Study on the Relationship between SOCX and Financial Sustainability Comparing OECD 19 Countries: Study of Using Hybrid panel data method and Granger Causality Test and implication for Korea fiscal policy

By

JO, Jaeho

THESIS

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Committee in charge:

Professor Liu, Cheol, Supervisor

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-KDI School, MPP, Jo, Jaeho –

Abstract

The increase in social expenditure due to the fact that aging population increases and the working population decreases is taking place in advanced countries. Given that social expenditure is a main part of mandatory spending of fiscal balance, it brings the concern of fiscal sustainability. The aim of this research is to investigate the relations between social expenditure and fiscal sustainability in 19 OECD countries from 2000 to 2018. 19 countries were divided into four groups, the southern Europe, the liberal, the central Europe, and the Northern Europe, except Korea and Japan. This research placed structural factors at its analytic centre using hybrid panel data model. Furthermore, this research examined the question as to whether the past time series of variables can predict other variables through granger causality test. For the purpose of analysis of granger causality test, IPS unit root test is used. Research result portraits that organization capacity is significant to explain the change of social expenditure at the 0.1 level of significance, holding other factors are constant. Granger causality test is rendered social expenditure and fiscal sustainability variables are granger caused each other for the last 18 years in most case. However, this research has largely two limitations; limitation of variables and short time series. Notwithstanding, this research is significant that using fiscal structural factors explains the change of social expenditure.

Keywords: Social Expenditure, Fiscal Sustainability, Comparative Studies, Panel data, Hybrid model, Granger Causality Test, OECD

Acknowledgements

I would like to express my deepest gratitude to my supervisor Professor Liu Cheol and Kim TaeJong that provided me with insightful comments, suggestions, and even future advice. For the last 1 year, I have taken all Professor Liu's classes every semester, budgeting and public finance, performance evaluation, and tax classes. Three of them really help me to understand fiscal policy. Professor Kim's Econometrics class was very useful. Thanks to his class, I could make a robust methodology. For sure again, all his lectures and guidance lead me to here. Also, I owe my sincere appreciation to Professor Yoon Heesuk, Kim Joonkyung, and Christopher Plumb. I also would like to acknowledge the financial support of the KDI School.

Above all, I wish to express sincere thankfulness to my parents, my brother, and my dog for putting up with me. Studying public policy was my dream, and now I can prove it to my family. While I wrote the thesis, my father fought against cancer. All my achievements totally belong to my father Jo Jongsu. Also I want to give a big hug to my lovely dog Boksiri.

Actually, at the last stage of writing the thesis, I was not able to write it intensively. There was a lot of loopholes every time I reopen it, I cannot help changing the topic slightly. At the same time, I was busy with some personal affairs. Nonetheless, everything is finished well thankfully.

Last I greatly appreciate all my friends whom I met from all over the world. I wish we become a seed that spreads the power of development to the world.

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Introduction

Since the 1990s, many of the Organization for Economic Cooperation and Development countries have sunk into a slough of economic stagnation, while welfare demands for aging population and rising unemployment have been increased. This arouses concern of a fiscal deficit, which is particularly observed in representative democratic countries. Moreover, the importance of fiscal sustainability has been increased since the 2008 economic crisis. Given that Wyplosz et al., (2012) states that OECD countries record consistently financial loss for the last 20 years, the risk of the fiscal sustainability is the crisis of modern states.

The crisis seems to be near at hand in Korea. Since the late 1980s, democratization, Korea has recorded continuously deficient Operational Fiscal Balance[1], especially for the last 5 years, the deficit has dramatically been increased. As a result, government deficit increases 40% of GDP, which was 10% of GDP in the middle 1990s. In 2018, among the main budget, 428.8 billion won, 50.6% of the main budget is 216.9 billion won as the mandatory spending, and 49.4% of the main budget is 200.9 billion won as the discretionary spending (Kim, 2018). Considering the mandatory spending, 123.3 billion won, 40.9% of the main budget in 2009, the growth is very fast. The majority causes of a rapid increase in the mandatory spending come from a sluggish economic situation. Rapid aging, increasing unemployment rate, and increasing inequality gap demand for much more social expenditure, hence concern over the deficit of fiscal balance is growing. Moreover, given that national pension is on the brink of

[1] Consolidated Fiscal Balance (CFB) = Total Revenue – (Total Expenditure + Net Loan)

Operational Fiscal Balance (OFB) = CFB – (Balance of Social Security-related Funds)

being exhausted and labour population is shrinking, the fiscal accountability of national assembly is a significant issue to long-term economic development.

Of special important is emergence of populism. Given that the key point of fiscal problem is a matter of common-pool resource, populism has the potential to threaten representative democracy and further deteriorate fiscal sustainability. It committed promiscuous well-being in every election using social polarization and inequality problem. Kim (2012) stated that the policies discussed in the politic circle do not take into account social structural issues. This is not the only Korean Story. Southern European countries, Greece, Spain, Portugal, and Italy have faced concerns over fiscal sustainability due to the fact that the excessive social expenditure has led to the financial crisis. In particular, Italy has increased in cash social expenditure by 3%, such as pension program, unemployment benefits, from 25.1% in 2008 to 28.1% in 2017 (OECD economy survey Italy, 2018). In Northern Europe case, Sweden has manged national financial balance with a high level of national burden and premium social insurance, which is more than 43% of GDP. Notably, as you can see the figure 1, social expenditure of welfare programs in most advanced countries is increasing due to the rapid aging and welfare omnipotence. What is worse, due to the Corona virus swiping the world, unexpected social spending is on the rise, consequently many governments are implementing fiscal mobilization. This brings about the concern of fiscal addiction for governments.

