

**THE EFFECTS OF HORIZONTAL FISCAL EQUALIZATION ON THE  
EXPENDITURES OF LOCAL GOVERNMENTS: THE CASE OF SEOUL,  
KOREA**

by

Minhee Kim

A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Public Policy and Administration.

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## **ABSTRACT**

The role of Fiscal Equalization (FE) transfers in economic development has been discussed extensively in studies of local/regional public finance. In a fiscally decentralized system, FE aims not just at reducing fiscal imbalance between jurisdictions, but also at enhancing productivity by leading efficient allocation of public resources. From this viewpoint, FE can be seen as a policy that brings about positive economic development by achieving both equity and efficiency in local tax and expenditure policies. However, the questions regarding the role of FE in the allocation of financial resources in transfer-receiving governments has long been debated. How does FE influence the allocation of resources for various services? Does FE change the recipient governments' investments and policy priorities? The most dominant assumption is that FE is a disincentive for transfer-receiving governments to focus on growth-enhancing policies.

Such a disincentive effect is also possible with Horizontal Fiscal Equalization (HFE), a transfer between units at the same level of government, but there is little empirical evidence to validate this. In particular, there is scarcer research on how the expenditure decisions of local governments respond to HFE implementation. HFE designates a participating government as either a donor (transfer-giving) or a recipient (transfer-receiving); this distinction can affect the two groups differently when it comes to spending choices. Although the donor-recipient issue is often discussed by scholars, it has not been tested empirically.

Based on these ideas, this study aimed to investigate the effects of HFE on the public expenditures of local governments. Specifically, this study examines the effects of HFE on economic development expenditures and on social development expenditures by local governments, both individually (the donor and the recipient governments) and collectively (donor-recipient combinations). In this study, the Shared Property Tax System (SPTS), an HFE system enacted in Seoul, South Korea, was used as a case study.

The Difference-In-Differences (DID) method and the triple difference (DDD) method were used to evaluate the effects of SPTS. For these two analyses, the annual data were collected and sampled from 25 local districts in Seoul and its comparison group (44 local districts in Korea); these data spanned public expenditures as well as socioeconomic and political conditions between 2002 and 2013.

The findings from DID and DDD modeling of local government's expenditures in Seoul were generally consistent with theoretical predictions. Consistent with the reduced motivational effect hypothesis, EDE declined in donor and recipient combined group after SPTS implementation, and the decline was much greater in recipient districts than in donor districts. Consistent with the income-effect hypothesis—along with the normative premises put forward as policy rationales for HFE schemes—recipient districts shifted their relative expenditure priorities away from economic development and toward social development services, while donor districts placed more weight on economic development services. The SPTS is still too recent to comprehensively observe its long-term effects on Seoul's economic and social development patterns. But the effects so far seem consistent with the behavioral premises upon which advocates based their arguments for HFE as a means of

enhancing efficiency and equity within metropolitan areas (through reducing inter-municipal economic development competition and ensuring a community's quality of life and environmental well-being).

## Chapter 1

### INTRODUCTION

#### 1.1 Background

Fiscal Equalization (FE) is to transfer fiscal resources across subnational jurisdictions and commonly used in developed and transitional countries. Reflecting the degree of a local government's fiscal autonomy and responsibility, a form of FE varies depending on the objective of the transfers, the resources to be shared, the way of pooling and distributing the resources, the actor(s) involved, and the regulation of the use of transfers (Bahl & Linn, 1994; Shah, 2007). FE can support governmental financial operations by enhancing allocative and technical efficiency and equity in the distribution and fiscal balance (Shah, 2007). However, FE may result in a loss of efficiency because it can create soft budget constraints (Kornai, 1979) and moral hazards that increase rent-seeking and waste in the government expenditure as well as provide a disincentive to focus on growth-enhancing policies (Bird & Smart, 2001; Boadway & Shah, 2007; Schroeder & Smoke, 2002; Spahn, 2012). From this perspective, it can be challenging for governments and policymakers to ensure the equity of resources distribution while promoting the efficient use of the resource at the same time.

One form of FE, tax base sharing and other forms of Horizontal Fiscal Equalization (HFE) involves sharing property wealth (tax base or revenue) between the same level of government within a region. HFE has more substantial effects on

reducing horizontal fiscal disparity than any other form of FE. However, it also raises concerns as it has the potential to reduce the desire for producing local economic growth which generates local tax revenue within their territories. For a number of reasons, such as the income effect associated with the common pool hypothesis and the reduced marginal benefit of attracting development, the question arises as to whether HFE reduces efficiency by alleviating the recipient governments' fiscal imperative to attract economic development activity (Keen & Marchand, 1997; Orfield & Luce, 2016; Wolman & Spitzley, 1996).

However, the proponents of HFE, such as Bird and Smart (2001), Ferede (2014), Gilje (2020), Hindriks et al. (2008), and Orfield and Luce (2016) counter that HFE improves efficiency by reducing the excessive or unnecessary inter-local competition for revenue-generating development in a way that harms the neighboring jurisdictions and itself as a whole. HFE advocates argue that less pressure on revenue-generating development could boost local economies by creating more orderly, balanced, and efficient patterns of regional economy that appeal to business and people (Blöchliger, 2008; Fisher, 1982; Hindriks et al., 2008; Hinze, 2020; Kemp, 2003; Reschovsky, 1980; Shah, 2007). In this respect, HFE may positively influence the efficiency, contrary to the conventional presumption that equalization tends to trade off efficiency for equity.

Despite a growing number of studies on HFE, the effects of HFE on expenditure appear to be not well studied. There are three reasons. First, in the realm of academic research on FE, less attention has been given to revealing differences in the effects of vertical and horizontal transfers for local government's fiscal policies (Fischer & Ulrich, 2011; Wildasin, 2009). HFE acts as an unrestricted lump-sum grant

to recipient communities but becomes a negative grant to donor communities. Thus, the effect of HFE on expenditure could differ between donor and recipient communities, departing from the results of vertical FE. To better understand the impact of HFE on spending, research is needed to investigate if HFE has the same effect on spending irrespective of the donor or recipient community, or if the collective effect of HFE on spending is the same as that of vertical FEs. Some studies using the cases of Canada (Cyrenne & Pandey, 2015; Ferede, 2014), and Germany (Hauptmeier, 2007) have reported that FE reduces the incentive for recipient governments to undertake expenditures intended to promote economic development in favor of expenditures that serve current needs of residents. However, these studies have analyzed the vertical FE effect, particularly focusing on the recipient governments. Thus, their results are not directly applicable for HFE cases.

The second reason is a small number of HFE practices, leading to a lack of empirical research. Within the U.S., there are only a few cases of metropolitan-scale HFE in Minnesota, New Jersey, and Virginia, etc (Bell, 1994, pp. 154-155). This presents many challenges to those who study the effects of HFE policies, including the limited demand for research and limited applicability. Additionally, the rarity of HFE schemes also makes it problematic to conduct multiple-case study that could draw a more concrete conclusion than a single case study.

The third reason is that most existing research on HFE policies has focused exclusively on the main objective of HFE, the equity (how much to mitigate the inequality of resources), while far less attention has been made to the corresponding effects of these policies on economic efficiency and development. This lack of understanding about the effects of such policies on efficiency is especially concerning

given the recent findings in urban and regional studies that predict the gradually positive, longer-term economic effect of HFE on a regional basis. HFE's advocates claim that the moderated fiscal imperative for revenue-generating development enables them to achieve more sustainable economic growth at the regional level because it leads jurisdictions to make more efficient fiscal policy decisions in the long term (Bird & Smart, 2001; Hunt, 1987). For example, with HFE, localities may be less concerned with revenue-generating activities and more concerned the policies that are best suited for their local conditions as well as residents' preferences (Hamilton, 2014, p.vii).

Also, as demonstrated by Orfield and Luce (2016) and Minnesota Department of Revenue (2012), HFE encourages local governments to invest on land use and public infrastructure that may yield less tax revenue but more conducive to sustainable development at the regional level (e.g., low-income housing, open space, and essential facilities on a regional basis). Recent studies report on HFE as a regional policy that complements equity and efficiency by reducing the desire for inter-local competition for tax bases, and by diverting interests to maintaining a residents' quality of life. Such an effect, however, has not been empirically validated.

This study aims to address some of these gaps in the literature by testing the effects of the Shared Property Tax System (SPTS) in Seoul, Republic of Korea. The SPTS is an HFE scheme introduced by the Seoul Metropolitan Government (SMG) in 2008 and all of the SMG's 25 districts (gu) have participated. The SMG pools 50% of all the property taxes collected by its 25 districts (gu), and then redistributes the pooled funds in equal shares. Its main objective is to mitigate the fiscal disparity and increase the quality of public services of recipient communities. Its design, fiscal

capacity equalization principles, and the fiscal incentives it provides to the districts are similar to those of HFE in the U.S (Thompson, 2015).

## **1.2 Research Objectives**

The objective of the study is to analyze the causal effect of the SPTS on the expenditure choice of local governments. Specifically, this study examines the SPTS impact on two types of expenditures, including economic developmental (growth-enhancing) expenditure, and social developmental (non-developmental or welfare-enhancing) expenditure. In addition, this study examine if the SPTS affects differently in the donor (transfer giving) and the recipient (transfer receiving) districts. The two research questions addressed in this research are: How do the local governments change their expenditure choices after the SPTS implementation? and how differently do donor/recipient local governments respond to the SPTS?

## **1.3 Significance**

This study looked at the SPTS by examining the incentive effect on spending choice as part of the SPTS economic effect. Therefore, the contribution of this paper is threefold: first, it defined a theoretically robust and empirically testable framework to see the HFE impact on spending choice. The research framework was based on reviewing the literature on fiscal decentralization, fiscal equalization (intergovernmental transfer) and the economic/political theory explaining the impact of grants, as well as the key facts and design features of grants affecting such impacts. Second, evaluating the SPTS impact on spending, in particular, this study employed economic development expenditures and social development expenditures following the theoretical models of Peterson (1981), Barro (1990), and Kneller et al. (1999), not

just using the classification of functional government expenditure as the indicators of SPTS spending impact. In addition, it empirically tested whether and how the SPTS affect the spending choices of local governments, and therefore expands on the literature by discussing the implications and limitations of these findings, as well as providing recommendations for further research.

This study helps local officers, policymakers, and institutions that are involved or will be involved in the HFE to gain a better understanding of the HFE practices. Many existing literatures tend to merely define how HFE works and desired outcomes, rather than what it has actually achieved so far. For them, this study can be a reliable source for revising and evaluating possible suggestions or guidelines toward the current and future implementations of HFE. Moreover, it contributes to better understand Korea's HFE practice, SPTS. Seoul's HFE has been adopted for 13 years as of 2021, however, only few studies have conducted to unveil the impact of HFE based on quantitative evidence. This study provided a framework for analyzing and predicting the outcome of HFE and offered insight into the current HFE practices as a reference.

#### **1.4 Organization**

This study organized as follows. Chapter 1 provides an overview of theoretical and empirical studies on fiscal equalization and the relationship between the expenditure choices of local governments, along with unconditional transfers and horizontal fiscal equalization transfers. A theoretical argument is developed to support the purpose of the study and its research questions, clarifying this study's academic and practical contributions to the fields of public choice studies, urban studies, and public finance and administration studies.

Chapter 2 presents an analytical review of literature related to fiscal decentralization, the economic theory of intergovernmental transfers, and other methods of fiscal equalization. Focusing on Horizontal Fiscal Equalization (HFE) practices, this chapter explains how the effect of HFE is discussed within a theoretical, empirical framework. This is followed by the description of the theoretical framework used to analyze the expectations of local government expenditures as a result of HFE.

Chapter 3 introduces the HFE (SPTS) practice in Seoul and review the previous studies focusing on the SPTS impact. The fiscal and political context of Seoul, South Korea is broadly explained.

Chapter 4 describes the empirical model and the analytic methods used and introduces the data. In particular, it includes a detailed explanation of how the variables are selected and collected, and why Difference in Differences (DID) and Difference in Difference in Differences (DDD) are particularly well-suited to address the research questions, and the limitations of its uses.

Chapter 5 identifies the findings and results of the DID and DDD statistical tests of the expenditure effects of the SPTS. Before presenting the results, a description of the underlying process will be presented.

Chapter 6 discusses the implications of how HFE (specifically the SPTS) needs to be modified, along with the limitations of the findings, identifying directions for further research. Collectively, this contributes to the current and future implementation of HFE and informs practitioners for effective, appropriate decision-making.

## Chapter 2

### **LITERATURE REVIEW**

#### **2.1 Fiscal Decentralization and Intergovernmental transfers**

Fiscal decentralization refers to the process of delegation of authority and responsibility for tax and spending policies from the central government to subnational governments to increase the efficiency of fiscal management and the accountability of local governments (Brennan & Buchanan, 1980; Musgrave & Peacock, 1958; Oates, 1972; Tiebout, 1956). Advocates of fiscal decentralization claim that the fiscal decentralization achieves greater economic efficiency, equity, and macroeconomic stability, which eventually positively affects economic growth (Bahl & Linn, 1992; Martinez-Vazquez & Rider, 2006; Oates, 1972).

