladder and achieve social or economic ambition (Labaree, 1997).

North Korea has used education for a radical version of *democratic equality*. Under the name of patriotism and loyalty to the nation, North Korean dictators used schooling primarily for "brainwashing" the citizens (Bennett, 2013). On the other hand, South

Korean society implicitly and explicitly promised *social mobility* via education, and this enables an impressive expansion of the number of educational institutions and high enrollment rate in every educational level evenly within a few decades (Shin & Koh, 2005; Seth, 2002). Interestingly, in order to achieve the two very different educational goals, both North and South Korea chose a centralized education system.

North Korea's dictatorship and its use of education clearly explain why North Korea chose a highly centralized education system; in fact, federalism does not exist in North Korea, which leaves no option for decentralization. On the other hand, it is helpful to analyze why South Korea persisted with their centralized education system over 70 years. According to Seth (2002), this centralized system reflects two intentions of South Korean government during the educational development: (a) to achieve internal efficiency to establish an educational system quickly after the consecutive historical incidents that broke the entire nation, and (b) to make schooling equally available to all students with an equal standard and content. Accordingly, the education system in South Korea is highly centralized, and the central government is spending almost 15 percent of its annual budget to education (National Assembly Budget Office, 2019); this is a similar amount of investment that the U.S. federal government makes to their defense (15.2 percentage) in the same year (Congressional Budget Office, 2020). Although the education budget from the central government flows as a grant and is executed at the regional governments, the educational grant from the central government makes more than 70 percent of the entire regional education finance (National Assembly Budget Office, 2019). When compared to the education finance of the United States, where the state and local governments usually provide approximately 70 percent of the education budget (Spellings, 2005), South Korea shows a significant dependence on the central government for education.

Two Different Attitudes on Korean Unification

Korean Unification is no longer a vain idea. Although there can be a lot of political perspectives to consider to make such a bold statement, this paper supports the idea of unification based on two non-political reasons. First, there is currently no rightful heir to Kim Jung-un, who is showing bad health since 2014 (Groll, 2014; Berlinger, 2020; Bowden, 2020). Second, with the trend of globalization and the strong cultural wave (in Korean, *Hallyu)* directly from South Korea, including K-pop and K-drama, is also affecting North Koreans, and it is no longer possible to "brainwash" most of North Koreans to think their country is better than South Korea (Jung, 2016; Park et al., 2011). However, it is more important to notice that these combined external influences now make North Koreans think Korean Unification attractive and beneficial. According to Park and colleagues (2011), North Korean refugees in South Korea reported that 99.2 percent of North Koreans they knew wanted unification.

Despite the fact that North Koreans have become more open to Korean Unification, the reverse has happened in the South. According to the survey conducted by Park and his colleagues (2011), majority of South Koreans (over 75 percent) disagreed with the idea that Korean Unification will benefit individuals in South Korea. The main reason for such a negative reaction was the cost of unification.

South Koreans' perspectives and predictions about the unification cost is based on the lessons from German Unification. In fact, West Germany originally expected to spend

approximately 30 to 40 billion Deutsche Mark (DM) (176 - 242 billion USD; 16 - 22 trillion KRW) annually for German Reunification; however, West Germany had to spend five times more of what they had expected for 10 years. In total, it is assumed that Germany spent approximately one trillion Euro (1 trillion USD) by 2019 for reunification (Shin et al., 2008). What is worse is that the current economic gap between North Korea and South Korea is significantly larger than that of two Germanies at their unification period. In general, researchers agree that the unification cost for Koreas would be between 1-2 trillion USD (1100-2200 trillion KRW) (Bennett, 2013).

Since 1991, Germany has put an extra tax called "solidarity tax" (in Germany, commonly known as the *Soli*), which is a specialized tax covering the costs of reunification. This tax comes from 5.5 percent of income tax and corporation tax. Germany finally announced the plan to end the solidarity tax in 2021 for most taxpayers progressively, almost 30 years after the reunification (Deutsche Welle, 2019). Most South Koreans who have heard or learned about Germany's significant effort to meet the unification cost showed a negative attitude toward unification (Park et al. 2011). In another survey on Korean Unification in South Korea, 40.5 percent did not want unification, and another 44.2 percent support unification only with a condition of no huge financial burden (Lee, 2020). This pessimistic attitude is more prevalent among younger generations of South Korea, who relatively share less the impact of Korean War and an ethical bondage to North Koreans but have to be responsible for the costs when the unification actually happens as an active labor force (Bennett, 2013; Shin et al., 2008).

Thus, the first and foremost task that Unified Korea must focus on is allocating governmental finance efficiently, so that unification would reach potential Pareto improvement. Potential Pareto improvement is an economic term from cost-benefit analysis that the benefit must be bigger than the cost (IGI Global, 2020). Applying this concept into Korean Unification, it means that the cost that South Koreans would pay has to be less than what North Koreans would gain as benefit. Therefore, it is very predictable that the fiscal decentralization would rise as a new political agenda of Unified Korea when the government has to focus on reaching efficiency in finance, as Germany exactly experienced during the earlier period of German Unification (Ziblatt, 2002).

Literature Review
The most basic yet important decision in determining the education finance model is that who is in charge of the budget. In other world, whether education finance will be controlled by the central government or local governments is the big question, and this leads us to questioning the decentralization theory. Oates (1972) and Rondinelli (1981) introduced the concept of decentralization theory in public services. In his seminal work, *Fiscal Federalism*, Oates (1972) argues that the decentralization in decision-making power is more beneficial to the local communities by allowing heterogeneous responses to the demands. Based on Oates' decentralization theory, Rondinelli stated that there are three forms of decentralization based on the degree of decentralization: deconcentration, delegation, and devolution. Although these two papers' main focuses were not limited to education, they were still seminal works for establishing fiscal decentralization within education. Later, scholars such as Welsh and McGinn (1999) brought this typology of decentralization into the context of education. They

first brought a decentralization movement with the administration autonomy within education and argued that lower governments or even parents should decide the curriculum, school structure, teacher hiring/training process, and monitoring method. This decentralization movement was later conceptualized within the education finance system by Werner and Shah (2006). They specifically brought the three types of decentralization – deconcentration, devolution, and delegation – in education finance and classified ten European countries' education finance systems into three. This typology of decentralization is now widely used in the education finance study.