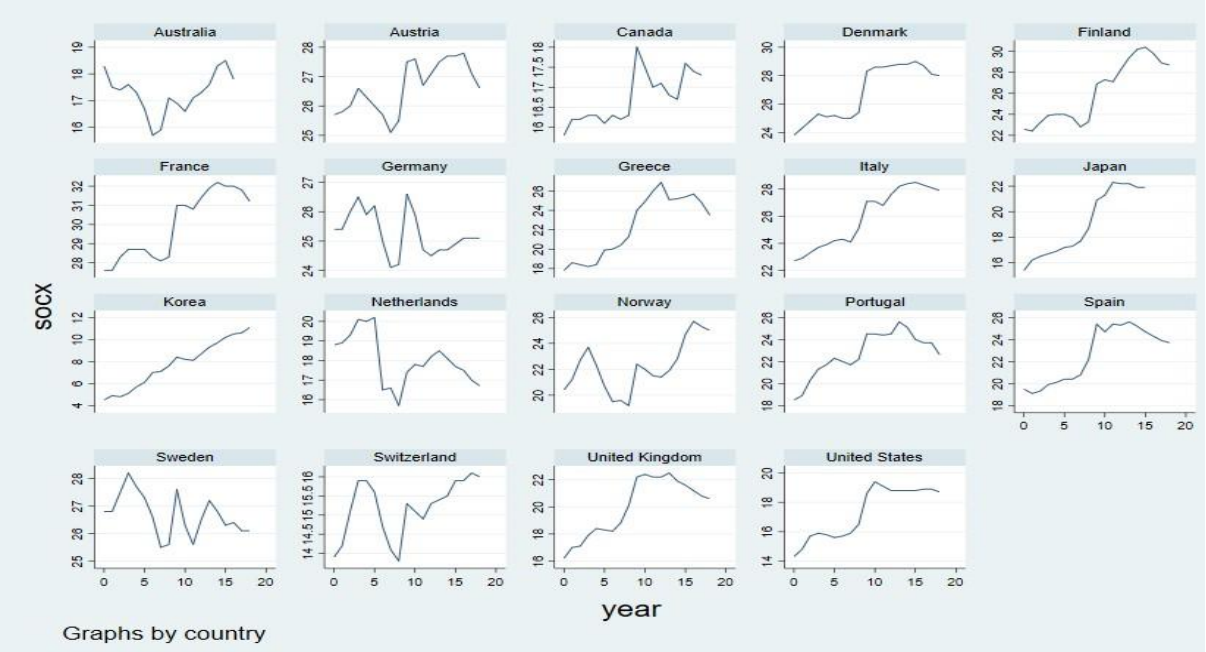

Figure 1 SOCX trend by country

In this context, first, in order to understand the fiscal situation, we should go through main concepts; fiscal policy, fiscal sustainability, and fiscal space. In sequent, this research would like to look at the variables which drive social expenditure. Numerous studies have shed light on the relationship between social expenditure and economic variables (Hagen, 1992; Arijona, 2001; Lee, 2011; Won, et al., 2012; Wilensky, 2015). They used government debt, national burden, and government fiscal balance variables which are representative indicators for measuring fiscal sustainability. Inter alia, Ko (2016) study is significant for adding political variables and economical structural variables. Because the research on the relationship between social expenditure and financial structure is still in its early stage. This suggests that public finance requires a holistic view including social phenomena and political and economic systems. From this point of view, this research would like to use financial structural factors, which are financial power and organization capacity. Both variables are used by Wehner (2006)

and Kim (2014). Kim (2014) developed Wehner's idea with Analytic Hierarchy Process model increasing accuracy.

Second, this research would like to explore the relationship using panel data 19 OECD countries from 2000 to 2018. Panel data has an advantage of retaining time series information as well as cross sectional data. Due to the fact that we have the time-invariant variables, pension wealth, financial power, and organization capacity, this study would like to use hybrid model through the use of within variable and between variable. Furthermore, we would like to examine the question as to whether each variables' time series can predict other variables through the use of granger causality test.

Therefore, this research aims to look into the matter: first, when organization capacity of the legislative increase, does social expenditure decrease? Second, does the change of social expenditure can be predicted by the change of fiscal sustainability?

Literature Review

To begin with, we would like to review previous literature. Literature review shows the strengths and limitations of the existing research, and lays the foundation for this research.

Numerous researchers have attempted to investigate the relationship between fiscal sustainability and social expenditure (Hagen, 1992; Wilensky, 2005; Hwang, 2011; Park, 2012; Jo, 2013). However, different outlook results are presented depending on the data used and the methodology. There are largely three interim results: first, social expenditure is a major factor

in deteriorating national fiscal sustainability, second, social expenditure drives economic growth consequently has a positive impact on national finance; third, there is no relationship between them. From the first point of view, expansion of welfare expenditures may not only weaken the motivation of entering work for the recipient and the taxpayer, but also reduce general savings. Moreover, given grey society and the populism of politics, welfare expansion is a critical problem for fiscal sustainability (Ahn et al. 2010). Conversely, from the second point of view, although social expenditure puts a burden on fiscal condition in the short-term, it is possible to draw a virtuous cycle of the economy. Jo (2013) stated that the expenditure is more important than the expenditure itself. On the other hand, from the last point of view, they argued that there is no significant direction between them, according to the observations from a dynamic point of view by comparing the cases of foreign countries (Hagen, 1992; Willensky, 2005). Through these studies, we may confirm that not all social expenditure is not decisive roles that adversely affect fiscal sustainability. Notwithstanding, they only focused on economic variables.

By contrast, there is an empirical study estimating the level of future social expenditure with aging. Won (2012) shed light on the structure of public expenditure in OECD countries and estimated the level of future spending. Furthermore, by comparatively studying fiscal sustainability, he comprehensively analysed the effect of social welfare expenditure level. His work became the basis for research on social expenditure and financial sustainability.

On the contrary, there is empirical research using financial, economical structural, and political variables. Ko (2016) insisted on the financial sustainability of welfare states studying 17 OECD countries from 1986 to 2013. For the purpose of estimating the basic financial balance response curve, she constructed a combined time series, and calculated long-term

interest rates, debt limits, and financial margins each country. Especially, it is meaningful to analyse the basic balance by dividing it into the financial, economic structural, and political parts for research. However, since there is no significant difference in political variables, which stands for strength of bicameralism from comparative political data, the regret for political variables remains.

In the following pages, we shall briefly illustrate main concepts: fiscal policy, fiscal sustainability, and fiscal space.

Defining Fiscal policy

According to the IMF definition, Fiscal policy is the use of government spending and taxation to influence the economy, in general, when governments seek to influence the economy, policymakers use fiscal policy. On the one hand, Fiscal policy is a government action in collecting and spending taxes which dynamically affect aspects of the economy such as capital formation, economic growth, and intergenerational equity (Auerbach & Koklikoff, 1987). In other words, we may claim that all government activities are part of fiscal policy. In this context, it is very important to interpret fiscal policy via interactions among social system, economic trends, political power, and financial structure. Because the financial consequence of welfare states does not end in a short-term and one-dimensional aspect at all, but it has an impact on long-term and generation by generation. In particular, fiscal policy highly depends on the global economic conditions. Analogously, the relationship between government and individual is always under the influence of economic condition, since the welfare states established in favour of economic situation. To speak in Keynesian theory context, all fiscal policy influences macroeconomics and microeconomics situation.