The efficiency of public service provision especially can be better ensured under a fiscally decentralized system because local governments can make the most appropriate taxes and expenditures decision in consideration of residents' preferences, local environmental characteristics, and the costs of local public services provision (Boadway & Shah, 2007). Also, it is expected that the accountability and transparency in the delivery of public goods can be improved with an increased autonomy over budgeting (Brillantes Jr & Sonco, 2004; Martinez-Vazquez & Searle, 2007). However, fiscal decentralization may have adverse economic effects, bringing

inefficiency by ‘destructive interlocal competition’ (Prud’Homme, 1995)<sup>1</sup> and reinforcing interregional inequalities between more wealthy jurisdictions and less wealthy jurisdictions (Martinez-Vazquez, 2011).

Fiscal Equalizations (FE) are often used to address such problems inherent in decentralization. According to the study of Blöchliger et al. (2007), Shah (2014), and others, FE is a transfer of fiscal resources between multiple jurisdictions with several objectives: (1) ensuring horizontal equity among residents of different regions, which allows people to enjoy similar levels of public services at comparable costs (tax rates) in all localities, thereby preventing fiscally induced migration, (2) securing a minimum (or national) standard of public services by supporting sub-national governments with greater fiscal needs and/or less revenue-raising capacities, (3) implementing efficient resource allocation by supporting the public goods that are either more highly valued by a central government or that have spillover effects on neighboring localities, (4) lowering a degree of revenue imbalance between subnational governments and central governments or between subnational governments, and (5) encouraging local tax efforts by providing a more level playing field for recipient governments (Bahl et al., 2002; Boadway & Shah, 2007; Musgrave, 1971; Oates, 2008).

---

<sup>1</sup> All tax competition does not necessarily reduce efficiency, nor is it considered harmful. The destructive competition referred to here is a state in which the resource allocation set by each local government to maximize individual profits is inefficient from the regional (collective) point of view, that is, the repetitive process of providing low tax rates to acquire tax bases from other localities causes a reduction in the tax rates and public provisions, leading to a race to the bottom (Min & Yoon, 2012; Oates, 2002). Regarding this, Prud’homme (1995) explained that destructive competition is a case wherein the local governments are made to deviate from the desired initial equilibrium state by when all local governments offer identical (close to zero) low tax rates to win the competition.

Table 1. Forms of Intergovernmental Transfers

<b>Conditional /Unconditional</b>	<b>Methods of Pooling</b>	<b>Methods of Sharing</b>
Unconditional Transfers	Predefined percentage of tax	Origin of collection of the tax
	Predefined percentage of tax	Formula
	Predefined percentage of tax	Ad hoc Decision
	Ad hoc Decision	Formula
	Ad hoc Decision	Ad hoc Decision
Conditional Transfers	Predefined percentage of tax	Total (partly) reimbursement of costs
	Ad hoc Decision	Total (partly) reimbursement of costs
	Reimbursement of approved expense	Total (partly) reimbursement of costs

*Source:* Adapted from Bahl and Linn (1994, pp. 7-16).

In order to achieve these goals, FEs should be designed in accordance with the intended objectives. Bahl and Linn (1994) defined the two main design components of transfers that match with policy objectives set by national and local governments (Table 1). They suggested that the taxonomy of grants be determined by the methods of pooling the revenue and the redistribution of the pool, and that this can be connected to various objectives. Ad-hoc decision-making and reimbursement of selected expenditures, for example, would be ideal for national-government perspectives on maintaining local financial control or stimulating preselected public services, while the pooling of a specified share of national governments' taxes would be ideal for subnational governments' perspectives on local finance management (p. 16).

Bahl and Linn (1994)'s ideas on the taxonomy provide an excellent reference to understand and predict the outcome of grants. Later, Shah (2007) extended the pioneering work of Bahl and Linn (1994) by including other elements in the design of grants. According to Shah (2007), FEs vary depending on (1) who is involved in the transfer system (different/same level of governments or as a whole/part of the jurisdictions), and (2) which source of tax revenue to be shared (a single tax or a set of taxes).<sup>2</sup>

## **2.2 Types of Intergovernmental Transfers and Effect on Local Governments' Fiscal Behaviors**

Intergovernmental transfers often refer to several different names such as grants, subsidies, tax revenue sharing, or fiscal equalization (Bahl et al., 2001). Also, there are many ways to classify intergovernmental transfers. In this study, transfers are classified into three broad types depending on the predicted effect on local governments' fiscal behaviors, especially on expenditure aspect, as suggested by Gramlich et al. (1973), Bahl et al. (2002), and Boadway and Shah (2007). This classification also can be understood with consumer behavior theory in that the income and price effects determine the community's fiscal behaviors on revenue and expenditure. From this point of view, intergovernmental transfers are categorized into three types of transfers: unconditional transfer, conditional matching transfer, and conditional un-matching transfer.

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<sup>2</sup> HFE can share various types of taxes, including retail sales, the income tax, sales tax, property tax, and occupation taxes (BBC Research & Consulting, 2001; Nunn & Rosentraub, 1996).

**Unconditional transfers:** unconditional transfer has no conditions upon its use; thus recipient governments can use the received grant for any spending as well as tax relief to residents (Bergvall et al., 2006; Spahn, 2012). This type of transfer, in general, is intended to not only enhance inter-jurisdictional equity but also to preserve local autonomy and spending flexibility (Bird & Smart, 2001; Shah, 2007). Thus, in the traditional theory of transfers, unconditional grants are expected to have an income effect only on local fiscal behavior. Recipient governments consider unconditional grants equivalent to additional income, thus expecting expenditure to increase along the income consumption curve because any expenditure is not required (Shah, 2007). In addition, from a theoretical point of view, since unconditional grants do not change any price of expenditures, it can stimulate both public spending and tax relief as income increases (Gramlich et al., 1973). Thus, the changes in the local expenditure generally are assumed to not correspond equally to the amount of transferred funds because a portion of the unconditional grant is used for tax relief to residents (Arvate et al., 2015).

**Conditional transfers:** the grantor (including the central or federal government, upper levels of governments, or donors) define the limits and purposes for the use of the grant. The restrictions may relate to the targeted expenditure (input conditionality) or a specific achievement of the performance (outcome conditionality) (Bergvall et al., 2006; Boadway & Shah, 2007). Conditional transfers are made up of two categories: non-matching transfers and matching transfers. **Conditional and Non-matching transfers** are funds that encourage recipient governments to engage targeted programs or activities without local matching required. This grant is best suited for subsidizing activities with high national priority but low local priority

(Shah, 2007). With this type of transfer, a grantor expects that grants are spent without changing local priorities or leading over-spending on the target activities/program (Shah, 2007, pp. 4-5). Thus, it is assumed that the recipient governments' spending on the targeted expenditure will equal the amount of grant amount or more than that (Shah, 2007). Notably, this type of grant is known as a hybrid of unconditional and conditional matching grants because it has an income effect like unconditional grants while encouraging the targeted programs/activities (Bergvall et al., 2006; Gramlich et al., 1973; Shah, 2007). **Conditional and Matching transfers** are funds that the grantor pays some portion of the cost of targeted expenditure, and the recipient matches the funds to an unlimited or certain extent. This type of transfer usually targets welfare-related programs or activities, as their main purpose is to support public goods that generate spillover benefit or positive externalities (Boadway & Shah, 2007, p. 312; Gramlich et al., 1973). Hence, conditional matching transfers are expected to have a substantial effect on recipient governments' fiscal preferences by reducing the price of targeted goods (Gramlich et al., 1973). Similar to unconditional transfers, since there is an income effect, non-targeted public goods and services can be expanded even if the prices of non-targeted items are relatively higher than those of targeted spending items (Shah, 2007). In other words, conditional matching transfers, through income and price effects, can lead recipient governments to increase spending on the targeted and non-targeted goods or tax relief (Bergvall et al., 2006; Gramlich et al., 1973; The World Bank Group, 2001). Although these three types of FE have the aforementioned intended effects, their effectiveness is maximized or minimized depending on how the policy is designed. As shown in Figure 1, there are many alternative design components to consider, depending on the FE's intended objectives.

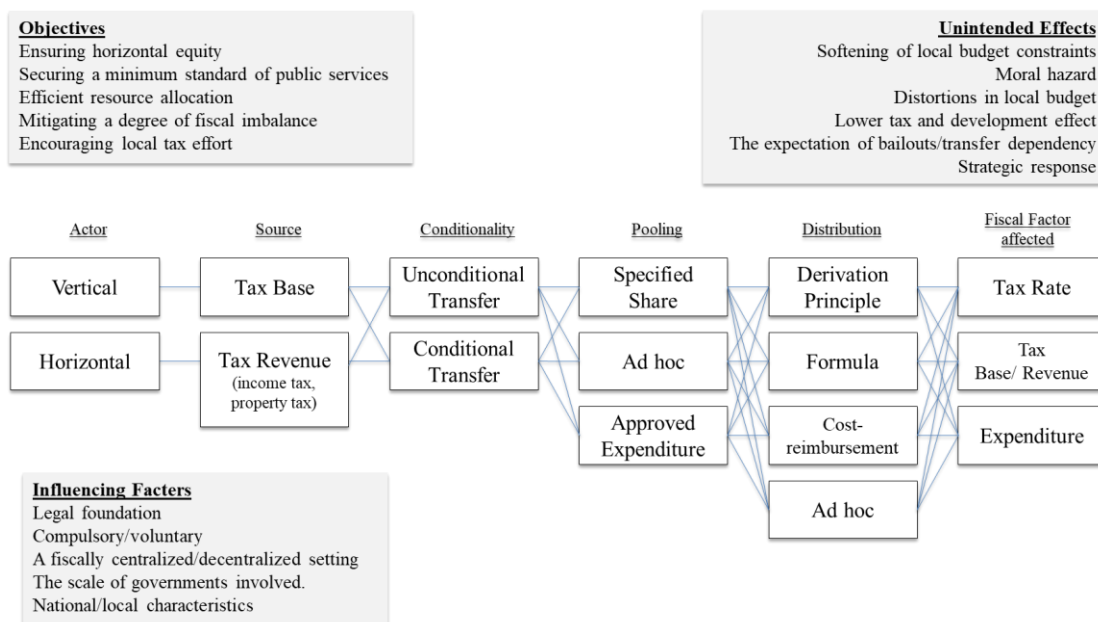


Figure 1. The Design Components and Factors Influencing the Form of Transfers<sup>3</sup>

**Actor** (vertical or horizontal): the vertical transfer is to collect the fund from upper-level governments then allocated to subnational governments, while the horizontal transfer is to collect and share the total pool of funds among subnational governments. Under vertical transfer, raising a common-pool resource is not responsible for recipient governments (Bahl, 2000; Bahl & Linn, 1992; Blöchliger & Charbit, 2008, pp. 11-12).

**Conditionality** (unconditional or conditional): a conditional transfer is designed to be spent on targeted programs or activities while an unconditional grant is assigned to a broad range of public goods and services (Bahl, 1994; Bahl & Linn, 1992).

**Pooling** (specified share, ad hoc, or targeted expenditures): the amount of transfers can be 1) decided by a certain percentage of certain tax revenue sources, 2) ad hoc decision based (it is based on specific indicators or some overall measures of aggregate demand for all

<sup>3</sup> It is based on Bahl and Linn (1992, 1994) and supplemented by Shah (2007) and Blöchliger and Charbit (2008).

participating governments), or 3) reimbursement of authorized expenses (Bahl & Linn, 1992; Bahl, 1994, pp.6-7).

**Distribution** (by derivation, formula-based, cost-reimbursement, or ad-hoc): transfers can be distributed on a derivation basis, the formula (per capita allocation or allocation based on general/specific indicators of demands/revenue capacity), reimbursement costs (all or part of actual local expenses), or ad hoc decision (no explicit formula applied) (Bahl, 1994, pp.6-7. Bahl & Linn, 1992; Boadway, 2015).

The impact of transfers is also affected by various factors beyond the pooling and distribution method, including the existence of a legal foundation (constitution, law) (Blöchliger et al., 2007), compulsory or voluntary legal obligation (Shah, 2017), a fiscally centralized or decentralized institutional setting (Masaki, 2018), and the scale of participating governments (metropolitan or state level) (Kirk, 2019; Nunn & Rosentraub, 1996).

### **2.3 Intergovernmental Transfers on the Fiscal Behaviors of Recipient Governments**

In a fiscally decentralized framework, Fiscal Equalization (FE) programs are important tools for promoting the fiscal discipline of recipient governments. FE especially allows some responsibility to improve and sustain economic performance, thereby financing their expenditures from their own sources, the ultimate goal of fiscal decentralization (Bird & Smart, 2001). However, these objectives are not always achieved, as the recipient government can undermine the intent of the sharing. The reasons that local government's fiscal response to intergovernmental transfer is expected are as follows: (1) the common pool effect: transfer as an external resource

(even a windfall resource)<sup>4</sup> causes overspending and low fiscal responsibility by preventing recipient governments from fully internalizing their full cost of expenditures (Bird & Slack, 2014; Caldeira & Rota-Graziosi, 2014; Eyraud & Lusinyan, 2013); (2) the expectation of bailouts with transfer dependency – recipient governments play a strategic role in receiving more transfers to compensate for spending or even budget deficits, as a result of softening budget constraints (Dahlby, 2002; Eyraud & Lusinyan, 2013; Rodden et al., 2003; Smart, 1998); (3) moderated marginal benefit of attracting development.– can be viewed as an implicit tax on economic activity (Baretti et al., 2002)<sup>5</sup>, thus reducing incentives for engaging in economic activity or reducing interlocal competition for the mobile tax base through taxing and public spending (Algoed, 2009; Bucovetsky & Smart, 2006); and (4) substitute sources of local income (tax) – reduce the local tax burden, thereby reducing the fiscal imperative to generate tax base and revenue. As a result, Bahl and Linn (1992), Bird and Slack (1990), Borck et al. (2007), Smart (1998), and Wolman and Spitzley (1996, p. 118) have noted that transfer makes the recipient governments less accountable for fiscal decisions, relax the fiscal imperative to generate tax revenue, reduce interlocal competition for revenue, more likely to overspend on transfers, inefficient and even wasteful with spending, and increase unproductive expenditures.