Deconcentration is a form of decentralization that shows similar characteristics with that of centralization; the main difference, however, is that the administration is divided into several lower levels of branches and operates in the regional or local offices. Clearly, the central government, the "headquarter", still remains as an important decision maker. *Devolution*, on the other hand, transfers most of the responsibility and authority to the state or local governments. Each regional government operates independently, and the involvement of the federal government is minimal. Lastly, *delegation* is the most progressive form of decentralization where a school is the primary decision maker and holds most of responsibility while the governments keep *de jure* responsibility for education. It is the most progressive form because the size of the unit for making critical decisions in education is smaller than the other two (Rondinelli, 1981; Werner & Shah, 2006; Ferrari & Zanardi, 2014). Such distinctions within the general term 'decentralization' highlight the need to consider several possible forms of decentralization in education, and the literature suggests that these differences must be considered in conversation about decentralization.

Fiscal decentralization of public services, including education, was traditionally supported by Anglo-American countries such as England and the United States. The advocates of educational decentralization stated that decentralization increases allocative efficiency because smaller governments hold the authority for tax allocation and spending power for their own communities; therefore. there is more autonomy in matching preferences and needs of people (Oates, 2008; Barankay & Lockwood, 2007). Decentralization was also preferred as it fosters accountability of local officials in terms of budget constraint and competition among other regions; decentralization enables each region to choose the most "efficient" way to help their students in their local context rather than following the orders from central government that sometimes do not reflect the different needs of different local communities (Welsh & Shah, 2006). Therefore, this could lead to innovative and creative approaches, as well as a positive competition among neighboring regions to improve student performances (Grauwe et al., 2015; Barankay & Lockwood, 2007).

Unlike such arguments, however, the real-world practices of fiscal decentralization often show mixed results on its impact. Barankay and Lockwood (2007) found evidence from Swiss cantons that fiscal decentralization increased education attainment; Similarly, Galiani et al. (2002) and Eskeland and Filmer (2002) also found out school decentralization in Argentina, which provided more autonomy in the budget as well, increased students' test scores. However, the studies by Galiani et al. (2008) and Gershberg and Winkler (2004) in West Africa stated that the correlation between fiscal decentralization and student outcome improvement is close to zero, and the most of positive improvement by decentralization is actually due to more parental

involvement rather than increased school autonomy in the budget. Ahmad and his colleagues (2008) also stated that there is a lack of consensus on the relationship between decentralization and higher student outcome as compared to a centralized system.

Hence, many countries—both in the Global South and North – show very diverse routes in their education finance system in the recent years. While the United States is historically well known for their belief and practices in decentralization, they are currently taking a smooth swing to a more centralized system in school finance through Title I, a US federal education funding for the disadvantaged population, under the name of adequate education (DeBoer, 2012). In the cases of Mexico and Mongolia, the two countries with traditionally centralized governments, they adopted decentralization once and recently returned to centralization due to cultural conflicts and municipal corruption under the decentralized system (Steiner-Khamsi & Stolpe, 2004; Gershberg, 1995). Meanwhile, in Italy, fiscal decentralization in education has been rising as a necessary educational reform to prevent the constant flow of unfair distribution of resources to southern regions of the nation (Ferrari & Zanardi, 2014).

This inconsistent trend in the education finance system implies there is no absolute answer, and therefore every country must analyze different factors, conduct empirical studies, and implement an efficient system for each country. However, most of existing literature on fiscal decentralization of education is limited to descriptive studies and there is a paucity of empirical studies that analyze its impact on students' educational outcomes. This paper aims to contribute to fill this gap by directly questioning and conducting quantitative research on the correlation between the fiscal decentralization policy and economic/academic outcomes.

To bring the context of Korean Unification into the existing literature on fiscal decentralization, the case of Germany is an important reference to Koreas. Though there is limited resource on fiscal decentralization specifically in education during German unification period, Ziblatt (2002) well explained how fiscal decentralization worked in post-unification Germany. According to Ziblatt (2002), Germany too proceeded the fiscal decentralization in the late 1990s, mainly led by leaders of rich states (Länder) to end "financial punishment on economically strong states" due to the financial crisis caused by unification. Also, with the global trend of decentralization in academics since the 1980s, many influential German think tanks also published reports supporting the German "fiscal federalism", which argues for taxing and spending autonomy within the state. However, as a final result, Germany did not pursue the fiscal decentralization of their public services because it was too radical considering the political reality of Germany's political structure as a nation-state and the fact that they just unified the nation (Ziblatt, 2002). The poorer states strongly disagreed, so did the Social Democratic Party, one of the major political parties in Germany. Even some politicians from Christian Democratic Union, the political party that led this proposal, disagreed. Though economists and scholars agree that fiscal decentralization would bring economic benefits, the majority of German politicians refuted and said the political cost of implementing such a proposal outweighs the economic benefit (Ziblatt, 2002). The literature on German unification and fiscal decentralization during post-unification signifies that fiscal decentralization and unification are huge political

matters, and fiscal decentralization with unification must be considered not only economic/academic benefits but also the political benefits.

Unfortunately, there is not much research focused on fiscal decentralization in education during post-unification period in Germany, and there are several different opinions on which education finance model Germany has used. Ferrari and Zanardi (2014) and Werner and Shah (2006) described German education finance system as deconcentration, which is the mix of fiscal centralization and political decentralization. Perhaps it was plausible to think that Germany has chosen deconcentration since it was often recognized as it maximizes the advantages of both decentralization and centralization systems. However, OECD's (2019) data on initial funding suggests that Germany is choosing devolution. Although there is no consensus in determining the education finance system of Germany, it is still noticeable that German chose deconcentration or devolution for post-unification period.

Methodology
This empirical analysis is to examine whether there is any correlation among the economic status, student outcomes, and the education finance system of one country. While this paper focuses on testing the decentralization theory in education finance for Korean Unification, the main analysis is broader by including 40 countries. There are three reasons in making a broader analysis; first, there are a significantly small number of countries that experienced unification to limit the sample of this analysis. Second, this paper also hopes to make a further impact on determining the education finance model of the communities where academic achievement and socioeconomic gap are wide as South Korea and North Korea.

Last but more importantly, many scholars studying North Korea believe that there is no reliable data from North Korea in order to make an ideal data set for Unified Korea (Park et al, 2011; Shin, 2013). This is why even the scholars of South Korea do a few empirical studies on the future scenario of Korean Unification. For example, the United Nations is the only reliable international organization that receives (or sometimes estimates) the statistics of the nation, but the UN Statistics Division (2020a, 2020b) itself did not have the concurrent data for GDP per capita from 2010 to 2019. Also, North Korea has never shared their Gini Index and also has never participated in the Programme for International Student Assessment (PISA). Thus, the only certain assumption for Unified Korea is that it will have a lower GDP per capita, a higher Gini Index, and lower PISA scores from current South Korea's statistics. Thus, by conducting a broader study of 40 countries, this paper would like to identify the countries with the estimated statistics of Unified Korea and see how they manage the education finance system for economic and academic improvement.