The figure 2 shows the change of marginal tax rate applying to the highest income in history from 1900. Conspicuously, after the end of the World war II, the government's taxation capacity dramatically increased, which became a great starting point for the construction of modern welfare states, it can be read that it is interlocked with the golden age of capitalism. To put it differently, welfare policy is determined by the government's taxation capacity, by the same token, fiscal policy also determined.

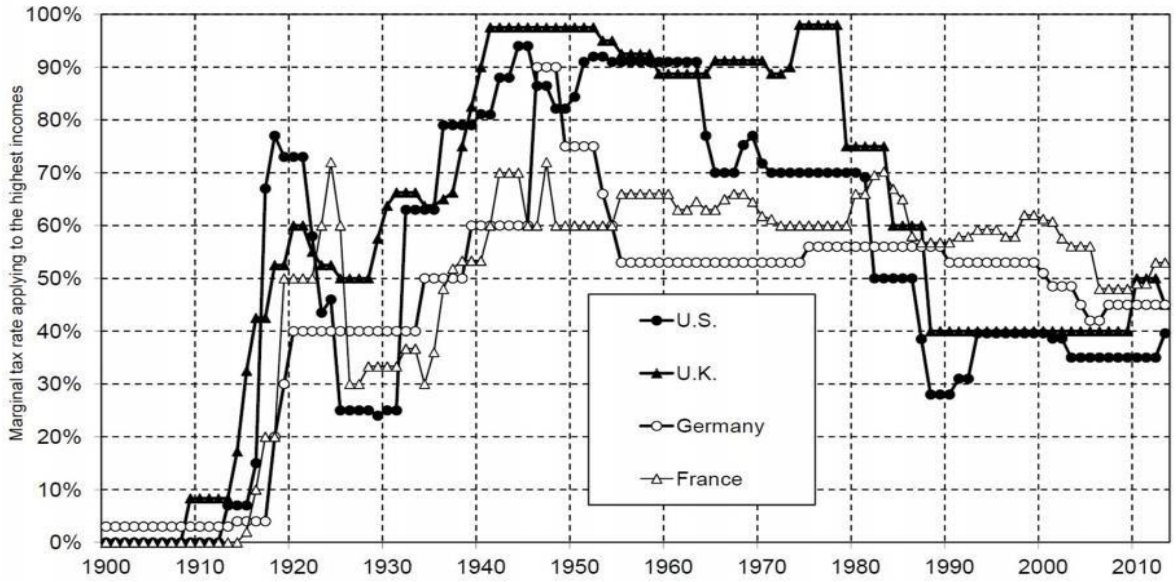

Figure 2 the maximum tax rate (Piketty, Thomas. (2014). Capital in the 21st Century)

On the one hand, the welfare policy is divided into two types: social investments to facilitate capital accumulation and social spending to alleviate social ills (O'Connor, 1973). In this point, we may understand that Fiscal policy plays a role in the smooth implementation of this, creating a virtuous cycle for households, markets, and the government. Therefore, in order to analyse fiscal policy, we need not only a broad perspective but also need a balanced and comprehensive idea.

Defining Fiscal Sustainability

Since the 1990s, numerous studies have attempted to explore fiscal sustainability as many OECD countries have encountered dramatic increases in financial demands (Corsetti & Roubini, 1991; Lane, 1993; Leibfritz et al., 1994; Ball & Mankiw 1995; IMF, 1995, 1998; ECB, 2007). Inter alia, the embryonic research of fiscal sustainability was carried out by Zee (1988), he argues that "fiscal sustainability means 'a sustainable level of public debt' which is, therefore one that allows the economy, in the absence of unanticipated exogenous shocks, to converge on a steady state" (p.666). Also, he further maintains that a continuous increase in public debt is not synonymous with an unsustainable fiscal policy, but the symptom of an unsustainable fiscal policy. In other words, fiscal sustainability may contain a hint of fiscal soundness or fiscal balance that how much a country performs fiscal policy. Afterwards, Burger (2005), who organized historical overviews of fiscal sustainability from the heritage of modern economists like Smith, Ricardo and Mills, proposes that fiscal sustainability is the possibility of recovering the balance of the budget to a balance without default. This is to say, it may be a matter of whether the financial income and fiscal expenditure can be structurally and consistently secured or not.

In Korea case, Korea government defines fiscal soundness[2], according to the National

[2] In terms of fiscal soundness, refer to more articles: Article 87 (Enactment of and Amendment to Statutes Entailing Treasury Burden), Article 88 (Restrictions on Rebates or Reduction of National Taxes), Article 89 (Formulation of Supplementary Revised Budget Bills), Article 90 (Appropriation of Surplus in Tax Accounts, etc.), Article 91 (Management of State Obligations), and Article 92 (Bearing and Management of State Guarantee

Financial Act, Article 86, the Law of Efforts to Improve Fiscal soundness (2006, amendment):

> The Government shall endeavor to maintain its fiscal soundness, manage State claims efficiently, and maintain State obligations at an appropriate level.

In here, due to the figurative expression of the law itself, however, it seems to be difficult to understand what exactly fiscal soundness is and what indicators could be used to evaluate it. Furthermore, according to Kim et al. (2011), there is no common consensus over fiscal soundness and what indicators would be utilized to check and evaluate fiscal soundness in academia.

However, this research will be anchored on CFB indicator as a gauge of fiscal soundness. Because OFB could be used as an insightful indicator of fiscal soundness since it could grasp the size of the government sector's finances and also could grasp the amount of pure financing activities, which are subtracted from internal transactions and adjustment transactions. In addition, CFB shows fiscal balance with pure fiscal activities that subtracted from the fiscal deficit and surplus, so it could be used as an indicator for assessing fiscal soundness every year. The more detailed data will be presented in the body of this research.

Defining Fiscal Space

Since fiscal Space which is an important issue among developed countries has emerged, fiscal space may be defined as the capacity of a government to dispense financial resources for a desired purpose, subject to the restriction that the fiscal situation is continuous, both over the

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Obligations).

medium and long-term (Heller, 2007). According to Doherty and Yeaman (2008), to maintaining economic growth and rising living standards, all countries should have some certain room for financial capacity. In other words, this is to make financial reserves for the economy to continue to gain momentum. For one instance, fiscal space may take advantages of breakthroughs in adopting new technology, driving domestic consumption, or even overcoming pandemic situation. In the same context, Ghosh et al. (2011) insisted that a critical question confronting the world nowadays is whether advanced countries have room for fiscal space or whether they need urgent fiscal adjustment for debt sustainability. In general, we may interpret the term of fiscal space as the budgetary room that enables a government to equip resources for public goals without impairing fiscal sustainability.