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<sup>4</sup> Regarding the issue of recognizing intergovernmental transfers as a windfall resource, Caldeira and Rota-Graziosi (2014) notes, “Central grants are perceived as a kind of windfall resource, which crowd out local own revenue by reducing the willingness of local governments to improve their tax effort” (p.362).

<sup>5</sup> Baretti et al. (2002) explain that fiscal equalization can be seen as “a tax on a state’s tax revenue”, because the more tax revenue a state generates, the less transfers it receives from the upper level of government (p. 3).

Regarding local governments' responses to transfers, researchers explain this tendency through various concepts such as fiscal laziness (reducing tax effort), transfer dependency, common-pool dilemmas, moral hazard problems, and soft budget constraint (Bahl & Bird, 2018; Purfield, 2004, pp. 4-5).

In short, while transfers can be an incentive for recipient governments to foster economic development activity (new sources of revenue), collect taxes efficiently from existing bases, or control deficits and local debts (Blöchliger & Petzold, 2009; Rodden et al., 2003; Wildasin, 2009), the more common and expected result, however, is to relax the fiscal discipline of the local governments and move the recipient governments' policy priorities away from attracting economic activities (Bird, 2010; Dahlby, 2002; Weingast, 2009). This trend is stronger when a transfer is inversely or negatively related to some indicator/measure of tax base or tax capacity (Bahl & Bird, 2018; Blöchliger & Charbit, 2008; Brun & El Khadari, 2016; Schroeder & Smoke, 2002). Also, such a tendency is stronger in top-down approaches (vertical fiscal equalization) than horizontal fiscal equalization (Spahn, 2012).

These deterrent effects have been verified in several empirical studies. Some studies have identified the negative effect of transfers on 'tax-enforcement efforts' and 'tax revenue-to GDP ratio' (Baretti et al., 2002) and tax rate in Germany (Buettner, 2006), Australia (Dahlby & Warren, 2003), Canada (Dahlby & Ferede, 2016; Ferede, 2014; Smart, 1998), temporary non-tax revenue and local (municipal) bonds in South Korea (Choi & Lee, 2014), and locally generated revenues in OECD countries (Blöchliger & Petzold, 2009). These literature supports the view that a transfer changes the fiscal choices of local governments by relieving the local government's fiscal responsibilities of some function associated with tax revenue.

### **2.3.1 Unconditional Transfer on the Government Spending**

Regarding the effect of the transfer on government spending, previous theoretical studies predicted that, within the framework of a simple median voter theory, an increase in unconditional transfers would have the same spending effect as a corresponding increase in local income (Bradford & Oates, 1971; Smart, 1998; Wilde, 1968). It is believed that government spending reflects the median voter's preferences, and transfer is assumed to be used as a substitute for local income (locally generated revenues) (Deller & Maher, 2005a). A large body of empirical studies on fiscal federalism literature has confirmed that unconditional grants lead recipient governments to expand their spending. Furthermore, expanding such a discussion that transfers have a positive income effect, thereby increasing local spending, many studies are prone to compare the effect of grants and the effect of local income on governmental spending. These same studies then concluded that grants increase local spending more than an increase promoted by local income, which is known as the flypaper effect (Arvate & Rocha, 2015; Dahlby & Ferede, 2016; Deller & Maher, 2005a; Gramlich et al., 1973; Hines & Thaler, 1995; Yoo, 2000).

On the other hand, some studies have focused on the effects of reduced transfers, predicting that reactions for reduced transfers may differ from what happens with an increase in grants. Following the pioneering work of Gramlich (1987), many researchers investigated the causal relationship between reduced transfers and spending behavior, which can be summarized as follows: First, when grants were cut, spending remained constant because the reduction was covered by a local tax increase (Gramlich, 1987; Heyndels, 2001; Lim et al., 2017). In this regard, Deller and Maher (2005b) noted that the recipient government would compensate the loss through additional local income and taxes while maintaining the level of expenditure. This was

because existing programs or activities run by government spending cannot be abolished only because of grant reductions. A second response was a decrease in spending more than a decrease in grants (Stine, 1994; Bae & Kwon, 2007; Lim, 2013). Looking at the Pennsylvania case during 1978-1988, for instance, Stine (1994) found that a reduction in transfers has led a negative income effect, thus reducing spending.<sup>6</sup> The last confirmed response was that reduced transfers decreased spending as much as the reduced transfer itself (Gamkhar & Oates, 1996). In summarizing the impact of increased and decreased transfers, the empirical results, although inconclusive, indicate that unconditional transfers cannot be treated the same as local income and clearly affect the level of local spending.

Also, the expansion of the literature on transfer effects on the level of spending has led to a growing body of knowledge focused on whether the impact of grants varies by selective expenditure types - as a result of moderated development efforts. Hauptmeier (2007) investigated the German local governments (1,111 cases) from 1990 to 2003 and concluded that the share of productive expenditure (education and transportation expenses) in total expenditure was decreased after receiving unconditional transfers. Similar results were found in a study by Deller and Maher (2005a), which looked at 575 Wisconsin municipalities from 1998 to 2000. Their finding was that unconditional grants increased spending on "non-essential, luxuries" than on "normal, necessary goods." In Korea, Hyun (2010) confirmed that the

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<sup>6</sup> Deller and Maher (2005b) defined three types of response of local government to the reduction in grants as replacement, asymmetric, and inducement.

unconditional transfer increased social development expenditure while decreasing economic development expenditures.<sup>7</sup>

As for such a causal relationship between unconditional transfers and selective spending, a relatively large number of Canadian studies show consistent results that local governments spend less on productive expenditures with unconditional transfers. Using Kneller et al. (1999)'s classification of public spending, for example, two studies, Cyrenne and Pandey (2015) and Hailemariam and Dzhumashev (2019) empirically tested the Canadian case and reported that recipient governments tend to increase their share of unproductive expenditures with transfers while decreasing the share of productive expenditures.<sup>8</sup> These findings are in line with Ferede (2014) that Canada's equalization grants increased the level of total and selective public expenditures, such as health care, resource conservation, industrial support, environment protection and housing. Although they did not divide public expenditure items into either 'productive' or 'unproductive' categories, their empirical results were somewhat similar to those of Cyrenne and Pandey (2015) and Hailemariam and Dzhumashev (2019), suggesting that this disincentive effect of transfers on the

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<sup>7</sup> Hyun (2010) classified expenditures on education, culture, public health, environmental protection, social security, and housing & community development as social development expenses.

<sup>8</sup> Following Kneller et al. (1999)'s classification of functional government expenditures, they classified expenditures as follows: 1) productive expenditure (health, education, housing, transportation and telecommunications, general government services, and transfers to other governments); 2) unproductive expenditure (social security, recreation, welfare and culture); and 3) other, including all other remaining expenditures.

expenditure is due to the tendency of recipient government to increase welfare-enhancing expenditure in favor of tax base-enhancing expenditures.

In contrast, some researchers in Korea investigated the effect of ‘reduced transfers’ on public expenditures and their results were different and strongly conflict. For instance, Mun and Kim (2008) concluded that a reduction in transfer did not result in decreased economic development expenditure, general administrative expenditure, or total expenditure, but a decrease in social development expenditure. In contrast, Choi and Lee (2015) examined the data during the period between 2005 and 2011 and found that local (districts) government lowered their economic development expenditure as a response to a reduced transfer. In addition, Kim and Park (2017) showed different results by analyzing 226 local governments in Korea from 2009 and 2015. They found that the reduced grants have increased the per capita economic developmental expenditure while having no significant effect on social developmental expenditure. In a more recent study done by Kim (2019), reduced transfers caused a decrease in all three types of expenditures (redistributive, allocative, and developmental expenditures), resulting in significant declines in developmental expenditures.<sup>9</sup>

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<sup>9</sup> Kim (2019) categorized expenditures as follows: (1) developmental expenditures: six expenditures including culture and tourism, Agriculture and Fishery Industry, Industries and SMEs, Transportation and traffic, National Land & Regional Development, and Science and technology (2) redistributive expenditures: Education, Social welfare, and Health. (3) allocative expenditures: General Administration, Public order & safety, Environmental Protection, others.

### **2.3.2 Horizontal Fiscal Equalization and Its Effect on Local Fiscal Policies**

Horizontal Fiscal Equalization (HFE) is a type of unconditional transfer, but it differs from other transfers in that it transfers between two or more sub-governments at the same level (Lane, 1992). The method of pooling and redistributing is determined by the participating governments or upper level of governments, and an amount of sharing is determined by a formula established in legislation or voluntary agreements (Pammer Jr & Dustin, 1993, p. 57).

HFE has several unique characteristics. First, the primary goal of HFE is to correct the horizontal fiscal imbalance. For this reason, the fiscal resources (tax revenue/base) that are pooled would mostly be the main sources of fiscal disparity among jurisdictions (Sung & Kim, 2006).<sup>10</sup> Second, unlike Vertical Fiscal Equalization (VFE), HFE is locally collected and locally shared, which means that wealthy jurisdictions directly provide resources to poor jurisdictions (Kim, 2008a). Since other levels of governments are not financially involved (pooling and redistribution), it can be seen as a zero-sum game in which gains in one jurisdiction equal losses in other jurisdictions, unless the pool expands from its own revenues (Blöchliger & Charbit, 2008; Eccleston & Woolley, 2014). Third, the HFE informs the financial changes of donor and recipient jurisdictions in the process of collection and

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<sup>10</sup> Metropolitan level of HFE is usually introduced in areas where industry (economic function) is in a certain municipality and adjacent municipalities support the workforce within a region, resulting in fiscal imbalances from the concentration in economic development (Bergvall et al., 2006; Kim, 2008a; Orfield, 2011; Shishkin, 2007). For example, ‘the fiscal disparity law’ was adopted in the Twin Cities where businesses are concentrated in a small number of areas (Orfield & Luce, 2016) and similarly, ‘the shared property tax system’ was adopted in Seoul where a few districts were selectively developed as the core centers of Seoul through regional planning (Hue, 2013).

redistribution. In this way, participating governments know which jurisdictions become net donors (contributors) or net recipients (beneficiaries) and how much they receive or lose transfer (Bergvall et al., 2006; Blöchliger, 2014). Such information can be helpful for jurisdictions to identify their position as well as their potential roles under HFE and could contribute positively to leading new intergovernmental agreements related to regional development cooperation (Kim, 2008a; Metropolitan Council). Fourth, HFE is used to achieve political gain in terms of fostering a sense of political cohesions in the face of large fiscal disparities that threaten to trigger social conflicts and division (Kim, 2008a; Shah, 2017). Further, HFEs can “potentially play a role in strengthening an internal common market and common economic, social and political union” (Shah, 2017, p. 2).

HFE can be adopted either mandatorily/compulsorily or voluntarily (Shah, 2017). Mandatory/compulsory approaches, including the so-called Robin-hood type of HFE, are led by federal/central governments, forcing wealthier localities to contribute to the less wealthy localities. In contrast, fraternal/solidarity HFE is a voluntary approach led by both affluent and less affluent jurisdictions based on the interest in not only mitigating fiscal imbalance but also improving regional competitiveness as united regions (Shah, 2017).

With respect to mandatory/compulsory HFEs, most of them are systematically stable, as there is a legal framework regulating how transfers are pooled and distributed, and regulatory changes are made under decrees by executive or ministry (Blöchliger et al, 2007). In addition, the objective of mandatory-based HFE is defined by constitutions that emphasize inter-jurisdictional equity, especially in the provision of public goods and services (Kim, 2008a; Shah, 2006). For example, the state level

HFE in Switzerland is established by federal law and their primary objective is to reduce fiscal imbalances and to ensure a minimum level of public services with comparable tax burdens across all municipalities (Shah, 2017). Australia's HFE is not established and defined by the Constitution, however, the Commonwealth Grants Commission (CGC), an administrative agency of Australia, defined the main objective of HFE as ensuring 'the comparable level of public services with the similar revenue effort at the close level of operational efficiency (Commonwealth Grants Commission, 2018; Shah, 2017). The details vary from country to country, but the main goal of an HFE is equalizing the ability of local governments to provide public services on a similar or specific levels, which goes towards leveling the fiscal playing field for all governments (Orfield & Wallace, 2007). Such forms of HFE is preferred more in federal countries than in unitary countries.<sup>11</sup>

Compared to the mandatory/compulsory HFE, voluntary-based HFE is not established by law nor by the constitution. Rather, the method of pooling and redistribution is determined by the agreement of the participating jurisdictions. Mandatory-based HFE aims mainly at achieving horizontal fiscal equality, while voluntary-based HFE, in practice, is not intended to alleviate horizontal fiscal imbalances, but rather to achieve regional economic development in the long term (Nunn & Rosentraub, 1996). For instance, one study listed the primary objectives of

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<sup>11</sup> Regarding this, Blöchliger and Charbit (2008) noted as, "Whether a country is constitutionally federal or not has surprisingly little influence on equalisation models: Although federal/regional countries tend towards horizontal revenue equalisation while unitary countries tend towards vertical cost equalisation, differences are small and variation within a country group is larger than variation between the two groups."(p.6)

voluntarily designed HFE in the United States as follows: 1) reducing fiscal imbalances between communities, 2) preventing/alternate for annexation, 3) using funds strategically for economic development, and 4) protecting/managing of environmental resources (BBC Research & Consulting, 2001, p.4). As described in this study, the main goal of voluntary-based HFEs is not limited to improve financial equity and, in many cases, promote regional cooperation on programs/activities that contribute to local and regional economic development (BBC Research & Consulting, 2001).