Therefore, this section will now provide a cross-country analysis using 40 countries' (a) GDP per capita, (b) Gini Index, (c) a mathematics score from 2018 PISA, and (d) the form of current education finance system.

Data Source
GDP per Capita, Gini Index, PISA Math Score
To make a comparison on different variables, data for each variable are gathered from different sources. For GDP per capita, this paper used the UN Statistics Division's

(2020b) Per Capita GDP at current prices – US dollars in 2018. For the Gini Index (a percentage form of Gini-coefficient that shows income inequality in a range of 0-100 [0=perfectly equal, 100=perfectly unequal]), I used World Bank's (2020) Gini Index estimates[2]. PISA, an international standardized test offered by Organization for Economic Cooperation and Development (OECD), provides a national score of reading literacy, mathematics, and science test scores from OECD members and partner countries, and I decided to use the most recent PISA mathematics scores from 2018 as a variable representing student performances. Also, data on the education finance model is brought from the OECD Education at a Glance 2019 indicators, showing the initial sources of public funds for education by governmental levels.

The Education Finance Form
For the last variable about the education finance model, it is very important to understand how classification is made. This paper is primarily interested in knowing the difference between the education expenditures that stay within the state/local borders and the education expenditures aggregated at the higher level and distributed according to the needs. Therefore, rather than the final funding power that could be diluted from the initial funding sources by either horizontal or vertical transfers between the governments, I decided to categorize the funding model according to the scale of initial funding. For example, approximately 70 percent of education finance of South Korea initially comes from the central government, but nearly all of them are transferred to the regional level to be executed (National Assembly Budget Office, 2019). In such cases, although the central government provides 70 percent of initial funds, the final funds describe that the budget is from the regional office. Indeed, the distribution of final funds narrates who has the most autonomy and takes responsibility in running education efficiently. However, it does not report whether the educational expenditures are aggregated solely within the border or outside of the border and are given from the central government, which is a critical implication to the future scenario of Unified Korea.

Therefore, I labeled the system based on the size of initial education funds from each level of governments. For the labels, I used centralization and the definitions from the existing literature categorizing decentralization into three different levels – deconcentration, devolution, and delegation. *Centralization* is used when more than 50 percent of initial education expenditures is from the central government and is not distributed enough to the sub-central governments via transfers. *Deconcentration* is when more than 50 percent of initial education expenditures is from the central government and is distributed enough to the sub-central governments by transfers so that more than 50 percent of final funds are at the lower governmental level. *Devolution* has been used when more than 50 percent of initial education funding is from sub-central (regional and local) level.

Delegation is the most progressive form of decentralization that a school has the most critical decision power than the governments. In terms of funding allocation, this

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[2] Note that the Gini Index in this dataset includes the latest version of the estimate and therefore is not from the same year; it is mostly from 2017 but includes years from a range of 2010-2018 as well. This follows the data collecting method of previous research that used Gini coefficient or Gini Index in cross-country analysis (Li & Zou, 2002; De Gregorio & Lee, 2002); because Gini coefficient is limited data mostly available by national level, it depends on each country' government to report, so it is hard to collect a single year's Gini Index if research uses cross-country analysis.

would be the case where either a school collects the initial funds directly from the families, or the school receives the funds directly from the central governments. Although Welsh and Shah (2006) named Denmark's form of decentralization as delegation due to the strong school autonomy in decision making, in this analysis, the case of Denmark is considered as devolution because the funds are still collected by the local size, not school size in Denmark. Thus, in this dataset, I assume that delegation is nonexistent, when the standard of naming (de)centralization is an aggregated level of initial educational expenditures.

Empirical Strategy

This paper focuses on a hypothesis based on Oates' (1972) decentralization theory, which states that the decentralization of public service increases efficiency by offering heterogeneous responses that are tailoring to the smaller group of people. To apply this theory in fiscal decentralization in education, this paper hypothesizes that the higher GDP countries or lower Gini Index countries (meaning less economic inequality), which are the countries with better economic outcomes and perhaps implying higher efficiency, will be concentrated on forming a decentralized finance system and therefore results in higher student outcome, vice versa. Plus, this paper will continue whether this theory can be also applied in Unified Korea, where it would show lower GDP and higher Gini Index yet aim to achieve efficiency – means higher GDP, Gini Index, and higher PISA score.

For the empirical analysis, this study will perform a) the descriptive analysis and b) the OLS regression analysis. The descriptive analysis will divide 40 countries into two categories and two subcategories – the former higher/lower GDP per capita and the latter higher/lower Gini Index. Then, the countries will be ranked by PISA Math scores. I wanted to see if there is any concentration of one education finance system by academic/economic status. The OLS linear regression analysis will target to find the most "efficient" education finance model to achieve a higher PISA test score and lower Gini Index. The dependent variable here will be GDP per capita, and independent variables are PISA scores and Gini Index of each country. For the regression and creating graphs, I will be using STATA 16 with the sample size of 40 (countries).

This study includes 40 countries, and most countries are the members of OECD and/or participants of the PISA test (See Appendix A). There are a number of countries whose students may have taken the PISA test yet are not included in this cross-country analysis because the data for initial and final funds for education was unavailable[3].

Results

Descriptive Analysis

To understand how education finance models are differentiated by the academic/economic status (GDP per capita and Gini Index), the table is first divided countries into high GDP per capita (Table 1) and low GDP per capita (Table 2); then,

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[3] Since this analysis is based on strict criteria that a country has to participate in PISA and provide OECD advanced information on its education expenditures, it leaves out most countries from Africa, Southeast Asia, and South America and some countries in East Europe. This suggests that there could be a selection bias on the findings and does not fully guarantee external validity of the findings, especially for the country that shares similar characteristics of opted-out countries. However, to mitigate the selection bias as much as possible, this paper categorized the nations by their levels of GDP per capita, as well as the level of Gini Index.

the tables have subcategories – low Gini Index and high Gini Index, respectively. Therefore, one table has two columns, and the countries are ranked again by PISA mathematics test scores. This is to see whether there is any concentration of education finance model by academic/economic status. Table 1 and 2 are the main descriptive analysis of this paper.

Table 3 and 4 are the altered version Table 1 and 2 in order to apply this empirical analysis specifically to the context of Korean Unification. While Table 1 and 2 are divided by median countries (Japan and Italy) and equal in the number of countries (20 countries in Table 1 and 2 each), Table 3 and 4 are centered by South Korea[4]. Table 3 and 4 are available in Appendix B.