Variable description and research question

Before embarking on the main analysis of this study, we will briefly look over the feature of variables and research question.

Variable description

This research identifies the explanatory variables of social expenditure, and analyses the relationship between social expenditure and fiscal sustainability using data for 19 Organization for Economic Cooperation and Development (OECD) countries over the last 18 years from 2000 to 2018. The 19 OECD countries used in this analysis are Australia, Austria, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, South Korea, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. Accordingly, those countries are grouped into 4, the Southern European group: Greece, Italy, Portugal, and Spain, the Liberal group: Australia, Canada, the United Kingdom, and the United States, the Central European group: Austria, France, Germany, Switzerland, and the Netherlands; the Northern European group: Denmark, Finland, Norway, and Sweden. Due to the data limitation, South Korea and Japan are not grouped. South Korea does not offer government debt data before 2011, and Japan does not offer social expenditure data since 2015.

Additionally, this study tries to shed light on three factors: social factor, economic factors, and structural factors. Frist, social factor uses an aging variable which is meaning the ratio of the elderly (over 65 years) to the youth (under 14 years) population. Aging directly increases fiscal spending, including pensions and public health. The equation is that (population over the age of 65 in the current year / population between 0 to 14 in the current year) x 100.

Second, economic factors use government debt, national burden, unemployment rate, GDP growth rate, government fiscal balance, and pension wealth variable. Government debt is measured by the gross debt of the general government as a percentage of GDP. It is a key indicator of the sustainability of government finance. Debt is a calculated as the sum of the following liability categories: current and deposits; debt securities, loans; insurance, pensions and standardized guarantee schemes, and other accounts payable (OECD government at glance, 2019). National burden is measured by taking the total tax revenues received as a percentage of GDP. This relates to government as a whole and measured in million USD and percentage of GDP (OECD government at glance, 2019). Unemployment rate means the share of the unemployed in the economically active population including the employed and the unemployed. GDP growth rate represents a substantial increase in economic scale given a year based on the year on year increase rate of the base year price GDP. Government Fiscal balance shows the difference between general government revenues and expenditures showing how much in a given year government spending is financed by a given year. In other words, as the number decreases, it means they spend more than revenue, whereas as the number increase, it means they collect revenue more than spends. Pension wealth shows a gross pension wealth showing the size of the lump sum that would be needed to buy a flow of pension payments equivalent to the promised by the mandatory pension system (OECD government at glance, 2019).

Third, structural factors have two variables: financial power and organization capacity. This research is devoted to an account for investigating relationship structural factors and social expenditure. In defining both variables, it may be useful to begin with a contextual theorem of concepts. The representative scholars who discussed the index of legislative budget institutions are Wehner (2006; 2010), who established a system for a comparative study of budget systems

across countries, Von Hagen (1992) and Gleich (2003), who identified the relationships between the budget system and the financial condition. Wehner laid the ground framework of the index of legislative budget institutions by considering the power of parliament along with the financial power of parliament which is prescribed by the Constitution for each country. He suggested Amendment powers, Reversionary budget, Flexibility, Time for security, Committee capacity, and Access to budgetary information.

Amendment powers is that it is to the extent legislature can amend the budget proposal. Reversionary budget is whether the administration can temporarily operate on a budget based on the last fiscal year plan without legislative approval. Flexibility means that the executive has the discretionary power using carry-over, reallocation or virements, and reserve fund flexibly during the fiscal year after the budget proposal. Time for scrutiny relates to a matter of obtaining the budget as soon as possible from the administration and whether there is enough time to review if sufficiently. Committee capacity is that a special expert group can have an effective impact on the budget process and the policymaking process. Finally, Access to budgetary information stands for the budget supervision and transparent access to all budget information (Wehner, 2006).

On the other hand, Kim (2014) developed Wehner's idea by subdividing, specifying, and weighing indicators. He first suggested integration indexes combining all indicators: financial power, which is Amendment powers, Reversionary budget, and Flexibility; organization capacity, which is Time for scrutiny, Committee capacity, and Access to budgetary information. Also, he created an AHP hierarchical structure and conducted a questionnaire through paired comparison analysis after forming a forty four pool, which is composed of financial experts of each country and international organization workers (Kim, 2014). By

applying Wehner's framework, he not only increased the reality and universality of the index of legislative budget institutions but also extended the number of 36 countries to 60 countries.

Since his work acquires discerning index comparing to previous literature, this study would borrow his data, financial power, organization capacity.

Variables		Resources	Time period	Missing observations
Dependant variable				
Social Expenditure		OECD	2000 – 2018	6
Independent variables				
Social factor	Aging	KOSIS	2000 – 2018	
Economical factors	Unemployment rate	KOSIS	2000 – 2018	
	GDP growth rate	KOSIS	2000 – 2018	
	General government debt	OECD	2000 – 2018	11
	National burden	OECD	2000 – 2018	2
	General government Fiscal balance	OECD	2000 – 2018	
Political factors	Pension wealth	OECD	2018	
	Financial power	Kim(2014)	2014	
	Organization capacity	Kim(2014)	2014	

Figure 3 variable description

Research Question

This Research would like to find out how the social, the economical, and the structural factors affect social expenditure based on empirical study. In the case of fiscal sustainability, we could check that previous works have concluded that social expenditure has a positive effect, negative effect, or no correlate depending on time series and variables.

The first hypothesis of this study is that the higher organization capacity, the more it

can help reduce social expenditure by suppressing unnecessary budget in the budget process. The second hypothesis is that changes in social expenditure can be predicted by changes in fiscal sustainability, and vice versa.

H_1: when organization capacity of the legislative increases, social expenditure decreases

H_2: Δ SOCX can be predicted by Δ fiscal sustainability

Research model

This chapter would like to examine two methods: hybrid model and granger causality test. In hybrid model, first, we focus on the variables that drive social expenditure and examine the relationship between independent variables, aging, government debt, national burden, unemployment rate, GDP growth rate, government fiscal balance, pension wealth, financial power, and organization capacity; and dependent variable, SOCX. Furthermore, in granger causality test, we explore the causal relationship between the three variables, government debt, national burden, government fiscal balance, which are representing fiscal sustainability, and SOCX in the last 18 years through how much the changes in variables have been induced each other.