HFE has been recognized as one of the strategies to address horizontal fiscal imbalance, but they rarely occur compared to other types of FEs. Some federal countries (Australia, Belgium, Canada, Germany, India, and Switzerland) and unitary countries (Austria, France, Sweden, and U.K) have adopted HFE at the state level (Bergvall et al., 2006; Béland & Lecours, 2014; Kim, 2008b) and Austria, Korea, Switzerland and the United States adopted it at the local level (Bergvall et al., 2006; Blöchliger et al., 2007; Shah, 2017). For political and/or legal reasons, as Payson (2014) stated, HFE is rarely practiced and more rarely adopted in the United States (p.349).<sup>12</sup>

Compared to the literature defining the forms of HFE and the equity and efficiency benefits of HFEs, empirical studies of HFE appear to be still in their infancy. There are few studies empirically demonstrating the effect of HFE. In the United States, Martin and Schmidt (1983) examined the HFE in the Twin Cities, Minnesota (the Fiscal Disparities Act, FDA) to see the impact of FDA on the tax and

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<sup>12</sup> Also see Béland and Lecours (2014) and Robinson-Barnes and Waugh (1998).

expenditure decisions of local governments. They assumed that FDA influence the local governments' behaviors because FDA relieve fiscal stress and discourage interlocal competition for tax base. The predicted results were the expanding effect on local spending and mitigating the disparity on tax rates (by lowering tax rates of recipient governments while raising that of donor governments) (Martin & Schmidt, 1983). The empirical results confirmed that the HFE in Minnesota has a significant impact on spending more than the impact on tax rates: the level of expenditure was increased but, the disparity of tax rate was not reduced. This study showed the possibility that HFE practice would have more significant impact on spending side, rather than on tax revenue/rate side.

In Germany, Barette et al. (2002) focused on the effect of state-level HFE on tax revenue in recipient governments. Using the data from 10 German states over the period 1970 to 1998, they found that HFE significantly reduced the tax revenue of recipient governments because of the disincentive effect. Another study was done by Siliverstovs and Thiessen (2015). They used 22 French regions from 2002 to 2008 and examined the relationship between HFE and regional economic growth (the per capita growth rate). They examined HFE impact on donor and recipient, respectively and concluded that HFE increased economic growth for both governments and had a more positive impact on donors compared to the recipient regions. Siliverstovs and Thiessen (2015) described it as a result of donor governments pursuing growth-maximizing policies to compensate for revenue losses.

To summarize, although the results of previous studies are inconsistent in detail depending on the purpose of the study, they emphasized the disincentive effect that HFE can influence the fiscal behavior of local governments by discouraging

engagement in activities/efforts to generate local income/tax base/revenues. Based on existing literature discussing other types of fiscal equalization such as unconditional grants and vertical fiscal equalization, HFEs are expected to influence the taxation and spending behavior of participant governments (recipient and donor). From the recipient's perspective, HFE can be considered additional income, thereby reducing the effort to grow their tax resources and spend less on the public goods and services focused on economic/tax revenue/base growth. On the other hand, from the donor's perspective, although HFE creates a disincentive to grow tax resources, they may potentially have a desire to make up the revenue loss. Thus, compared to the recipient governments, donor governments may respond differently to HFEs, depending on the relative influence of income and motivational effects; the motivation for economic growth will either be strengthened by lost revenues or weakened by the reduced marginal benefit of attracting development.

## Chapter 3

### **A CASE OF HFE POLICY IN SOUTH KOREA: THE SHARED PROPERTY TAX SYSTEM (SPTS)**

#### **3.1 Local Government in South Korea**

South Korea is a unitary country with two levels of local government system. As shown in Figure 2, there are (1) upper-level governments including one central government, six metro and eight provincial governments, two special self-governing cities (Jeju and Sejong, since 2012), and Seoul, the capital city; and (2) the lower or municipal (local) level governments that are composed of Si (city), Gun (county), and Gu (autonomous district) (Kim, 2004; MLIT, 2015). In Korea, all upper-level and lower-level local governments have their own executive and legislative branches, and their mayors or heads of municipal governments are directly elected by the vote every four years (KRILA, 2007; OECD, 2016a).

Local governments in South Korea have limited authority over their taxation and spending (Bae, 2016; Kim, 2004; Shin, 2016). As defined by Wright (1988), the intergovernmental relation in Korea can be explained as an inclusive-authority model that has a hierarchical relationship between central (national) government and local (sub-national) governments and the central government has a predominant role in taxation and spending than sub-national governments (Kim, 2003; Park & Shin, 2019).

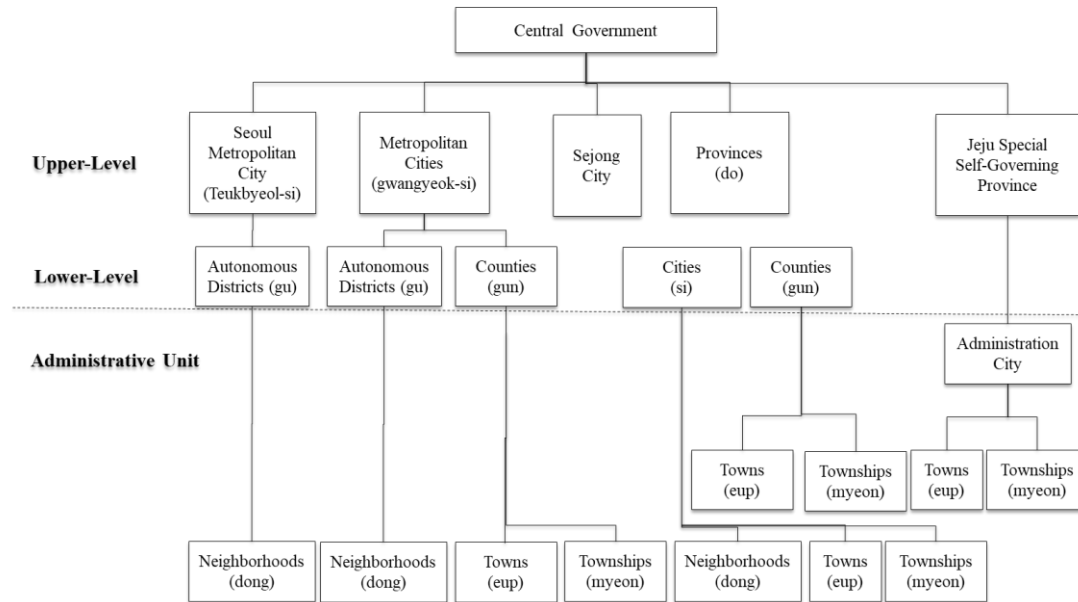


Figure 2. The Government System of Korea (adapted from MLIT, 2015)<sup>13</sup>

### 3.1.1 Assignment of Local Government Expenditures

In Korea, the expenditure responsibilities and government functions are centralized, no specific functional responsibilities given to local (district) governments are defined by law.<sup>14</sup> Regarding the unique features of expenditure assignments of local governments in Korea, OECD (2007) pointed out the following: 1) with the long history of centralized control in Korea, local governments are forced to perform basic functions primarily for administrative purposes; 2) local governments tend to rely on conditional transfers from the central government, thus, local autonomy over spending

<sup>13</sup> A special self-governing province could be understood as a metropolitan local government.

<sup>14</sup> Regarding this, Kim (2004) and OECD (2016a) explained that both metro level and local level government work on the same function, but on a different scale (Kim, 2004, pp. 9-10; OECD, 2016a).

decisions is low (OECD, 2007, p. 84); 3) as a result of reforms in administrative decentralization since 2003, the central government has shifted the authority and financial responsibility for social welfare to local governments so that local governments could set up their social welfare plans and organize related councils. Such expanded local function has become a fiscal pressure on local governments (Kwon, 2016); and 4) the local authority is still limited in that the central government delegates many parts of local executive functions such as education, police, and firefighting services (Stein et al., 2011). Therefore, for these public services, local governments act mainly as agents of their metropolitan or regional government. The list below gives detailed information about the types of expenditure assignments that are unique to the Korean context (Bae, 2016; Chang, 2013; Kim, 2004; OECD, 2007; Shin, 2016).

- Education: the educational services in Korea are controlled by the central government (the national Ministry of Education, MoE). Thus, lower level of governments (metropolitan and district level) have their education offices for local autonomy but are controlled by the MoE and relevant laws and orders. In addition, they have only discretion for primary to upper secondary education, not a higher education (colleges and universities) that is administered by the MoE and councils (OECD, 2016a; OECD, 2016b). Since 1996, the district government's discretion has been expanded over the use of local spending on subsidies to schools (from primary to high school) for constructing and maintaining the educational environments, including kitchen facilities, and financing of school-related activities (Kim et al., 2018; Park, 2007). However, the authority of central governments in relation to the school budget and school supervision has been strengthening since 2008. As a result, the local

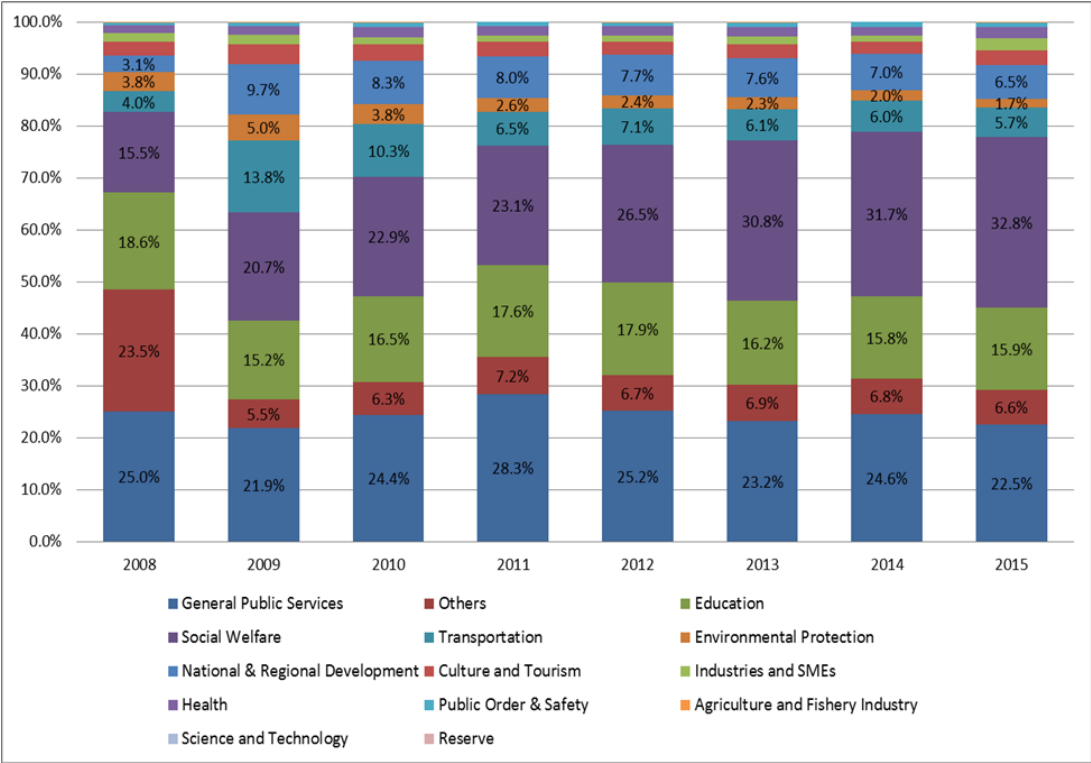
government has provided educational services as an agent of the central government (Lee & Joo, 2009).

- **Police:** police services are mainly controlled by the central government. The local government is not responsible for police service, and the police function is operated with separate funds from the central government under the Ministry of Government Administration and Home Affairs (MOGAHA). Local governments only work to maintain administrative cooperation with them (Kim, 2004).

- **Firefighting:** fire service is divided into national firefighting officers and local firefighting officers but most of them are local officers under the command and supervision of the metropolitan/region city mayors. Thus, although a certain level of fire safety administration is secured and maintained in accordance with fire safety laws, the level of equipment quality, the number of firefighters, and the welfare of firefighters may vary between jurisdictions. Moreover, firefighting services are handled at the level of metro/regional level, not at the municipal (district) level (Joo & Kim, 2003; Kim & Lee, 2018).

Figure 3 and Figure 4 show how areas of government spending have been made by SMG and local districts in Seoul from 2008 to 2015. As shown in Figure 3, Seoul Metropolitan Government (SMG) has spent most of the revenue on general public service, others, education (by educational offices), social welfare, transportation, and national land and regional development (economic affairs): general public service constituted the largest part of SMG expenditure in 2008, but gradually shifted to social welfare over time. The share of social welfare on total public expenditure rose from 15.5% in 2008 to 20.7% in 2009, 30.8% in 2013, and

32.8% in 2015. On the other hand, the share of expenditure on transportation, traffic, and national and regional development functions has steadily declined.