The OLS Regression Analysis
To test the hypothesis in a broader sense, Figure 1 and 2 include all of the countries by its GDP per capita (Figure 1) and Gini Index (Figure 2) with PISA mathematics scores. The education finance models are categorized by the colors; red represents countries with a centralization system, green represents countries with a deconcentration system, and lastly, blue represents countries with a devolution system. Each figure also contains the fitted OLS regression lines for three different systems, so that education finance models can be compared and test a decentralization hypothesis – whether fiscal decentralization leads to higher academic outcomes, higher GDP per capita, and less inequality[5]. I acquired the idea and developed the model from DeBoer's (2012) Figure 'Fiscal educational decentralization and income, population, and diversity' (Figure 1 of DeBoer (2012)). The significance tests of Figure 1 and 2 have done and can find in Appendix C. To summarize, the education finance model of deconcentration in Figure 1 shows statistical significance, but other education finance models don't seem statistically significant in determining PISA Math scores, holding GDP and/or Gini Index constant. However, further study has to follow in order to make a more precise conclusion since this statistical insignificance may be due to smaller sample size (N=40), rather than the education finance models' effectiveness. With this caveat, however, this paper still considers the outcomes of Figure 1 and 2 important in recognizing the difference of education finance models on producing academic achievement, holding economic status constant.

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[4] China is not included in the Table 1 and 2 because it does not provide national PISA test scores but only four regional scores (Beijing, Shanghai, Jiangsu, and Guangdong) (OECD,2016). However, since Table 3 and 4 are divided by economic status of South Korea and thus exclude South Korea from the table, I decide to include one more country (China) for adding more context.

[5] Note that data for GDP per capita in Figure 1 has been "top-coded" to a range of 10,000 – 80,000 USD; in other words, GDP per capita less than 10,000 were replaced to a value of 10,000, and similarly, GDP per capita higher than 80,000 were replaced with a value of 80,000. The countries that were replaced with the minimum value (10,000) are Colombia, Mexico, Turkey, and Brazil, and the countries that were replaced with the maximum value (80,000) are Luxemburg, Norway, and Switzerland. This has been done in order to visualize the data more effectively, and this change was minor and did not hamper the findings we made according to the results visualized in Figure 1 and 2.

Table 1. Cross-country Analysis of High GDP per capita (Divided by Median)

GDP Status	High GDP per capita										
Gini Coefficient	Low Gini (More Equal Income Distribution)					High Gini (Less Equal Income Distribution)					
	PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund		PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund
Country						**Country**					
Netherlands	519	53,583	28.5 (2017)	**Centralization**	Central	Japan	527	39,082	32.9 (2013)	**Devolution**	Regional & Local
Denmark	509	61,834	28.7 (2017)	**Devolution**	Local	Switzerland	515	82,709	32.7 (2017)	**Devolution**	Regional & Local
Belgium	508	47,293	27.4 (2017)	**Devolution**	Regional	Canada	512	46,192	33.8 (2013)	**Devolution**	Regional
Finland	507	50,136	27.4 (2017)	**Devolution**	Local	United Kingdom	502	42,526	34.8 (2016)	**Deconcentration**	Central
Sweden	502	55,767	28.8 (2017)	**Devolution**	Local	Ireland	500	79,415	32.8 (2016)	**Centralization**	Central
Norway	501	81,336	27 (2017)	**Devolution**	Local	New Zealand	494	43,836	33.3 (2017)	**Centralization**	Central
Germany	500	47,514	31.9 (2016)	**Devolution**	Regional	Australia	491	58,393	34.4 (2014)	**Deconcentration**	Central
Austria	499	51,230	29.7 (2017)	**Deconcentration**	Central	Luxembourg	483	117,370	34.9 (2017)	**Centralization**	Central
France	495	41,358	31.6 (2017)	**Centralization**	Central	United States	478	62,918	41.4 (2016)	**Devolution**	Regional & Local
Iceland	495	76867	26.8 (2015)	**Devolution**	Local	Israel	463	44,215	39 (2016)	**Centralization**	Central

Source: UN Statistics Division (2020b), World Bank (2020), and author's calculation based on OECD (2019) *Education at a Glance 2019*, Figure C4.3., and Welsh & Shah (2006).

Table 2. Cross-country Analysis of Low GDP per capita Countries (Divided by Median)

GDP Status	Low GDP per capita										
Gini Coefficient	**Low Gini (More Equal Income Distribution)**						**High Gini (Less Equal Income Distribution)**				
	PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund		PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund
Country						**Country**					
South Korea	526	33,622	31.6 (2012)	**Deconcentration**	Central	Poland	516	15,444	29.7 (2017)	**Deconcentration**	Central
Estonia	523	23,242	30.4 (2017)	**Deconcentration**	Central	Latvia	496	17,852	35.6 (2017)	**Deconcentration**	Central
Slovenia	509	26,005	24.2 (2017)	**Centralization**	Central	Russia	488	11,394	37.5 (2018)	**Devolution**	Regional
Czech Republic	499	23,079	24.9 (2017)	**Devolution**	Local	Hungary	481	16,264	30.6 (2017)	**Centralization**	Central
Portugal	492	23,478	33.8 (2017)	**Centralization**	Central	Turkey	454	9,368	41.9 (2018)	**Centralization**	Central
Italy	487	34,389	35.9 (2017)	**Centralization**	Central	Chile	417	15,923	44.4 (2017)	**Centralization**	Central
Slovak Republic	486	19,431	25.2 (2016)	**Deconcentration**	Central	Mexico	409	9,695	45.4 (2018)	**Deconcentration**	Central
Spain	481	30,406	34.7 (2017)	**Devolution**	Regional	Colombia	391	6,650	50.4 (2018)	**Centralization**	Central
Lithuania	481	19,083	37.3 (2017)	**Deconcentration**	Central	Brazil	384	8,921	53.9 (2017)	**Devolution**	Regional & Local
Greece	451	20,731	34.4 (2017)	**Centralization**	Central	Argentina	379	11,688	41.4 (2018)	**Devolution**	Regional

Source: UN Statistics Division (2020b), World Bank (2020), and author's calculation based on OECD (2019) *Education at a Glance 2019*, Figure C4.3.

Figure 1. *Cross-country Analysis on Education Finance Model by PISA scores and GDP per capita*

Note: GDP per capita in Figure 1 were top-coded with a range of (10,000-80,000) USD, and the value of seven countries were adopted accordingly. Country codes are available in Appendix A. Source: UN Statistics Division (2020b), World Bank (2020), and author's calculation based on OECD (2019) *Education at a Glance 2019*, Figure C4.3., Welsh & Shah (2006).