***Hybrid model method*:** In the panel research, the first step to be checked is the question as to whether to consider the error term as fixed effects model or random effects model. In other words, if the inference of idiosyncratic error term u_i is randomized from the population, u_i follows the probability distribution. The second step to be checked is Hausman test whether

$cov(x_{i,t}, \mu_i)=0$, $\mu_i \sim N(0, \sigma_\mu^2)$ or $cov(x_{i,t}, \mu_i)\neq 0$, $\mu_i \sim N(0, \sigma_\mu^2)$. If $cov(x_{i,t}, \mu_i)=0$, random effects model may be selected, meanwhile $cov(x_{i,t}, \mu_i)\neq 0$, fixed effects model may be selected. However, since OECD data or national panel data, such as the U.S states panel data, is not a sample but the whole population, it is intuitive that idiosyncratic error term u_i could be fixed (Min & Choi, 2012).

Thus, this study may examine the relationship between SOCX and fiscal sustainability as follow the linear fixed effect equation

$$Y_{i,t} = \beta_0+\beta_1+\ldots+ \beta_k+\mu_i + e_{i.t,}\ i = 1,2,\ldots,N\ ;\ t = 1,2,\ldots,T$$

To apply this study's variables, the basic equation is

$$Y_{i,t} = \beta_0+\beta_1 aging_{i,t}+\beta_2 \ln\_government\ debt_{i,t} +\beta_3 \ln\_national\ burden_{i,t\ t}+\beta_4 \ln\_unemployment\ rate_{i.t} +\beta_5 \ln\_GDP\ growth\ rate_{i.t}+\beta_6 \ln\_government\ fiscal\ balance_{i,t}+\beta_7 \ln\_pension\ wealth_{i,t} +\beta_8 \ln\_financial\ power_{i,t}+\beta_9 \ln\_organization\ capacity_{i,t}+ +u_i+e_{i,t}$$

However, pension wealth, financial power, organization capacity, and the budget institution variables are time-invariant. In this case, we may use hybrid model by converting each variables into within and between variables. Hybrid model has an advantage that it estimates within effects in random effects models (Allison 2009; Neuhaus and Kalbfleisch 1998; Rabe-Hesketh and Skrondal 2008; Raudenbush 1989; Wooldridge 2010).

$$Y_{i,t} = \beta_0 + \beta_w (x_{i,t} - \bar{x}_i) + \beta_b \bar{x}_i + \mu_i + e_{i.t,}\ i = 1,2,\ldots,N\ ;\ t = 1,2,\ldots,T$$

In this equation, we may assume β_1 with within effects estimate $\beta_{w,}$ also assume β_b with between effects model (Reinhard, 2013). Thus, to apply this study's variables, the equation of hybrid model is

$$Y_{i,t} = \beta_0 + \beta_{1w}\text{aging}_{i,t} + \beta_{1b}\overline{aging}_{i,t} + \beta_{2w}\ \text{ln\_government debt}_{i,t} + \beta_{2b}\text{ln\_}\overline{government\ debt}_{i,t}$$

$$+ \beta_{3w}\text{ln\_national burden}_{i,t\ t} + \beta_{3b}\overline{\text{ln\_}nat\imath onal\ burden}_{\ i,t} + \beta_{4w}\text{ln\_unemployment rate}_{i.t}$$

$$+ \beta_{4b}\overline{\text{ln\_}unemployment\ rate}_{\ i,t} + \beta_{5w}\text{ln\_GDP growth rate}_{i.t} + \beta_{5b}\ \overline{\text{ln\_}GDP\ growth\ rate}_{i,t}$$

$$+ \beta_{6w}\text{ln\_government fiscal balance}_{i,t} + \beta_{6b}\ \overline{\text{ln\_}Government\ fiscal\ balance}_{\ i,t}$$

$$+ \beta_{7}\text{ln\_pension wealth}_{i,t\ +} + \beta_{8}\text{ln\_financial power}_{i,t} + \beta_{9}\text{ln\_organization capacity}_{i,t} + + u_i + e_{i,t}$$

***Granger causality test*:** granger causality is widely used for proving causality between variables and predicting future in time series analysis. According to Granger (1969), the logic of the causality is that using X's past data (X_{t-1}, X_{t-2}, X_{t-2}, X_{t-k}) with Y's past data (Y_{t-1}, Y_{t-2}, Y_{t-3}, Y_{t-k}) is more predictable than using only Y's past data. Based on this axiom, the following model could be

$$\text{Yt} = a_0 + \sum_{j=1}^{n} a_j \beta_{t-j} + \sum_{k=1}^{n} \gamma_K Y_{t-k} + \varepsilon_t$$

Where, α_j is a time series value of X_t, γ_k is a time series value of Y_t, and ε_t is a white noise series. In order to run granger causality test, we need to check existing unit root in variables. Because, when unit root exists, granger causality raises a question in terms of the stationary of time series. If the time series is non stationary, there is a risk of being identified as spurious regression (Granger & Newbold, 1974; Philips, 1986). Moreover, when the time series is short, a strong correlation between variables appears, while the time series is long, the power of test decreases (Kwon, 2011). Therefore, the appropriate time series of model should be considered. On the other hands, Hurlin and Venet (2001) argued that Fixed effects model in panel data analysis cannot infer causality precisely. At this point, it is highly probable that we examine

granger causality test with hybrid model.

To apply this study, the equation is

$$SOCX_{i} = a_0 + \sum_{j=1}^{n} government\ debt_{t-j} + \sum_{j=1}^{n} national\ burden_{t-j} + \sum_{j=1}^{n} government\ fiscal\ balance_{t-j} + \sum_{t=1}^{n} SOCX_{t-k} + \delta_i + \varepsilon_t$$

Social Expenditure: SOCX
Government debt: Govern_debt
National burden: Natin_burden
Government fiscal balance: Govern_fb
δ_i : Fixed effects by country group (i = country group)
ε_t : white noise (t = time)