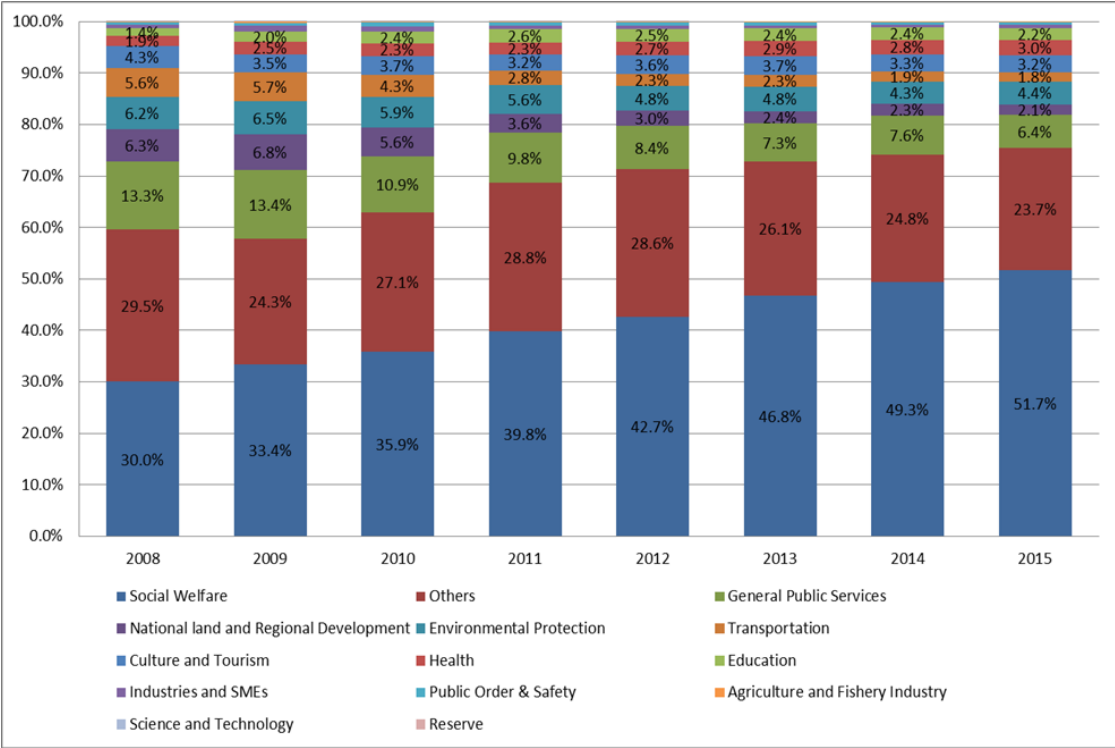


Source: <http://stat.seoul.go.kr>

Figure 3. SMG's Expenditure by Functions (2008-2015) (%)

The main areas of local (district) spending in Seoul do not differ from those of the SMG but show a different trend during the period from 2008 to 2015. Figure 4 shows that social welfare expenditure accounted for the largest proportion of district expenditure along with others. The share of social welfare expenses in total expenditure has increased overwhelmingly from 30.0% in 2008 to 46.8% in 2013, and 51.7% in 2015, which means that more than half of district budget in Seoul was spend

on social welfare. In contrast, the spending on transportation and traffic, and land and regional development functions have been smaller over time. transportation spending accounted for 5.6% of total expenditure in 2008, but only 1.8% in 2015. To sum up, the largest budget item in SMG and district governments is social welfare (32.8% of SMG spending and 51.7% of local spending in 2015).



Source: <http://stat.seoul.go.kr>

Figure 4. Districts' Expenditure by Functions (2008-2015) (%)

### 3.1.2 Assignment of Local Government Revenue

Although the Local Finance Act, which determines SMG financing, has been amended several times to increase the degree of fiscal decentralization and reform the tax and fiscal transfer systems, the current system still provides limited revenue

autonomy for local government (OECD, 2016): the sources of revenue are quite limited, and the central government defines the tax bases and rates. Local governments are allowed to set different tax rates, but very few use it, with less incentive for raising revenue (Choi & Jeong, 2007). The basic sources of revenue in local governments are categorized by three: local-owned revenue, including local taxes and non-tax revenues; intergovernmental grants from central governments and metropolitan governments (unconditional grants and conditional grants); and local debts (Ministry of Strategy and Finance, 2014; Yoo, 2008).

Local government revenue in Seoul could be explained as the following. First, local-own revenue has made up a small portion of local tax revenues. For local tax, SMG levies seven ordinary taxes -acquisition, leisure, local consumption, tobacco consumption, resident, automobile, and local income tax- and two objective taxes (regional resource facilities and local education), whereas local (district) government levies only two ordinary taxes (registration license tax and property tax) (OECD, 2016). For this reason, the proportion of local taxes in districts is relatively low. Table. 2 and Table. 3 show the difference between the share of local tax on total revenue in SMG and local governments: the share of local tax in SMG is high (75.2% in 2008 and 80.2% in 2015), while those in districts is low (21.1% in 2008 and 19.4% in 2015).

Second, intergovernmental transfers have become a main revenue source of local governments in Seoul. For intergovernmental transfer, district governments in Korea have two intergovernmental transfers- local shared tax and subsidies. While local shared tax is an unconditional transfer allocated according to a formula based on fiscal needs and revenues, subsidies are conditional transfers given to certain purposes

such as natural disaster recovery or reimbursing expenses for the implementation of delegated functions (Mun & Kim, 2008).

Table 2. The Revenue of Districts in SMG (unit: billion KRW, %)

	2008	2009	2010	2011	2012	2013	2014	2015
Total	87,698	100,949	87,974	84,316	90,669	99,128	108,489	121,070
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Local Tax	18,465	11,678	19,031	12,150	11,928	20,785	21,594	23,480
	21.1%	11.6%	21.6%	14.4%	13.2%	21.0%	19.9%	19.4%
Non-tax	27,022	31,150	26,625	20,704	20,637	20,472	11,369	11,640
	30.8%	30.9%	30.3%	24.6%	22.8%	20.7%	10.5%	9.6%
Unconditional grants (a)	2,189	1,940	1,468	9,486	9,784	1,558	1,475	2,085
	2.5%	1.9%	1.7%	11.3%	10.8%	1.6%	1.4%	1.7%
Unconditional grants (b)	20,628	28,990	16,706	17,654	18,461	19,164	20,227	22,380
	23.5%	28.7%	19.0%	20.9%	20.4%	19.3%	18.6%	18.5%
Conditional grants	19,394	27,191	24,143	24,322	29,853	37,149	43,079	50,627
	22.1%	26.9%	27.4%	28.8%	32.9%	37.5%	39.7%	41.8%
Others (Bonds/Borrowings)	-	-	-	-	-	-	10,746	10,800
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	9.9%	8.9%

Source: MOGAHA

- Unconditional grants (a) is referred to the grants given by the central government, while unconditional grants (b) is referred to the grants given by Seoul Metropolitan Government (SMG).

- Since government revenue classification reform in 2014, several items of non-tax revenue category moved to 'others' category.

- The debt ceiling was raised as part of the Local Finance Act of 2013 (Jeon & Choi, 2013)

Since 2008, the share of conditional transfers (subsidies) has increased compared to the share of unconditional transfers (local shared tax): The share of conditional transfers (subsidies) rose from 22.1% in 2008 to 41.8% in 2015, while the share of unconditional transfers (local shared tax) reduced from 26% in 2008 to 20.2%

in 2015, meaning that district governments in Seoul have gradually influenced by conditional transfers rather than unconditional transfers (Table 2).

Table 3. The Revenue of SMG (unit: billion Won, %)

	2008	2009	2010	2011	2012	2013	2014	2015
Total	147,928	163,593	146,344	146,932	152,233	159,441	169,889	194,612
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Local Tax	111,409	108,263	109,533	116,990	122,441	117,916	132,496	156,244
	75.3%	66.2%	74.8%	79.6%	80.4%	74.0%	78.0%	80.3%
Non-tax	22,688	21,649	15,868	8,132	12,744	18,785	9,292	7,945
	15.3%	13.2%	10.8%	5.5%	8.4%	11.8%	5.4%	4.2%
Unconditional Grants	3,852	7,857	1,418	2,048	1,414	1,621	1,304	1,245
	2.6%	4.8%	1.0%	1.4%	0.9%	1.0%	0.7%	0.6%
Conditional Grants	9,979	15,174	14,225	14,344	15,634	19,009	23,797	29,178
	6.7%	9.3%	9.7%	9.8%	10.3%	11.9%	14.0%	15.0%
Others (Bonds/Borrowings)	0	10,650	5,300	5,418	0	2,110	3,000	0
	0.0%	6.5%	3.6%	3.7%	0.0%	1.3%	1.7%	0.0%

Source: MOGAHA

Third, the share of local government debt in total local revenue is relatively small compared to other sources of revenue. In the case of local government debt in Korea, municipal bonds consist of borrowing and bonds and the borrowing from the central government account for most of the local debt (Kim, 2004). According to the Local Autonomy Act, by 2013, local governments can borrow and issue bonds to finance investment projects, however, in effect, local debt issued by the autonomous district is very scarce since a balanced budget (all expenditures should be covered by tax revenues on a yearly basis) is strongly recommended (OECD, 2016), and such

borrowing can be only issued when their debt levels are very low<sup>15</sup> (Jeon & Choi, 2013; Kim, 2002).

Another reason of low issuing local debt is the strict eligibility for issuance of borrowing. According to Local Finance Act, eligibility for issuance is limited by a municipality's taxation capacity or financing capacity as well as the purpose of local bonds that are set by the local finance law. In addition, even if these two conditions are met, the issuance of local debt should be approved by the local council and the amount of local debt is limited and regulated; autonomous districts can only issue local debt within 3-5% of their two years' prior budgets. Local debt can be incurred (money can be borrowed from the central government) only in cases that ordinary expenses cannot finance, such as natural disaster recovery, large-scale construction projects, or broadening the tax base (Lee & Ka, 2020; Ministry of Strategy and Finance, 2014). For this reason, local bonds (debt) are mostly issued at the regional level and are very passively issued at the district level. In fact, only two out of 25 districts issued local bonds, and since 2008, there has not been any issue at the district level (Jeon & Choi, 2013).

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<sup>15</sup> Since 2014, local borrowing has been permitted without prior approval from the central government if it finances investment only (OECD, 2016).

### 3.2 The Classification of Expenditures of Korean Local Government

At a local government level, the classification of spending has undergone several revisions since 1995. The first revision occurred in 1996 to simplify the traditional classification of public expenditure by functions, which referred to the Line-Item Budget System (LIBS). LIBS consisted of 8 chapters and 29 sub-chapters but was simplified to 5 chapters and 16 sub-chapters. Until 2007, local government's expenditure had been categorized into five groups: (1) general services: general public services, defense, public order, and safety, (2) community services: education, health, social security, and welfare, (3) social services: housing and community amenities, recreational, cultural and religious services, (4) economic services: agriculture, industry, transport and communications, and other economic services, and (5) unallocational (Bhatia, 2006). Later in 2008, the Program Budgeting System (PBS) was applied. As a result, as shown in Table 4, the current classification by function is changed from 5 chapters with 16 sub-chapters to 14 chapters with 52 sub-chapters (Choi, 2016).

Table 4. The Classification of Expenditures of Korean Local Government

Before 2008 (5)		Since 2008	
Chapter (5)	Clause (16)	Chapter (14)	Sub-chapter (52)
General administration (2)	Legislation & election General administration	General Administration (4)	Legislation & Election Management Local Administration & Financial Support Budget & Finance Administration General Administration

Social Development (4)	Education & culture	Education (3)	Preprimary & primary and secondary education Tertiary education Lifetime / Vocational Education
		Culture and Tourism (5)	Culture & Art Tourism Sports Cultural Properties General Affairs
	Health & amenities	Health (2)	Health & Medical Service Food & Medicine Safety
	Social security	Social welfare (8)	Basic Livelihood Support Marginal Class Support Childcare & Family & Women Senior Citizens & Juveniles Labor Patriots & Veterans Affairs Housing General Affairs
	Housing & Development of local community	Environmental Protection (6)	Water management Waste management Air management Nature Protection Ocean Protection General Environmental Protection
Economic development (4)	Agriculture & Fishery, and forestry	Agriculture and Fishery Industry (3)	Agriculture & Agricultural Village Forestry & Forestry Village Fishing & Fishing Village
	Regional economic development	Industries and SMEs (6)	Industrial Financial Support Industrial Technical Support Trade & Investment Attraction Industrial Promotion & Advancement Energy & Resource Development General Affairs
	Preservation & development of land resources	National Land & Regional Development (3)	Water Resource Region & City Industrial Complex
	Transportation	Transportation and traffic (5)	Roads City Railways Marine Transport & Ports Air Transport & Airports Public Transport & Logistics & Others
		Science and technology (3)	Technology Development R&D Support

		General Affairs	
Civil defense (2)	Civil protection (Civil defense corps management Fire service management	Public order & safety (2)	Police service Disaster Prevention & Civil Defense
Support & other (4)	Local borrowing repayment All other expenditure Grants Contingency	Reserve (1) Others (1)	Reserved budget

Source: budget summary of local governments (MOGAHA) and Jang (2013), Choi & Lee (2014)

### 3.3 The Shared Property Tax System in Seoul, South Korea

Fiscal disparity across local administrative districts of Seoul Metropolitan Government (SMG) has become one of the main problems of the city due to the substantial inter-districts difference in the quality of public services, such as housing, education and transportation (Hue, 2013; Yoo & Han, 2014). In 2008, SMG initiated the Shared Property Tax System (SPTS) to reduce the fiscal imbalance, ensuring that the minimum service standards are provided to all citizens in Seoul, while also promoting balanced economic development of Seoul as a whole. Under this system, 50% of property taxes in local taxes are collected and then redistributed equally to 25 districts. The distributed property taxes are included in the general account of the local tax revenue (Figure 5).