Figure 2. *Cross-country Analysis on Education Finance Model by PISA scores and Gini Index*

Note: Following the characteristics of Gini Index and a more intuitive data visualization approach, the x axis is reversed and has a minimum (more equal) value at the right side and a maximum (less equal) value at the left side. Country codes are available in Appendix A. Source: UN Statistics Division (2020b), World Bank (2020), and author's calculation based on OECD (2019) *Education at a Glance 2019*, Figure C4.3., Welsh & Shah (2006).
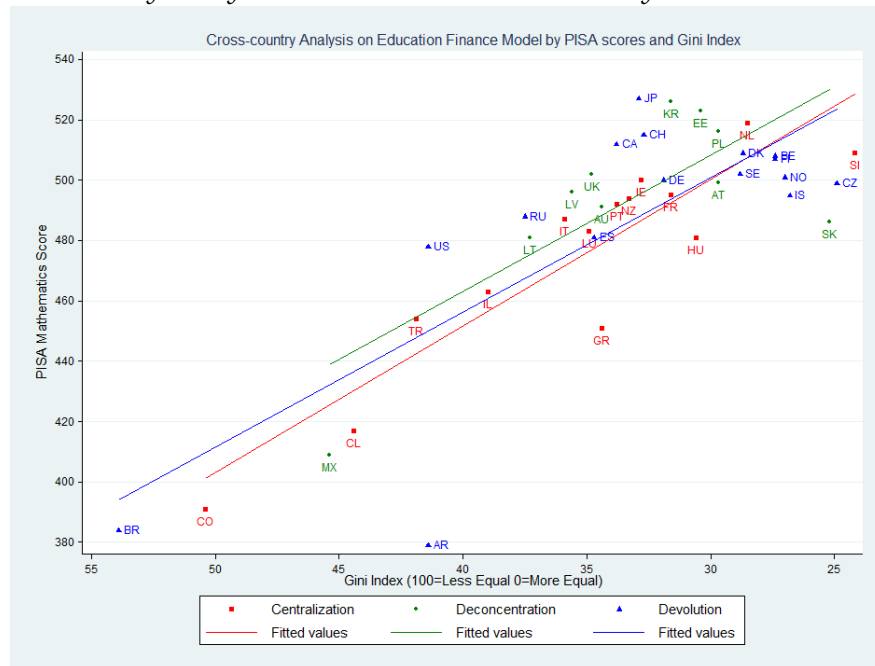
Discussion and Conclusion
Findings
This paper extends the idea of fiscal decentralization and the decentralization theory with the following several findings. First, separating and recognizing the difference of the sources of initial funds from final funds where the school finance is actually executed, this study argues that the definition of the centralization or decentralization of education must be more accurate. When applying the definition of deconcentration, devolution, and delegation into the education finance model, there is actually a significant number of countries where the initial funds are collected in national level yet the executive power is divided into smaller branches, such as regional governments, local governments, or municipalities, in a form of deconcentration. This implies that considering the initial sources of budget and where it comes from, there are more "centralized" countries in education finance than the existing literature often argue (DeBoer, 2012), and therefore needs a more accurate distinction of fiscal decentralization and political decentralization of education.

Following the first finding, this paper also recognizes that, as current literature has suggested, there is no one "absolute" education finance model prevailing in achieving better economic and academic outcomes. Tables 1-4 explicitly show that there is no concentration on one education finance model in achieving higher GDP per capita, lower Gini Index, or higher PISA mathematics scores. This aligns with the conclusions of DeBoer (2012), Steiner-Khamsi and Stolpe (2004), Ahmad et al. (2008), and Welsh and McGinn (1999) that the form of education finance of one country must be determined in consideration of its politics, culture, feasibility, and administrative motives, and it should not be based on neither international trend nor a simple belief that choice near people would bring efficiency. A further study on fiscal decentralization may devise how quantitative research can include political factors and expand the decentralization theory further.

Third, besides the distinction of fiscal decentralization, the OLS regression cross-country analysis shows that political decentralization, or the distribution of administrative power to lower governments, tends to lead to higher economic and academic outcomes. Among three education finance systems, deconcentration and devolution are the system with political decentralization. The outcomes from Tables 1 – 2, and Figures 1 – 2 describe countries with either deconcentration or devolution as the education finance model ranked higher in GDP per capita and PISA mathematics scores, as well as lower Gini Index. In fact, 70 percent of countries with higher GDP/lower Gini Index per capita were using either deconcentration or devolution (Table 1 and 2). This implies that the decentralization hypothesis is valid when it is specific to political or administrative context.

Lastly, the results from OLS regression analysis in Figure 1 and 2 suggest that the optimal education finance model for better economic (higher GDP per capita and lower Gini Index) and academic (higher PISA scores) outcomes is deconcentration. One caveat that must be addressed, however, is that there is not enough data supporting the external

validity of this finding at the highest range of GDP per capita (60,000-80,000 USD) since there is no country having a form of deconcentration within that range (Figure 1). However, in Figure 2, the effectiveness of deconcentration as an education finance model is reconfirmed with external validity at this time. These results are aligned with the previous findings as well; deconcentration is a mixed form of fiscal centralization and administrative decentralization, and this is the education finance model that could maximize the advantages of centralization and decentralization of the education system.

Policy Implications for Unified Korea

Reflecting the results of the cross-country analysis, deconcentration is the educational finance model that will achieve higher economic and academic outcomes with less inequality between regions. Thus, according to the cross-country analysis, this paper suggests that deconcentrated education finance model would also work in imagined Unified Korea. In fact, centralization of the educational expenditures at the national level would be also preferred in political and administrative motives at the earlier stage of unification. South Korea and North Korea have been very different in terms of politics, and the political difference eventually results in a huge verge at the economic and academic status of two Koreas. Hence, education would rise as a critical administrative tool that could mend this verge by providing the same curriculum and pedagogy (Kim et al., 2014). Welsh and McGinn (1999) also argues that educational decentralization must be considered only when political support is promised. In such special political cases where two countries have to integrate under one regime, the centralization of curriculum development and teacher training are needed. Therefore, this paper recommends to maintain centralization in education finance, as well as the centralization of curriculum development and teacher training for Unified Korea.