All this considered, we may use unit root test. There are LLC(Levin-Lin-Chu) test, HT(Harris-Tsavalis) test, IPS(Im-Pesaran-Shin) test, and Fisher test, which are widely used in panel unit root tests (Stata, 2009). LLC and HT are designed for testing common unit root, on the other hand, IPS and Fisher are designed for testing panel specific unit root. LLC proves that t test for $\hat{\gamma}$ under certain conditions is progressively following standard normal distribution, while HT derives the mean and standard error of $\hat{\rho}$ under the null hypothesis $H_0 : \rho = 1$ (Min & Choi, 2012) . The significant difference is that LCC is used in the condition N/T → 0 (T→∞), whereas HT is used in the condition N/T → ∞ (N→∞). Since both tests are required extremely strong balanced panel data, however, this study could not use them due to some missing data. On the contrary, IPS and Fisher test have no requirement for extremely strong balanced panel data. Unlike LLC and HT, IPS estimates for each i and calculates the $\bar{t}$ in terms of $\hat{\gamma}$ with t statistic, in the equation $\Delta Y_{i,t} = \gamma_i y_{it-1} + \beta_i Z_{i,t} + \varepsilon_{i,t,}$ and Fisher test which estimates p value ρ_i from individual unit root test for cross section i, which is proposed by Choi (2001), with the

equation P= $-2\sum_{i=1}^{n} log\rho_i$ (following $\chi 2$ distribution) (Min & Choi, 2012).

$$\Delta Y_{i,t} = \gamma_i y_{it-1} + \beta_i Z_{i,t} + \varepsilon_{i,t}$$

$$P= -2\sum_{i=1}^{n} log\rho_i$$

Thus, this study uses three tests, Augmented Dickey-Fuller test, Phillips-Perron test, and IPS test for checking unit root test in terms of main six variables: socx, government debt, national burden, unemployment rate, GDP growth, and government fiscal balance. The null hypothesis of Fisher ADF, Fisher PP, and IPS is unit root, alternative hypothesis of them is some cross sections without unit root.

$$H_0 : \rho\text{-}1 = \gamma = 0, \text{ for all i}$$

$$H_1 : \rho\text{-}1 = \gamma \neq 0, \text{ for all i}$$

As the result, in Fisher ADF, SOCX can be interpreted that it has no unit root and all countries have the same γ with normal distribution at the 0.05 significance level. However, the others can be interpreted as being unit root and all countries have different γ. In Fisher PP, GDP can be read that it has no unit root and all countries have the same γ with normal distribution at the 0.01 level of significance. However, the others can be read as being unit root and all countries have different γ. Lastly, in IPS, unemployment rate, GDP growth, and government fiscal balance can be understood that those have no unit root and all countries have the same γ with normal distribution at the 0.01 level of significance.

Variable	Fisher test Augmented Dickey-Fuller	Fisher test Phillips-Perron	IPS test
SOCX	***65.971**** ***(0.003)***	24.803 (0.951)	-0.831 (0.203)
Government Debt	31.067 (0.779)	34.597 (0.627)	-0.028 (0.488)
National Burden	16.538 (0.999)	22.190 (0.980)	0.917 (0.820)
Unemployment Rate	28.480 (0.868)	28.571 (0.866)	***-2.939**** ***(0.001)***
GDP Growth	45.002 (0.202)	***119.800**** ***(0.000)***	***-9.556**** ***(0.000)***
Government Fiscal Balance	41.355 (0.326)	48.766 (0.113)	***-3.320**** ***(0.000)***
Time lags[3]	Lags(5) demean	Lags(5) demean	Lags(aic 3)

Figure 4 unit root test result

The above result may be construed that IPS method is the fittest model among them. Seen from the other view, however, since government debt includes financial debt which relates to world financial markets, and it does not cover local governments' debt and non-profit public institutions' debt, it might be true the variable is being non stationary. Otherwise, given that different countries has different issue on SOCX and total tax revenue, the trend might show us non stationary. Meanwhile, we can check unemployment rate, GDP growth, and government fiscal balance are stationary. Even though non stationary variables might bring spurious regression with random walk bias because as the number of N and T increases, the value of regression coefficient increases, suffice it to say that it is significance in showing how variables affect each other for the last 18 years.

[3] Added demean commend to remove simultaneous correlation. Time lag is 5 years, which means it includes t-5. In other words, considering time series, 1)2000~2014, 2)2001~2015 3)2002~2016 4)2003~2017 5)2004~2018, total 5 time series are examined.

Research Results

Variables	(1) FE	(2) BE	(3) HYD
aging	***0.00201****	0.00026	
	(0.012)	(0.886)	
Ln_unemp	0.0611	0.05659	
	(0.075)	(0.563)	
Ln_gdp_grow	***-0.0580*****	0.6912	
	(0.001)	(0.211)	
Ln_govern_debt	***0.107****	0.1308	
	(0.010)	(0.329)	
Ln_natin_burden	***0.378****	***1.2758*****	
	(0.028)	***(0.000)***	
Ln_govern_fb	***-0.118****	-0.2908	
	(0.015)	(0.204)	
pension_wealth		0.0071	-0.00783
		(0.293)	(0.134)
finan_pow		0.0039	0.00398
		(0.100)	(0.051)
org_cap		-0.0075	***-0.00760****
		(0.066)	***(0.015)***
w_aging			***0.00200*****
			(0.006)
Ln_W_unemp			0.0611
			(0.061)
Ln_W_gdp_grow			***-0.0580*****
			(0.000)
Ln_W_governdebt			***0.108*****
			(0.004)
Ln_W_natinburden			***0.374****
			(0.020)
Ln_W_governfb			***-0.117*****
			(0.008)
bar_aging			0.000362
			(0.825)
Ln_B_unemp			0.0533
			(0.364)
Ln_B_gdp_grow			***0.656****
			(0.030)

Ln_B_governdebt			0.130 (0.247)
Ln_B_natinburden			***1.295**** ***(0.000)***
Ln_B_governfb			-0.295 (0.095)
_cons	1.387* (0.011)	0.808 (0.058)	***-2.924**** ***(0.012)***
N	344	344	344
adj. R^2	0.68669		
Number of id	19	19	19

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 5 research results

The empirical results are shown in the figure 5 is the result of fixed effects model, (2) is the result of between effects model including pension wealth, financial power, and organization capacity. (3) is the result of hybrid model using within and between variables. In hybrid model, the result of within variables is close to fixed effects model result, while the result of between variables is close to between effects model result. Aging, government debt, national burden, and government fiscal balance are statistically significant at the 0.1 level of significance, and GDP growth rate is statistically significant at the 0.01 level of significance in fixed effects model. On the contrary, in between effects model, only national burden is statistically significant at the 0.01 level of significance.