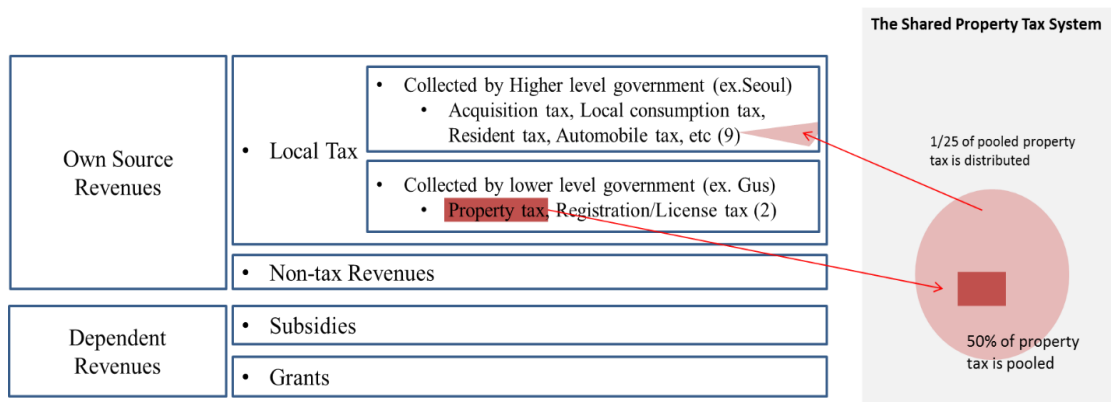


Figure 5. Shared Property Tax System (SPTS) of Seoul and the Tax Revenue

As shown in Table 5, the donor refers to a district that property tax revenue collected is above the average while the recipient refers to a district that property tax revenue collected is below the average. Considering the design and operation of the SPTS, it is essentially a lump-sum unrestricted grant to recipients, while it is a negative grant to donors.

Table 5. Example of Allocation Mechanism of the SPTS

	<b>Local Property Tax Revenue</b>	<b>Pooling (50%)</b>	<b>The SPTS (Pool/N)</b>	<b>Adjusted Property Tax Revenues (net)</b>	<b>Donor/Recipient status</b>
A	50	- 25	+ 15	40	Donor
B	40	- 20	+ 15	35	Donor
C	30	- 15	+ 15	30	- (average)
D	20	- 10	+ 15	25	Recipient
E	10	- 5	+ 15	20	Recipient
Total	150	- 75	+ 75	150	

To prevent significant changes in the revenue on the district level, a portion of property taxes to be collected into the pool was gradually increased from 2008, started at 40% in 2008, then increased to 45% in 2009, and again to 50% since 2010. In addition, SMG provided supporting subsidies and additional financial assistance to the donor districts in the first three years to alleviate any financial shock from the SPTS (60% of decreased amounts of donors in 2008, 40% in 2009, and 20% in 2010). These three years' financial supplements gave donor communities time to modify their fiscal management plans for the SPTS (Hue, 2013).

The SPTS is a system in which the national assembly and Seoul Metropolitan Government (SMG) have taken a leading role. The national assembly set up a horizontal fiscal equalization system associated with the idea of separating the property taxes on non-residential real estate from the property taxes levied by autonomous districts (Kim & Choi, 2010). In other words, it was assumed that the administrative services provided by autonomous districts could have a significant effect on the value of residential properties, but for non-residential properties, its value is influenced more by the administrative role of the SMG, rather than the autonomous district (Hue, 2013). Based on these claims and because the share of property tax revenue levied on non-residential properties accounts for approximately 50% of total property tax revenue (see Table 6)- 50% of property tax revenue is collected into the SPTS pool and redistributed equally among the autonomous districts (Hue, 2013).

There are still controversies regarding the implementation of the SPTS: Some of the donor districts refused to participate in the SPTS and raised an objection to the Constitutional Court against the National Assembly, but their objections were struck

down (Choi, 2007; Ahn, 2010). On the other hand, some recipient districts argued that 100 percent of the property tax was to be shared. This idea has become a common pledge of candidates in elections, but was also rejected (Noh, 2012).<sup>16</sup>

Table 6. Imposed Property Tax Revenue of Districts in Seoul (Unit: billion KRW)

	<b>Total (A+B)</b>	<b>Property tax revenue levied on residential property (A)</b>	<b>Property tax revenue levied on non- residential property (B)</b>
2007	13,341	5,910 (44.3%)	7,431 (55.7%)
2006	10,726	4,588 (42.8%)	6,138 (57.2%)
2005	9,321	4,436 (47.6%)	4,885 (52.4%)

Source: Adapted from Hue (2013). A study on the effects and problems of the Shared Property Tax System-Focused on the issue of financial imbalance between autonomous districts in Seoul. [Master Thesis, Korea University, Korea]. (p.13)

The detailed financial data about how much each local government contributed to and received from the SPTS is difficult to find in the database provided by KOSIS (Korean Statistical Information Service) and MOIS (Ministry of the Interior and Safety), which are commonly used for obtaining financial data at the local level.

<sup>16</sup> See Noh (2012, Aug 31). 'Woo Won-sik Proposes a 100% Shared Property Tax System in Seoul.' Newspim. <https://www.newspim.com/news/view/20120831000878> and 'Pooling 100 % of the Property Tax For the SPTS? A Retrograde Step of Local Self-Government System' <http://www.junggunews.com/news/articleView.html?idxno=16680>

Instead, SMG has provided an annual report describing the amount of property tax revenue, pooling, and redistributing from the SPTS. Table 7 summarizes how much the property tax revenue was received from or contributed to the shared tax pool from 2008 to 2017, where the positive values indicate the amount of tax received (recipients) and the negative values indicate the amount of tax contributed (donors). The six districts have been identified as donors, as highlighted in blue in Table 7. All other districts were considered as recipients, though one district, Jongno, has changed their role from the recipient to the donor in 2009 and 2015 (Kim & Choi, 2010).

Considering the fact that Seoul has five sub-regions and has been implemented a triple city center system, as shown in Figure 6, it could be understood that the SPTS is sharing property tax revenue that is collected from the districts where are consisted of city centers having a large number of commercial and business properties. On the other hand, most recipient districts are commuter towns having many residential properties with little commercial or industrial activity of their own.

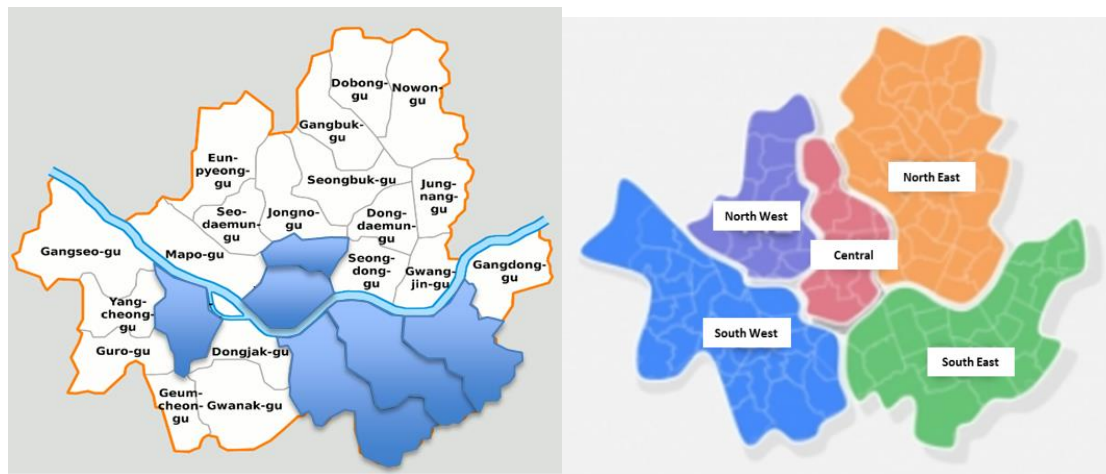


Figure 6. Donor Districts in Seoul (blue) and a list of sub-regions in Seoul

Table 7. The Change in Property Tax Received from or Contributed to the SPTS pool

	2008	2009	2010	2011	2012 (a)	2012 (b)	2015	2016	2017
Gangnam	-1,057.7	-1053.8	-1363.0	-1352.8	-1,372.9	-1350.6	-1,473	-1,596	-1,713
Seocho	-494.5	-436.2	-581.6	-596.8	-641.1	-594.6	-654	-719	-807
Songpa	-384.5	-337.6	-456.3	-460.7	-458.9	-458.5	-489	-541	-562
Jung	-73.4	-113.0	-111.0	-113.4	-122.5	-111.2	-154	-175	-148
Yeongdeugpo	-36.9	-40.7	-48.5	-43.5	-45.0	-41.3	-53	-38	-43
Yongsan	-15.0	-16.4	-25.3	-37.7	-44.6	-35.5	-9	-14	-26
Jongno	7.4	-11.7	8.0	11.2	4.5	13.4	-2	13	14
Yangcheon	18.7	66.0	67.2	69.1	78.4	71.3	106	117	120
Gangdong	27.7	30.2	34.8	32.7	34.9	34.9	56	64	65
Gangseo	53.5	47.7	73.9	80.6	69.8	82.8	32	34	29
Mapo	60.9	47.0	59.2	49.9	43.8	52.1	14	18	6
Gwangn	97.8	102.0	133.4	134.0	138.2	141.8	150	162	181
Seongdong	108.7	97.6	125.9	126.7	123.9	128.9	132	143	136
Guro	111.8	102.1	137.1	139.6	137.0	141.1	150	166	180
Dondaemun	112.9	100.7	138.8	138.9	146.0	136.2	163	165	197
Seongbuk	114.9	109.5	144.0	143.3	147.5	145.5	161	180	194
Dongjak	117.4	112.3	146.5	144.9	149.0	147.1	159	169	179
Gwanak	119.9	110.4	146.4	149.8	156.9	152.0	170	186	205
Nowon	123.5	111.7	147.9	150.4	162.3	152.6	179	197	212
Seodaemun	141.3	139.2	175.7	180.9	190.1	183.1	201	214	226
Eunpyong	156.9	148.7	184.0	181.0	185.3	183.2	185	196	212
Junrang	168.5	166.4	212.5	214.9	224.4	217.1	236	254	276
Dobong	169.1	171.0	217.2	223.8	236.8	226.0	261	281	303
Geumcheon	171.1	168.0	208.4	203.1	213.2	205.3	218	241	260
Gangbuk	179.8	178.8	224.9	230.3	242.8	232.5	260	283	303

Unit: 100 million KRW

Source: the data from 2008 to 2010 is identical with Kwon (2012), Choi & Kum (2012), and internal data of SMG. The data of 2011 and 2012(a) are from Kwon (2012)'s study. The data of 2012(b) is from Bae et al. (2012); the data from 2015 to 2017 is internal data of SMG. 2013 and 2014 data are excluded.

Table 8. The Total Revenue, Amount Received/contributed to the SPTS Pool (Donors/Recipients)

	Total Revenue of 6 Donor (A)	Amount donated to the SPTS (B)	Top Donor Gangnam (C)	Amount donated to the SPTS (D)	Total Revenue of 19 Recipient (F)	Amount received from SPTS (G)	Top Recipient Gangbuk (H)	Amount received from SPTS (J)
2002	41,470		13,225		42,350		1,435	
2003	43,146		13,665		43,407		1,403	
2004	43,382		14,121		40,399		1,237	
2005	45,572		14,522		41,904		1,287	
2006	51,504		17,399		47,452		1,264	
2007	55,628		17,868		48,468		1,405	
2008	60,909	-2,062	19,046	-1,058	50,658	2,062	1,448	180
2009	55,490	-1,998	18,090	-1,054	49,292	1,998	1,301	179
2010	56,184	-2,586	18,556	-1,363	47,938	2,586	1,332	225
2011	61,271	-2,605	20,026	-1,353	50,247	2,605	1,298	230
2012	65,140	-2,685	21,794	-1,373	51,153	2,685	1,449	243
2015	80,819	-2,831	29,766	-1,473	66,419	2,831	1,709	260
2016	82,976	-3,083	26,710	-1,596	71,256	3,083	1,762	293
2017	87,411	-3,298	27,598	-1,713	78,155	3,298	1,834	303
%	(B/A)*100		(D/C)*100		(G/F)*100		(J/H)*100	
2008	3.39		5.53		4.07		12.4	
2009	3.60		5.83		4.05		13.8	
2010	4.60		7.35		5.39		16.9	
2011	4.25		6.76		5.18		17.7	
2012	4.12		6.30		5.25		16.8	
2015	3.50		4.95		4.26		15.2	
2016	3.72		5.98		4.33		16.6	
2017	3.77		6.21		4.22		16.5	

This data is from the general account only (i.e., settlement); unit: 100 million KRW; GDP deflator was not applied; gross revenue

Table 8 shows how much revenue was changed by the SPTS. Six donor governments contributed to the SPTS pool by 3.39 percent of their total tax revenue in 2008, 3.6% in 2009, and 4.66% in 2010. In the case of top donor governments (Gangnam district), it contributed 5.53% of total revenue into the pool in 2008, and 7.35% in 2010 at the maximum. In terms of the amount of revenue shared, the top donor government has covered more than half of transfers since 2008. It can be predicted that the top donor district (Gangnam) was most affected by the SPTS compared to the rest of the donor districts. On the other hand, the top recipient district (Gangbuk) received from 17.9 to 30.3 billion KRW each year from SPTS, which ranges between 12.4% and 17.7% of its local tax revenue. It can be assumed that the top recipient district (Gangbuk) had experienced a financial change. Also, since 2008, the donor group has experienced a decline of approximately 3-4% of total revenue, while the recipient group has received approximately 4-5% of total revenue from the SPTS.