However, maintaining centralization in every aspect of education is not as efficient as deconcentration, and therefore, regional autonomy must also be prioritized after the essentially centralized systems. For example, Ryu (2017) pointed out that current South Korea's educational grants are usually block grants, which are the funds delivered to the sub-national governments with specific categories. Rather than black grants, lump sum transferring mechanism promises a greater administrative freedom in planning educational budgets according to the needs of a smaller population (Burns & Köster, 2016), and this strategy may be beneficial in the case of Unified Korea, where every region would greatly vary in economy, culture, and demography. Likewise, while prioritizing the essential centralization for efficiency of the unification, the central government should continuously strive to empower the regional autonomy as well.

Limitations

There are three limitations in this paper's cross-country analysis and following findings. The first caveat that ought to be addressed with the results is that the analysis is based on the sample size of 40, which is a very small number of observations to confirm a statistical significance of the OLS regression. In order to make a more statistically significant estimate, it is necessary to include more countries with diversity in location, economic status, and academic performance because the current dataset is limited to 40 countries in OECD or its partner countries, which are mostly from the "Global North" (Odeh, 2010).

Another caveat regarding this study is that the typology for the education finance model in Table 1-4 is based on one dataset and one author's interpretation of it. Although the classification was done with calculation based on the amount of initial funds from each level of governments and the amount of transfers done via educational grants, there is a chance that the dataset provided in the OECD report may not reflect the actual proportion of how one country is distributing the educational expenditures. Since this paper is based on secondary resources, not information directly collected from each government, this paper could have misinterpreted the education finance model of one country. This, however, also implies that the comparative research about school funding should be continued and expanded to accumulate more precise data on each country's source of initial funding and the management of educational grants by sub-national governments.

Last, this paper has a clear limitation on making a claim of "the optimal education finance model of Unified Korea" because of the lack of North Korea's statistics. Due to the communist political regime that censors even the basic information such as a GDP per capita and population growth rate, it is impossible to calculate how different it will be when education is financed by the central government or local governments. Thus, this paper could only assume Unified Korea's academic and economic status based on the current South Korea's statistics. In order to test whether the deconcentration of education finance in Unified Korea would truly produce academic and economic efficiency like the 40 OECD countries' cross-country analysis finding, the data from North Korea is necessary. This implies that one of the early processes of Korean Unification must include a thorough and up-to-date data collecting for the better unification strategy construction.

Conclusion

The study of Korean unification and the policy recommendations for Unified Korea are not limited to North Korea and South Korea. Rather, this paper also aims to reflect the plausible education policies in the community with high inequality in economy and politics. A clearer distinction between fiscal and political decentralization in education must be drawn, and it is often more efficient to pursue a mixture of fiscal centralization and administrative decentralization as an optimal form of the education finance model, including the future case of Unified Korea.

Seulgi Kang - *also known as Seulgi "Abby" Kang- is a M.A. graduate of Economics and Education program from Teachers College, Columbia University. Prior to her Master's degree, she studied Economics and Educational Policy Studies in University of Wisconsin - Madison. She is interested in how to apply economic theories in education policies. Her research interest covers education finance, data-driven decision making in building an education policy, and the role of education for Korean Unification. She is currently working for the Korean Educational Development Institute (KEDI) in South Korea. Email: sk4652@tc.columbia.edu.*

References

Ahmad, M. E., Brosio, M. G., & Tanzi, M. V. (2008). *Local service provision in selected OECD countries: Do decentralized operations work better?* International Monetary Fund.

Barankay, I., & Lockwood, B. (2007). Decentralization and the productive efficiency of government: Evidence from Swiss cantons. *Journal of Public Economics*, *91*(5–6), 1197–1218.

Bennett, B. W. (2013). *Preparing for the possibility of a North Korean collapse*. RAND corporation.

Berlinger, J. (2020, April 20). Why the confusion about Kim Jong Un's health actually makes sense. *CNN.* https://www.cnn.com/2020/04/21/asia/kim-jong-un-health-analysis-intl-hnk/ index.html.

Bowden, E. (2020, April 21). Kimg Jong Un's potential successors including powerful sister Kim Yo Jong. *New York Post.* https://nypost.com/2020/04/21/kim-jong-uns-potential-successors-include-powerful-sister/.

Burns, T. & Köster F. (2016). Governing Education in a Complex World, Educational Research and Innovation, OECD Publishing.

Congressional Budget Office. (2020). *The Federal Budget in 2019.* https://www.cbo.gov/syste m/files/2020-04/56324-CBO-2019-budget-infographic.pdf.

DeBoer, J. (2012). Twentieth-century American education reform in the global context. *Peabody Journal of Education*, *87*(4), 416–435.

Deutsche Welle. (2019, November 14). Eastern German solidarity tax to be abolished for almost all taxpayers. *Deutsche Welle.* https://www.dw.com/en/eastern-german-solidarity-tax-to-be-abolished-for-almost-all-taxpayers/a-51235971.

Economist Intelligence Unit. (2016). *Democracy index 2015: Democracy in an age of anxiety*. Economist Intelligence Unit, Whitepaper, 2016.

Eskeland, G., & Filmer, D. (2002). *Autonomy, Participation, and Learning in Argentine Schools: Findings and Their Implications for Decentralization*. The Word Bank.

Ferrari, I., & Zanardi, A. (2014). Decentralisation and interregional redistribution in the Italian education system. *Education Economics*, *22*(5), 529–548.

Galiani, S., Gertler, P., & Schargrodsky, E. (2008). School decentralization: Helping the good get better, but leaving the poor behind. *Journal of Public Economics*, *92*(10–11), 2106–2120.

Galiani, S., Schargrodsky, E., Hanushek, E. A., & Tommasi, M. (2002). Evaluating the impact of school decentralization on educational quality [with comments]. *Economia*, *2*(2), 275–314.

Gershberg, A.I. (1995). Fiscal decentralization and intergovernmental relations: An analysis of federal versus state education finance in Mexico. *Review of Urban & Regional Development Studies*, *7*(2), 119–142.

Gershberg, A. I., & Winkler, D. (2004). Education decentralization in Africa: A review of recent policy and practice. *Building State Capacity in Africa*, *323*.

Grauwe, A. D., Lugaz, C., Baldé, D., Diakhaté, C., Dougnon, D., & Odushina, D. (2015). Does decentralization lead to school improvement? Findings and lessons from research in West-Africa. Journal of Education for International Development, 1(1), 1-15.

Groll, E. (2014, October 13). Kim Jong Un is back but walking with a cane. *Foreign Policy*. https://foreignpolicy.com/2014/10/13/kim-jong-un-is-back-but-walking-with-a-cane/.

Hanushek, E. A., Link, S., & Woessmann, L. (2011). Does school autonomy make sense everywhere? Panel estimates from PISA. *Journal of Development Economics, 104*, 212-232.