Hybrid model presents the result that we intended with political factors. The salient feature is organization capacity is statistically significant at the 0.1 level of significance whereas financial power and pension wealth are not statistically significant at all. Organization capacity is interpreted that a 1% difference in organization capacity is associated with -0.0076% difference in social expenditure, holding other factors are constant. In other words, it can be

construed that the more the legislature has sufficient time resources to review budget proposal, the more the committee structure composed of experts supervises budget process thoroughly, and the more transparent budget information is open to the legislative, the possibility of reducing social expenditure spending slightly increases.

Furthermore, the table provides that a 1% difference in GDP growth rate is associated with -0.058% difference in social expenditure, holing other factors constant. These result depicts that the relationship between economic growth rate and social expenditure is negative. However, given that GDP growth promotes the overall redistribution of wealth through the market, it might be read that the growth of government's social expenditure decreases.

Of special important variables government debt, national burden, and fiscal balance which are representing fiscal sustainability factor, shows different idea. A 1% difference in government debt is associate with 0.108% difference in social expenditure and a 1% difference in national burden is associate with 0.374% difference in social expenditure, holding all other variables constant. This is to say, given that the increasing rate of economic growth is ceteris paribus, government debt and national burden will be increased with social expenditure. For the same reason, government fiscal balance also depicts that government spends more than their revenue given a year.

In granger causality test result,

Excluded / Equation	Ln_socx	Ln_govern_debt	Ln_natin_burden	Ln_govern_fb
Ln_socx		$\rightarrow^{***}$ ***79.137*** ***(0.000)***	$\rightarrow^{***}$ ***15.558*** ***(0.001)***	
Ln_govern_debt	$\rightarrow^{**}$ ***38.369*** ***(0.000)****		$\rightarrow^{***}$ ***171.1*** ***(0.000)***	$\rightarrow^{***}$ ***134.27*** ***(0.000)***
Ln_natin_burden	$\rightarrow^{**}$ ***11.567*** ***(0.009)***	$\rightarrow^{***}$ ***32.319*** ***(0.000)***		$\rightarrow^{**}$ ***12.352*** ***(0.006)***
Ln_govern_fb	$\rightarrow^{**}$ ***14.642*** ***(0.002)***	$\rightarrow^{***}$ ***35.749*** ***(0.000)***	$\rightarrow^{*}$ ***8.717*** ***(0.033)***	

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 6 the Southern Europe

The table of Southern Europe group shows that ln SOCX granger causes ln government debt and ln national burden at the 0.01 level of significance, ln government debt granger causes ln national burden and ln government fiscal balance at the 0.01 level of significance. Likewise, ln national burden granger causes ln government debt at the 0.01 level of significance, ln government fiscal balance granger causes ln government debt at the 0.01 level of significance. Remarkably, ln SOCX cannot granger cause ln government fiscal balance, but ln government fiscal balance granger causes ln SOCX. Thus, we may say that in predicting ln government fiscal balance, the historical data of ln SOCX cannot be inexplicable, whereas in predicting ln SOCX, the historical data of ln government fiscal balance can be explicable.

According to IMF (2017), the common characteristic of Southern Europe, Italy, Greece, Spain, and Portugal have not followed fiscal policy rules well. Spain is the only country that has the balanced budget fiscal rule since 2003. All though they are member of the Maastricht

Treaty, there has been no incentive to continue to comply with the fiscal rules after the 2008 financial crisis amid European debt crisis. This may be one reason why the all variables are granger cause each other for the last 18 years.

Excluded / Equation	Ln_socx	Ln_govern_debt	Ln_natin_burden	Ln_govern_fb
Ln_socx		→*** ***132.32*** ***(0.000)***	→*** ***2600*** ***(0.000)***	→*** ***11,181*** ***(0.000)***
Ln_govern_debt	→*** ***7.4e+07*** ***(0,000)***		→*** ***21e+12*** ***(0.000).***	→*** ***4.1e+09*** ***(0.000)***
Ln_natin_burden	→*** ***2000*** ***(0.000)***	→*** ***1518.3*** ***(0.000)***		→*** ***405e+05*** ***(0.000)***
Ln_govern_fb	→*** ***2032.8*** ***(0.000)***	→*** ***1538.1*** ***(0.000)***	→*** ***1.7e+07*** ***(0.000)***	

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 7 liberal group

While, the table of the liberal group displays that all variables granger cause each other at the 0.01 level of significance. This is to say, all factors' past data can be explicable for predicting each other. IMF (2017) states that Canada, the United Kingdom, the United States, and Australia have strictly followed fiscal policy rules. However, they have exceptions to their share of mandatory expenditures, such as social security, medical care, and health insurance. This could be one reason why all factors are strongly granger causes for the last 18 years.

Excluded / Equation	Ln_socx	Ln_govern_debt	Ln_natin_burden	Ln_govern_fb
Ln_socx		$\rightarrow^{***}$ ***16.902*** ***(0.001)***		$\rightarrow^{***}$ ***23.242*** ***(0.000)***
Ln_govern_debt	$\rightarrow^{***}$ ***81.127*** ***(0.000)***			
Ln_natin_burden	$\rightarrow^{***}$ ***487.55*** ***(0.000)***	$\rightarrow^{***}$ ***390.98*** ***(0.000)***		$\rightarrow^{***}$ ***269.27*** ***(0.000)***
Ln_govern_fb	$\rightarrow^{***}$ ***80.263*** ***(0.000)***	$\rightarrow^{***}$ ***68.324*** ***(0.000)***	$\rightarrow^{**}$ ***13.565*** ***(0.004)***	

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 8 the Central Europe

The table of central Europe group says that ln SOCX granger causes ln government debt and ln government fiscal balance at the 0.01 level of significance, at the same time ln government debt granger causes ln SOCX at the 0.01 level of significance. In that case, *F* value of ln government debt, 81.127, is greater than *F* value of ln SOCX, 16.902, which can be read the past data of ln government debt is more explicable than the past data of ln SOCX to each other. On the other hand, ln national burden granger causes ln SOCX, ln government debt, and government fiscal balance at the 0.01 level of significance, and ln government fiscal balance granger causes ln SOCX and ln government debt at the 0.01 level of significance. Notably, ln SOCX cannot granger causes ln national burden and ln government debt cannot granger causes ln national burden and ln government fiscal balance. It might be presumed that there is another factors such as fiscal rules in reality.

One the other hands, in the case of Austria and Germany, they have a law of federation that the structural deficit cannot exceed 0.35% of GDP, including social insurance and medical care. France has strongly prevented the increase in social expenditure via the zero volume fiscal rules (IMF, 2017). These conditions may cause that Central Europe countries have shown

different results of granger causality.