Since there is no mechanism to control the use of the SPTS transfers, the impact of the SPTS on public expenditures is dependent upon the decisions made by individual districts. The SPTS transfers are lumped together with other local tax revenues; thus it is challenging to delineate the sole effect of SPTS on the expenditure changes without analyzing it. Nevertheless, one article has provided evidence to show how the SPTS has impacted recipient governments' public expenditures and services. For example, Nowon-gu used the part of SPTS fund to expand cultural facilities in 2009 (a culture complex office, a youth culture information center, a library, and a childcare center), and Gangseo-gu spent the SPTS fund for investing in the maintenance and management of urban infrastructure and renovated a cultural and

welfare center (Chosun, 2009). These examples indicate that SPTS has improved the public goods and services of recipient communities by influencing local spending.

### **3.4 Previous Studies**

Through the revision of the Local Tax Act on July 20, 2007, the SPTS has been in effect since 2008 (Yoo & Han, 2007). The SPTS is the first HFE program introduced in Korea, and due to a short history of implementation, not much research has been done on the SPTS impact. Previous studies mainly focused on whether the SPTS has reduced the fiscal disparity, while less focused on how it has influenced local tax and expenditure policies.

Before the year of implementing the SPTS, some researchers have explored whether the design of SPTS is appropriately made. For instance, Yoo and Han (2007) stated that the SPTS could mitigate the fiscal inequality among districts in Seoul. However, regarding the background and procedures before the policy was implemented, they criticized that the rationale for the SPTS adoption is ambiguous, and suggested Seoul Metropolitan Government (SMG) to implement the supplement policies that could prevent the possibility that the SPTS discourages local governments to raise local revenue. In addition, Choi and Jeong (2007) scrutinized the way of pooling and distribution in the SPTS (50% of pooling from all districts in Seoul and equally distributed) and suggested to adjust the method of distribution to promote fiscal responsibility and efficiency of local governments. They especially pointed out the possibility that the effect of SPTS on the revenue would be minimized by the vertical transfers given by the upper level of governments. Later, Sohn and Lee (2008) empirically examined whether the current collection ratio, 50% is the most appropriate to reduce the fiscal inequality, compared to a different degree of collection ratio. They

concluded that 40% of property tax revenue with the discriminatory distribution method could bring better fiscal equalization and political feasibility than the current system (non-discriminatory distribution method). In addition, reviewing three distribution scenarios - distribution based on (1) the fiscal indicator (financial capacity index), (2) the population index, and (3) both fiscal indicator and population index, Sohn and Lee (2008) concluded that the distribution based on the financial capacity index has a more significant effect on fiscal inequality. These studies focused on the policy evaluation and suggesting directions for improvement in policy design.

After 2008 when the SPTS was implemented, there are two strands of literature. The first strand of literature attempted to reveal the SPTS impact empirically (Choi et al., 2012a; Jang et al., 2012; Kim & Choi, 2010; Kwon, 2012). For example, Choi et al. (2012a) and Kwon (2012) noted that SPTS in Seoul has contributed to reducing fiscal disparities among districts and giving financial flexibility to recipient governments in Seoul. Kwon (2012) examined the impact of the SPTS on the difference in property tax revenue and the Standard Financial Needs Satisfaction Index (SFNSI). Using the data from 2002 to 2013, he found that the SPTS reduced the gap of the SFNSI and the level of property tax revenue between two groups and that was a result of the negative effect of the SPTS on 6 donor government and the positive effect on the 19 recipient governments.

In recent years, the second strand of literature focuses on how the SPTS affects donors and recipients, respectively. For instance, Choi et al. (2012a) examined the SPTS impact on four fiscal variables such as the operating expenses ratio, the capital expenses ratio, the local project/business expenses ratio, and local revenue ratio. Assuming the differential effect on donor and recipient governments, they divided the

treatment group into 6 districts of donor group and 19 districts of recipient group. Using ANOVA and a fixed effect model, they found that after the SPTS was adopted in 2008, both groups showed similar results: three variables, the capital expenses ratio, the local project/business expenses ratio, and local revenue ratio, were increased but variable the operating expenses ratio was decreased, over the period between 2005 and 2010. However, they noted that the result of this research is limited in that the statistical models they used in this study could not reveal whether such changes in fiscal outcomes are caused by the SPTS only or caused by other factors that are associated with the change in outcomes. In the subsequent studies, Choi et al. (2012b) used a DID method to see whether the changes in operating expenses ratio, own project/business expenses ratio, and local tax revenues ratio are due to the SPTS, compared to the control groups in the absence of SPTS. Choi et al. (2012b) compared the outcome of treatment group (25 districts in Seoul) to the outcomes of three control groups (44 districts in six metropolitan cities, 15 districts in Busan, and 25 districts selected by the nearest neighbor propensity score method), the DID results showed that the SPTS had a statistically significant effect on reduction in the operating expenses ratio regardless of control group. However, the SPTS impact on two variables, the ratio of local tax revenues in total revenues and the ratio of own project/business expenses in total expenses, were inconsistent and statistically insignificant. Based on these results, Choi et al. (2012b) concluded that the SPTS has contributed to lowering the operating expenses ratio by distributing property tax to less wealthier communities, however, the SPTS has not yet contributed to higher local expenses for local projects or higher local revenue yet.

A study by Cho (2015) focused on how the SPTS affected the change in various fiscal indicators of two subgroups in Seoul. Cho (2015) selected two subgroups: one was five districts with the highest property tax revenues and another subgroup was five districts with the lowest property tax revenues, among 25 districts in Seoul. He selected the four indices explaining fiscal capacities as dependent variables and revealed that the three out of four fiscal indices (financial independence ratio (the share of local tax revenue and non-tax revenue on local budget), fiscal self-reliance ratio (the share of sum of local tax revenue, non-tax revenue, grants, and subsidies on local budget), and the share of local governments' own program expenditure on local budget) were reduced in both groups. However, one indicator, SFNSI, showed contradictory result: the SFNSI of top 5 districts was reduced, while those of the bottom 5 districts was increased. Based on the result of Cho (2015)'s study, it was found that the impact of SPTS on local revenue of the districts with the low property tax revenue was not positive, but rather negative. His study showed the need to further studies that examine how the SPTS affect the local budget in detail.

Focusing on the motivational effect of SPTS, Chung (2019) used the Interrupted Time Series (ITS) analysis with the panel data in the period of 2003 to 2014 to see whether donor (six districts) and recipient governments (19 districts) changed their effort to collect local revenues in response to the SPTS. Assuming that the SPTS would affect the effort of local governments to raise revenue through collecting fines, penalties, and fees, he concluded that the gap of non-tax revenue between the donor and the recipient groups has been widened because the donor group has increased their non-tax revenue with the SPTS. Chung's study (2019) provided the

empirical evidence on the possibility that the local government behave strategically to response to the SPTS.

To sum up, all previous studies have used different periods of data, different dependent variables with different statistical method, so they have not been able to derive consistent results. In almost all studies, however, it was agreed that the SPTS played a role in mitigating the gap in property tax revenue between localities. In addition, the results of statistical analyses in the previous studies showed the possibility that the tax and spending decisions of the local government were influenced by the income effect and motivation effect that the SPTS have had: (1) little or negative impact on revenue was mentioned in several studies. (2) recipient governments did not spend on raising revenue (the local own project expenses) while donor governments increased their non-tax revenue after the SPTS.

## **RESEARCH DESIGN AND THEORETICAL FRAMEWORK**

### **4.1 Conceptual Framework**

To evaluate the SPTS impact on spending behaviors, Difference-In-Differences (DID) method is used in this study. This is a statistical technique that analyzes whether the effect of a policy intervention exists by using the difference between the policy outcomes of the group exposed to the policy (treatment group) and the group that is not (control group). It allows for using longitudinal data to evaluate the effects of a policy when outcomes can be observed in both groups in pre- and post-policy periods (Lechner, 2011). In addition, since DID model cannot consider the baseline difference between donors and recipients that could influence the results of the SPTS, a triple-difference (DDD) method is used for accounting for it. DDD model can consider ‘donor-recipient status’ as potential confounding factors that may affect the analysis results (more detailed explanation on these methods is provided in subsequent sections).

As shown in Figure 7, the DID model and the triple-difference model can employ a number of variables (independent, dependent, and control) as well as can be performed individually for donors, recipients, and donor-recipient combined to adequately address the developed research questions.

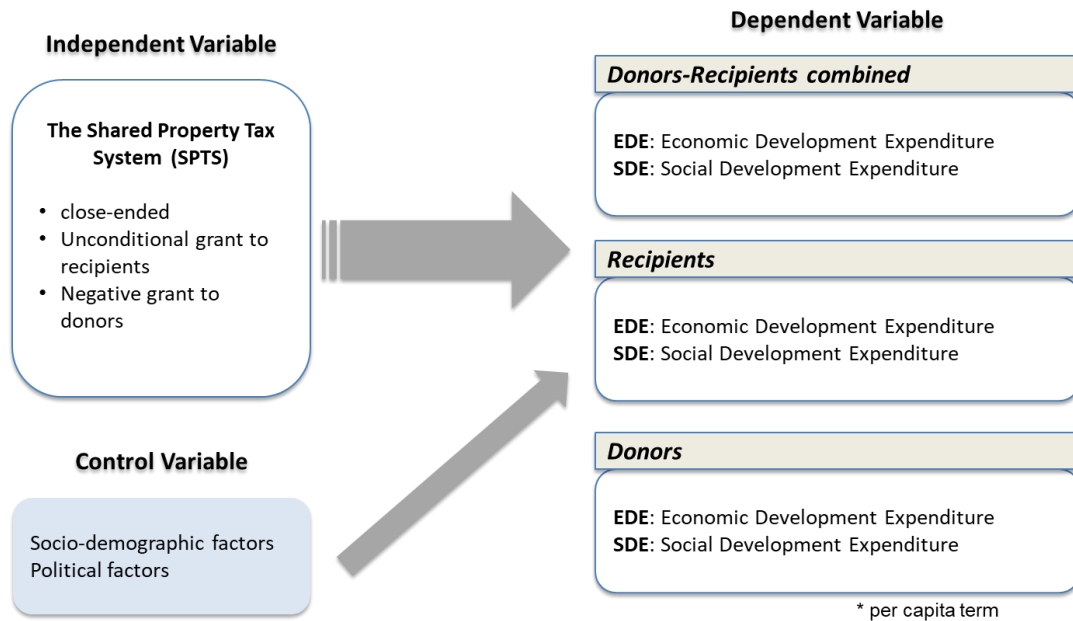


Figure 7. Independent, Dependent, and Control Variables Considered in This Study

## 4.2 Unit of Analysis

The unit of analysis is 25 districts of Seoul metropolitan city (treatment group) and 44 districts selected from 6 other metropolitan cities (control group) in South Korea, which are Incheon, Daegu, Gwangju, Daejeon, Busan and Ulsan (Figure 8). Red circles indicate Seoul city and other six metropolitan cities from which the districts for treatment and control group were selected. The control group is selected based on several criteria, including the same pre-trends in outcomes as the treatment group, availability of data, and enough size of samples to support the reliability and validity of the analysis and results. Since this study use balanced panel data, which consists of six pre-treatment periods (2002-2007) and six post-treatment periods (2008-2013), the sample size will be 828 in total.