IGI Global (2020). What is Potential Pareto Improvement. https://www.igi-global.com/dictionary/p otential-pareto-improvement/40117.

Jung, D. (2016). Survey analysis of the effects of North Koreans' exposure to South Korean culture on their attitudes toward unification. *Journal of Peace and Unification Studies, 8(2),* 111-148.

Kim, J. S., Park, S. Y., Kim, C. H., & Hwang, I. P. (2014). Directions of developing unified curricula of Korea. Korea Institute for Curriculum and Evaluation.

Labaree, D. F. (1997). Public goods, private goods: The American struggle over educational goals. *American Educational Research Journal*, *34(1),* 39-81.

Lee, H.Y. (2020, August 16). Three out of Four of South Korean "have resentment to North Korea" (KOR). *KBS News*. http://news.kbs.co.kr/news/view.do?ncd=4518185&ref=A.

Ministry of Education China (2019, October 20). Release of 2018 Statistical Bulletin on Education Spending. http://en.moe.gov.cn/documents/reports/201910/t20191021_404535.html.

National Assembly Budget Office (2019). *Public Finance of Korea 2019.* National Assembly Budget Office.

Oates, W. E. (1972). *Fiscal Federalism*. Edward Elgar Publishing.

Oates, W. E. (2008). On the theory and practice of fiscal decentralization. *Institutional Foundations of Public Finance: Economic and Legal Perspectives*, 165 - 176.

Odeh, L. E. (2010). A comparative analysis of Global North and Global South economics. *Journal of Sustainable Development in Africa, 12(3), 338-348.*

OECD (2016). *Education in China: A snapshot.* OECD. https://www.oecd.org/china/Education-in-China-a-snapshot.pdf.

OECD (2019). *Education at a Glance 2019.* OECD. https://www.oecd-ilibrary.org/education/edu cation-at-a-glance-2019_f8d7880d-en.

Park, J. C., Heo, M. Y., Kang, I. K., Kim, H. S., Yang, H. M., Jung, S. W., Jung, E. M., & Choi, E. S. (2011). *National issue for unification preparation: Grand strategy for national unification master plan.* Korea Institute for National Unification.

Rondinelli, D. A. (1981). Government decentralization in comparative perspective: Theory and practice in developing countries. *International Review of Administrative Sciences, 47*(2), 133–145.

Ryu, M. J. (2017). A study on the reform of financial grants for local education. *Korean Journal of Local Government Studies, 17(3).* 315-334.

Seth, M. J. (2002). *Education fever: Society, politics, and the pursuit of schooling in South Korea.* University of Hawaii Press.

Shin, D. C., & Lee, E. K., & Oh, J. R. (2008). Unification cost and the inter-Korean Cooperation Fund: Lessons from the German unification. *Korean Unification Studies, 12(1), 3-45.*

Shin, S., & Koh, M. S. (2005). Korean education in cultural context. *Essays in Education, 14(10),* 1-10.

Shin, Y.J. (2013). Plan on establishment of post-unification North Korean medical safety net. *Journal of the Korean Medical Association, 56.*

Spellings, M. (2005). *10 Facts About K-12 Education Funding.* U.S. Department of Education. https://www2.ed.gov/about/overview/fed/10facts/10facts.pdf.

Steiner-Khamsi, G., & Stolpe, I. (2004). Decentralization and recentralization reform in Mongolia: Tracing the swing of the pendulum. *Comparative Education, 40*(1), 29–53.

UN Statistics Division (2020a). Economic indicators for Republic of Korea and Democratic People's Republic of Korea. http://data.un.org/default.as px.

UN Statistics Division (2020b). Per capita GDP at current prices – US dollars. http://data.un.org/Data.aspx?q=GDP+per+capita&d=SNAAMA&f=grID%3a101%3bcurrID%3aUSD%3bpcFlag%3a1.

Welsh, T., & McGinn, N. F. (1999). *Decentralization of Education: Why, When, What, and How? Fundamentals of Educational Planning Series, Number 64.* ERIC.

Werner, J., & Shah, A. (2006). Financing of education: Some experiences from ten European countries. *Institute of Local Public Finance, Langen, Working Paper*, 2–2006.

World Bank, (2020). Gini index (World Bank estimate). https://data.worldbank.org/indicator/SI.POV.GINI?view=map.

Ziblatt, D. F. (2002). Recasting German federalism? The politics of fiscal decentralization in post-unification Germany. *Politische Vierteljahresschrift*, *43*(4), 624–652.

Appendix A

The Descriptive Table of 40 Countries on GDP per Capita, PISA Mathematics Scores, Gini Index and Year, the Education Finance Form, and the Major Resource of Initial Education Fund (by alphabetical order)

Country	Country Code	GDP per Capita (USD)	PISA Math Score (2018)	Gini Index (year)		Education Finance Model	Major Resource of Initial Education Fund
Argentina	AR	$11,688	379	41.4	2018	Devolution	Regional
Australia	AU	$58,393	491	34.4	2014	Deconcentration	Central
Austria	AT	$51,230	499	29.7	2017	Deconcentration	Central
Belgium	BE	$47,293	508	27.4	2017	Devolution	Regional
Brazil	BR	$10,000	384	53.9	2017	Devolution	Regional & Local
Canada	CA	$46,192	512	33.8	2013	Devolution	Regional
Chile	CL	$15,923	417	44.4	2017	Centralization	Central
Colombia	CO	$10,000	391	50.4	2018	Centralization	Central
Czech Republic	CZ	$23,079	499	24.9	2017	Devolution	Local
Denmark	DK	$61,834	509	28.7	2017	Devolution	Local
Estonia	EE	$23,242	523	30.4	2017	Deconcentration	Central
Finland	FI	$50,136	507	27.4	2017	Devolution	Local
France	FR	$41,358	495	31.6	2017	Centralization	Central
Germany	DE	$47,514	500	31.9	2016	Devolution	Regional
Greece	GR	$20,731	451	34.4	2017	Centralization	Central
Hungary	HU	$16,264	481	30.6	2017	Centralization	Central
Iceland	IS	$76,867	495	26.8	2015	Devolution	Local
Ireland	IE	$79,415	500	32.8	2016	Centralization	Central
Israel	IL	$44,215	463	39	2016	Centralization	Central
Italy	IT	$34,389	487	35.9	2017	Centralization	Central
Japan	JP	$39,082	527	32.9	2013	Devolution	Regional & Local
Latvia	LV	$17,852	496	35.6	2017	Deconcentration	Central
Lithuania	LT	$19,083	481	37.3	2017	Deconcentration	Central
Luxembourg	LU	$80,000	483	34.9	2017	Centralization	Central
Mexico	MX	$10,000	409	45.4	2018	Deconcentration	Central
Netherlands	NL	$53,583	519	28.5	2017	Centralization	Central
New Zealand	NZ	$43,836	494	33.3	2017	Centralization	Central
Norway	NO	$80,000	501	27	2017	Devolution	Local
Poland	PL	$15,444	516	29.7	2017	Deconcentration	Central
Portugal	PT	$23,478	492	33.8	2017	Centralization	Central
Russia	RU	$11,394	488	37.5	2018	Devolution	Regional
Slovak Republic	SK	$19,431	486	25.2	2016	Deconcentration	Central
Slovenia	SI	$26,005	509	24.2	2017	Centralization	Central
South Korea	KR	$33,622	526	31.6	2012	Deconcentration	Central
Spain	ES	$30,406	481	34.7	2017	Devolution	Regional
Sweden	SE	$55,767	502	28.8	2017	Devolution	Local
Switzerland	CH	$80,000	515	32.7	2017	Devolution	Regional & Local
Turkey	TR	$10,000	454	41.9	2018	Centralization	Central
United Kingdom	UK	$42,526	502	34.8	2016	Deconcentration	Central
United States	US	$62,918	478	41.4	2016	Devolution	Regional & Local