Excluded / Equation	Ln_socx	Ln_govern_debt	Ln_natin_burden	Ln_govern_fb
Ln_socx		→*** ***403.02*** ***(0.000)***	→*** ***304.72*** ***(0.000)***	→*** ***168.44*** ***(0.000)***
Ln_govern_debt	→*** ***41.369*** ***(0.000)***		→*** ***34.13*** ***(0.000)***	→*** ***20.177*** ***(0.000)***
Ln_natin_burden	→*** ***138.77*** ***(0.000)***	→*** ***45.447*** ***(0.000)***		→*** ***221.62*** ***(0.000)***
Ln_govern_fb	→*** ***186.68*** ***(0.000)***	→*** ***145.67*** ***(0.000)***	→*** ***125.04*** ***(0.000)***	

p-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 9 the Northern Europe

The table of Northern Europe group shows that all variables granger cause each other at the 0.01 level of significance. In other words, past data of all variables can be explicable for predicting other variables.

The Northern European developed countries are known for high social spending. Moreover, among the Europe, Finland, Sweden, and Denmark are regarded as countries that have not violated the fiscal rules well in keeping with the Maastricht Treaty (Yoon, 2016, pp.105). From these reason, the result can be read as a consequence of the fact that SOCX and fiscal sustainability variables are closely granger cause each other.

Conclusion

First of all, this research inquiries into SOCX and financial sustainability variables as panel data using hybrid model. Second, this study examined into granger causality test of the relationship between social expenditure and fiscal sustainability factors. Panel data has an advantage of retaining time series information as well as cross sectional data. The variable used in the analysis was aging, unemployment rate, government debt, national burden, government fiscal balance, and pension wealth, financial power, and organization capacity. The variable aging represents social factor, unemployment rate, government debt, national burden, government fiscal balance, and pension wealth stand for the economical factor. The variable financial power and organization capacity mean structural factor. All variables are converted into natural logarithm to increase normality and to get accurate values. The data from 2000, the end of the Asian financial crisis, to the most recent 2018 were used. 19 OECD countries were selected, and the countries were grouping in a classic way for granger causality test.

As the research method, hybrid model which is using within and between variables was utilized for dealing with time-invariant factors. The results show that national burden is significant at the 0.1 level of significance, while aging, government debt, and government fiscal balance are significant at the 0.05 level of significance. Likewise, GDP growth is significant at the 0.01 level of significance, and organization capacity which is the key variable is significant at the 0.1 level of significance.

For granger causality test, Fisher ADF, Fisher PP, and IPS used for checking unit root. Through IPS, we could confirm that unemployment rate, GDP growth rate, and government fiscal balance variables are stationary. As the result of granger causality test, with the exception of the Central Europe, the past time series data of each variable helps to infer a meaningful

causal relationship with other variables.

This research has two limitations: first, this study starts with limited data. Although the pension wealth variable is time variant, it is used as a time-invariant variable, because OECD provides data from 2018. This may leave room for misreading data. At this point, further research with the variable may be needed. In addition to this, political factors were not included. When it comes to the increasing social expenditure, relative power position of ruling party based on sharing in parliament could be a factor. Also how many regime changes have been made through the election or how many elections have been held during the period might be a factor. Because, undoubtedly most politicians use welfare as bait in elections. Nevertheless, it is significant that this research looked at the causal relationship with SOCX through structural variables.

Second, the time series is tackled. As is well known, if the time series is too short, there is a strong correlation between the variables, conversely, if it is too long, there is a weak correlation between the variable. Given that most papers use more than 30 observation time series, the time series of this study is rather short. Moreover, unit root were detected in some variables, which mean the data is non-stationary overall. This suggests that there is a probability that there will be no long-term balance between variables. In that case, the time series should be stabilized through additional differential methods, sequentially panel cointegration test should be performed. Notwithstanding, it is significant that this research empirically identified the causal relationship between SOCX and fiscal sustainability variables by country group.

Implication for Korean fiscal policy

This study suggests a few implications for Korea. First, aging population is progressing very rapidly, and by 2060, it is predicted that the rate of support for the elderly will rise to 82.6%, at the same time the government debt ratio will be 200% of GDP (NABO, 2018). Moreover, the old-age dependency ratio maybe 79 in 2050 comparing to 7.4 in 1990. This reminds of us to design high quality welfare service via program reform and structural reform for the elderly. Likewise, it is highly necessary to manage the proportion of mandatory expenditure. Without structural reform, a significant portion of spending may have to be financed through constant increases, which is the tax increase.

In this respect, we need to check three virtues for the good budget policy constantly: aggregate fiscal discipline, allocative efficiency, and technical efficiency. When it comes to aggregate fiscal discipline, the government should specifically consider the total amount of the national budget. Because excessively flexible budgeting, such as revised supplementary budget bill, causes a continuous increase in government spending. This leads to fiscal deficits and failure to control governance. Korea has implemented the top-down system and mid-long term national fiscal management plan, however, the effectiveness is doubt due to the low accountability of congressmen. The second is allocative efficiency, which means that the government prioritizes budget expenditures and divides the budget according to the priorities. This may maximize the performance of a project because it sets a strategic plan by the government level. Although Korea has implemented the program budgeting system, it tends to be customary to make unnecessary expenditures due to political demands of civic groups and stakeholders. The last is technical efficiency, which is a method of raising the result compared to the same input and lowering the input compared to the result as a way to improve efficiency

in the financial operation process. Korea has implemented the performance based system, but there is a limit to the formalization of management projects and the use of them in the National Assembly budget deliberation.

In other words, in Korea, the issue of the fiscal accountability of the National Assembly can be viewed as the Achilles of fiscal policy. Korean organization capacity of the legislative is relatively sound. However, in a situation where the ruling party in power of the government occupies the majority of the National Assembly, and internal and external economic crisis such as the Corona pandemic threatens a country, it may generate escapist budgeting. On the surface, it meets social demands, but if financing is unclear or continuous revenue is impossible, this can be a false fiscal policy. The other problem is Korean Won is not a key currency, which means that although Korea is regarded as having a good taxation capacity, there is also a need for the purpose of intensive management of the government debt ratio. Consequently, the legislative accountability and the government's taxation capacity should be emphasized.

This paper provides supportive evidence for developing account of organization capacity of the legislative. However, it is believed that further research with a developed idea using these is worthwhile. Any inaccuracies which remain are, of course, my own.

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