Source: UN Statistics Division (2020b), World Bank (2020), and author's calculation based on OECD (2019) *Education at a Glance 2019*, Figure C4.3., and Welsh & Shah (2006).

Appendix B

Table 3. Cross-country Analysis for High GDP per capita Countries (Divided by South Korea*)

GDP Status						**High GDP per capita**					
Gini Index	**Low Gini (More Equal Income Distribution)**						**High Gini (Less Equal Income Distribution)**				
	PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund		PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund
Country						**Country**					
Netherlands	519	53,583	28.5 (2017)	**Centralization**	Central	Japan	527	39,082	32.9 (2013)	**Devolution**	Regional & Local
Denmark	509	61,834	28.7 (2017)	**Devolution**	Local	Switzerland	515	82,709	32.7 (2017)	**Devolution**	Regional & Local
Belgium	508	47,293	27.4 (2017)	**Devolution**	Regional	Canada	512	46,192	33.8 (2013)	**Devolution**	Regional
Finland	507	50,136	27.4 (2017)	**Devolution**	Local	United Kingdom	502	42,526	34.8 (2016)	**Deconcentration**	Central
Sweden	502	55,767	28.8 (2017)	**Devolution**	Local	Germany	500	47,514	31.9 (2016)	**Devolution**	Regional
Norway	501	81,336	27 (2017)	**Devolution**	Local	Ireland	500	79,415	32.8 (2016)	**Centralization**	Central
Austria	499	51,230	29.7 (2017)	**Deconcentration**	Central	New Zealand	494	43,836	33.3 (2017)	**Centralization**	Central
France	495	41,358	31.6 (2017)	**Centralization**	Central	Australia	491	58,393	34.4 (2014)	**Deconcentration**	Central
Iceland	495	76,867	26.8 (2015)	**Devolution**	Local	Italy	487	34,389	35.9 (2017)	**Centralization**	Central
						Luxembourg	483	117,370	34.9 (2017)	**Centralization**	Central
						United States	478	62,918	41.4 (2016)	**Devolution**	Regional & Local
						Israel	463	44,215	39 (2016)	**Centralization**	Central

 *: South Korea: GDP (33,622 USD); Gini Index (31.6)
Source: UN Statistics Division (2020b), World Bank (2020), and author's calculation based on OECD (2019) *Education at a Glance 2019*, Figure C4.3., and Welsh & Shah (2006).

Table 4. Cross-country Analysis of Low GDP per capita Countries (Divided by South Korea*)

GDP Status	Low GDP per capita										
Gini Index	**Low Gini (More Equal Income Distribution)**						**High Gini (Less Equal Income Distribution)**				
	PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund		PISA (2018)	GDP per capita (USD)	Gini (year)	Education Finance Model	Source of Initial Fund
Country						**Country**					
Estonia	523	23,242	30.4 (2017)	**Deconcentration**	Central	B-S-J-Z (China)**	591	9,532	38.5 (2016)	**Centralization**	Central
Poland	516	15,444	29.7 (2017)	**Deconcentration**	Central	Latvia	496	17,852	35.6 (2017)	**Deconcentration**	Central
Slovenia	509	26,005	24.2 (2017)	**Centralization**	Central	Portugal	492	23,478	33.8 (2017)	**Deconcentration**	Central
Czech Republic	499	23,079	24.9 (2017)	**Devolution**	Local	Russia	488	11,394	37.5 (2018)	**Devolution**	Regional
Slovak Republic	486	19,431	25.2 (2016)	**Deconcentration**	Central	Spain	481	30,406	34.7 (2017)	**Devolution**	Regional
						Lithuania	481	19,083	37.3 (2017)	**Deconcentration**	Central
						Turkey	454	9,368	41.9 (2018)	**Centralization**	Central
						Greece	451	20,731	34.4 (2017)	**Centralization**	Central
						Chile	417	15,923	44.4 (2017)	**Centralization**	Central
						Mexico	409	9,695	45.4 (2018)	**Deconcentration**	Central
						Colombia	391	6,650	50.4 (2018)	**Centralization**	Central
						Brazil	384	8,921	53.9 (2017)	**Devolution**	Regional & Local
						Argentina	379	11,688	41.4 (2018)	**Devolution**	Regional

*: South Korea: GDP (33,622 USD); Gini Index (31.6) **: Beijing, Shanghai, Jiangsu, and Guangdong only
Source: UN Statistics Division (2020b), World Bank (2020), and author's calculation based on OECD (2019) *Education at a Glance 2019,* Figure C4.3., and Ministry of Education China (2019)

Appendix C

Significance Tests of Figure 1 and 2 on PISA Mathematics Scores

Independent Variables	Figure 1	Figure 2	Combined
GDP per capita	0.0009***	-	0.0004**
	(0.003)		(0.0001)
Gini Index*	-	-4.6168***	-4.0732***
		(0.577)	(0.476)
Centralization (base line)			
Deconcentration	25.0444*	9.6796	13.3103*
	(12.968)	(7.918)	(7.437)
Devolution	3.0031	2.3726	-0.3872
	(13.311)	(8.410)	(8.175)
Constant	440.6765***	637.4667***	604.4181***
	(14.271)	(20.914)	(19.085)
Observations	40	40	40
R-squared	0.317	0.685	0.724

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1