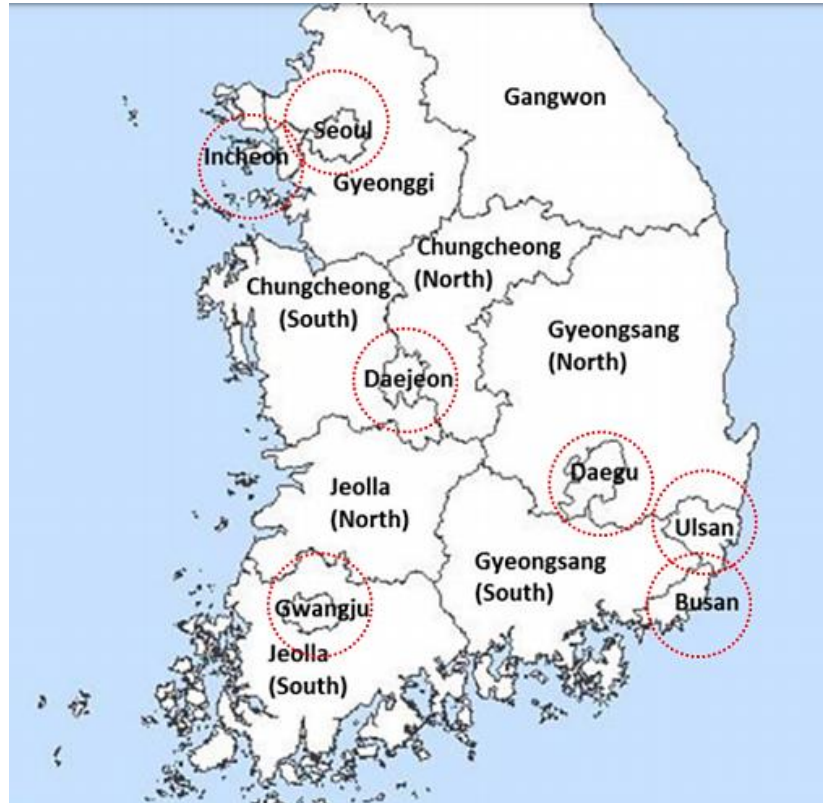


Figure 8. Regions and Metropolitan Cities of South Korea

### 4.3 Research Questions and Hypotheses

This study first looks at the impact of HFE on the spending of all participating (both donors and recipients) districts on average. What has happened in spending of districts with the SPTS? Based on prior theories and research, it is assumed that HFE has a negative effect on economic-development spending due to 1) common pool effect, 2) the expectation of bailouts with transfer dependency, 3) moderated marginal benefit of attracting economic development, or 4) substitute sources of local income (Algoed, 2009; Bahl & Linn, 1994; Bird & Slack, 2014; Bucovetsky & Smart, 2006; Dahlby, 2002; Eyraud & Lusinyan, 2013; Rodden et al., 2003; Smart, 1998). In addition, HFE is expected to reduce the local governments' willingness to compete to

gain tax base and revenue, resulting in diverting attention to the public goods and services that aims at improving the well-being of residents. Given the motivational effects of the "fiscal imperative" for local economic development, districts are expected to respond by reducing their economic development efforts through the local public spending decisions. With such a response, the SPTS would result in a decrease in Economic Development Expenditures (EDE), thus freeing districts to spend more of their budgets on Social Development Expenditures (SDE). This leads to two hypotheses:

- H1. The donor-recipient combined group decrease EDE on average.
- H2. The donor-recipient combined group increase SDE on average.

Since the HFE divides participating districts into donor districts that contribute to the pool, and recipient districts that receive resources from the pool, the impact of HFE would be different depending on the donor/recipient status. Thus, another research question is whether donor and recipient districts respond to the HFE differently. First, for recipient districts (they receive additional public funds available to purchase any public goods), the SPTS would be a positive income effect; thus, both EDE and SDE would increase as their revenue is increased. In addition, there are two possibilities for how they might respond to SPTS depending on the two effects-income effect and motivational effect (mainly caused by the moderated marginal benefit of increases in economic development). First, if there is no motivational effect existed, the SPTS impact on EDE and SDE would be the same (meaning that there is no significant difference in the size and directions of coefficients of EDE and SDE).

The second possibility is when the motivational effect is more influential than the income effect. Recipient districts may spend less on the EDE, meaning that a change in EDE will be less than a change in SDE.

- H3. Recipients would increase EDE due to the income effect.
- H4. Recipients would increase SDE due to the income effect.
- H5. EDE would increase less than SDE in light of the reduced motivational effect in recipient districts.

For the donor districts' side, the SPTS would be 'negative income effect' that local governments cut the level of public expenditure, as their revenue is reduced by the SPTS; therefore, both EDE and SDE would be decreased. In addition, associated with the reduced motivational effect of HFE, donor districts may show one of three responses. First, if there is no motivational effect, the degree of HFE impact on EDE and SDE would be the same, meaning that the size and directions of the coefficient of EDE and SDE would be the same. Second, if the disincentive created by the reduced marginal revenue associated with economic development outweighs the fiscal imperative to seek additional revenue, donor districts may reduce EDE more than SDE. The third possibility is that the fiscal imperative motive may outweigh the reduction in marginal gains from economic development. In other words, if the desire to preserve the level of expenditure by increasing local revenue to offset the loss of revenue is strong, donor districts may reduce EDE less than SDE.

- H6. Donors would decrease EDE due to the negative income effect.

- H7. Donors would decrease SDE due to the negative income effect.
- H8. Donors' EDE and SDE might be affected differently by the relative influence of income and motivational effects, and whether the motivation is strengthened by desire for revenue or weakened by the reduced marginal benefit of attracting development.

#### **4.4 Variables**

##### **4.4.1 The Rationale of Expenditure Categorization**

In order to assess the impact of SPTS on the local government's public expenditures, it is hypothesized that (1) upon receiving/donating funds from/to the SPTS, local governments reassess their expenditure priorities and make adjustments – increasing expenditures for certain functions while maintaining or decreasing expenditures for other functions, and (2) the SPTS affects the fiscal imperative of local governments and it disincentives to recipient governments to provide productive or developmental government expenditures in favor of unproductive expenditures, while leading donor governments to spend differently compared to recipient governments.

Current public expenditures in South Korea are categorized by their main socio-economic functions following the Classification of the IMF, such as general administration, defense, education, health, social security, etc. It is assumed that not all types of expenditure are relevant for local economic growth or help expand tax revenue, but a subset of public expenditure has growth-enhancing (productive) function, and the rest does not. Thus, there is a need for classifying different types of expenditures into two categories – Economic Development Expenditure (EDE, developmental or productive expenditure) and Social Development Expenditure (SDE,

redistributive or unproductive expenditure) – prior to analyzing the time-series data for policy effect assessment. For this end, this study reviewed two of the most influential studies that used extensively in the urban policy literature to distinguish a priori between productive and unproductive expenditures.

The first classification was suggested by Kneller et al. (1999)'s work where they looked into productive and unproductive expenditures using a sample of 22 OECD countries. They adopted the studies of Barro (1990) and Barro et al. (1995) that extended an endogenous growth model to include public spending as a factor of production. They provided a conceptual distinction that productive expenditure is the spending that enhances economic growth (output) by increasing private sector productivity, whereas non-productive expenditure is the spending that directly improves household welfare, without causing a change in the efficiency of the private sector. Adopting their models, Kneller et al. (1999) connected theoretical categories with functional categories. They stated that productive expenditure includes general public service, education, health, housing and land development, infrastructure, environmental protection, defense, public order, and public safety, whereas non-productive expenditure includes culture, recreation and religion, and social security.

The classification of Kneller et al. (1999) was defined by an analysis on a state level; however, on a city level, another classification was suggested by Peterson (1981) in his book, *City Limits*. He theorized that the primary interest of local governments is the economic sustaining of their communities and the competitiveness at the local, regional, and national levels. Based on the net effect of each spending on the local economy, Peterson split spending types into three following regimes: developmental, redistributive, and allocational. The first type, developmental spending

is a policy that encourage the economic vitality of a community as well as local competitiveness. According to his model, local governments are more likely to favor developmental spending (policies) that attracts high-income taxpayers, generates additional tax bases, and supports the expansion of the local economy. Peterson (1981) stated that "developmental policies enhance the local economy because their positive economic effects are greater than their cost to community residents"(p.42). The second type is redistributive spending that provides equal access to public services, mostly to low- and middle-income residents. This type of spending is considered to cost the local government more than benefits because social welfare improvements are unlikely to show economic benefits in the short term. The third type is allocational spending that is not fit into the developmental/redistributive dichotomy because it is neutral in its effect on the local economy or the attractiveness of the community. This type of spending includes basic city operations and services, such as police, fire, public health, recreational facilities, and garbage collection services (pp.41-46).

Kneller et al. and Peterson's two classification models have been used in many empirical studies to examine a country/local's fiscal decisions toward economic development; however, these two models have a different view on the spending on education. Kneller et al. (1999) considered education as productive spending with spending on public health and housing, while Peterson (1981) viewed education as spending that have both developmental and redistributive characteristics. Therefore, it should be noted that some types of spending are controversial, and some judgments have been made in existing studies since, as there is no universally accepted, definite classification model. For example, expanding the above two classification models, Pitlik and Schratzenstaller (2011) further developed the definition of a subset of public

expenditures. According to their definition, productive expenditure includes the following three items: core public services, infrastructure spending, and merit goods/externalities. The core public services consist of three spending items that are not related to private expenditure: general administration, public order & safety, and national defense. The infrastructure spending is for enhancing the productivity of private sectors and includes three expenditures: public investment in economic affairs, housing and community services, and environmental protection. Spending on merit goods/externalities (education and public health) are categorized into productive expenditure in that it helps human capital investment. The unproductive expenditure includes redistribution, other, and interest payments that do not directly impact the economy but may have growth-enhancing effects in the long term. However, they also noted and were concerned that the spending on merit goods could be categorized as unproductive expenditure because its primary purpose is enhancing public welfare rather than directly improving economic growth (Pitlik & Schratzenstaller, 2011, pp. 11-12).

#### **4.4.2 Dependent Variables**

This study grouped public expenditures based on the two criteria: 1) corresponds to the IMF classification for functional expenditures which distinguish between economic, social, general public services and other expenditures, 2) classification into two categories, Economic Developmental Expenditures (EDE) and

Social Development Expenditures (SDE), based on a presumptive judgment regarding the impact on the local economy.<sup>17</sup>

As noted earlier, there is no universally accepted model for placing specific spending subcategories into larger spending areas. This study also tried to be consistent with the previous literature; however, it found that definitions and standards varied considerably depending on the purpose of the study and the research field. Thus, expenditures are categorized according to the specific circumstances of Korea and make some judgments based on data availability as well as based on the aforementioned theoretical models including the study of Peterson (1981) and Kneller et al. (2011). The specific local government functions that are placed into each spending area are described below and are consistent with the recent empirical work of Choi and Lee (2014), Kwon (2016), and Lee and Kim (2015).

- Economic Development Expenditure (EDE): Agriculture, Forestry, Fishery, Industries and SMEs, Preservation development of resources, national land and regional development, and Transportation
- Social Development Expenditure (SDE): Education, Culture, Tourism, Health, Social welfare, and Environmental protection

Since the operation of local autonomous entities began in Korea in 1995, the public expenditures were classified by function into 8 chapters and 29 sub-chapters, subsequently simplified to 5 chapters and 16 sub-chapters in 1996. Later in 2008, expenditures of Korean local governments have been classified by a new functional

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<sup>17</sup> According to the traditional functional classification of expenditures that was used in Korea until 2008, see <http://documents.worldbank.org/curated/en/996171468314699324/pdf/WPS4663.pdf>

category system intended to follow the UN COFOG. This re-categorization increased the number of categories from five to 14. These frequent changes of classification make analyzing the succession of data difficult. For this reason, many Korean studies limit the period of analysis to either until 2007 or after 2008. However, since the STPS was adopted in 2008, it is necessary to link the data before and after 2008 to see pre- and post-STPS comparisons. Date was integrated as illustrated in the Table below.

Table 9. Functional Classification of Expenditures, Social Development Expenditure, and Economic Development Expenditure

<b>Functional classification</b>		<b>Classification in this study</b>	
<b>1996-2007</b>		<b>After 2008</b>	
General Administration Expenditure	Legislation & Election General Administration	General public service	
Social Development Expenditure	Education & Culture Health & Environmental improvement Housing & Development of Local Community Social Security	Education Culture & Tourism Health Environmental protection Social Welfare (+ housing)	Social Development Expenditure
Economic Development Expenditure	Agriculture & Fishery Regional Economic Development Preservation Development of Resources Transport	Agriculture, Forestry, Fishery Industries and SMEs National Land & Regional Development Transportation Science & Technology	Economic Development Expenditure
Civil Defense Expenditure	Civil Protection Fire Service	Public order & safety	
Support & Other Expenditures"	Contingency Local Debt Repayment All Other Expenditures" Grants	Reserve Budget Others	
Total	16	14	

**Economic Development Expenditure (EDE)** includes Agriculture, Forestry, Fishery, Industries and SMEs, Transportation, National Land & Regional Development, and Science & Technology. Many studies have generally included the range of transportation-related spending (for highways, airports, and parking facilities) as the main category of developmental spending because it attracts private investment and directly supports local industry and firms that contribute to capital expansion (Moon et al., 2016). The EDE in this study is similar to Barro's productive expenditure and Peterson's developmental expenditure that aims to increase the marginal productivity of private capital in the community by increasing production efficiency. Compared to the Social Development Expenditure (SDE), which is expected to improve the mid- to long-term economic growth through expansion of the social safety net and welfare of all residents, EDE is expected to have a more direct effect on employment and investment, resulting in a positive effect on local economic growth in a short period of time (Moon et al., 2016).

**Social Development Expenditure (SDE):** In this study, SDE is defined as spending that directly benefits a household by improving their health and living conditions. It also primarily aims to give equal access to public services for all residents or protect certain groups against various social risks.<sup>18</sup> SDE includes Education & Culture, Health, Social welfare (security), and Housing & Development of Local Communities were categorized into social spending categories in Korea until 2008, and after 2008 the following items were included: Education, Culture, Tourism,

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<sup>18</sup> Social services and welfare also affect economic growth in the long term. However, the primary goal of SDE is to improve the well-being of its residents.

Health, Social welfare, and Environmental protection. More details on these dependent variables are presented below:

- Social welfare: district government spending on social welfare is mostly used for vulnerable groups, including the physically and mentally disabled, the elderly, abused children, and women in need. Such spending can be expected to contribute to further human capital formation and development in the community, as described by Lichter and Jayakody (2002); however, its primary purpose is enhancing the welfare of low- and moderate-income households. Thus, it is categorized into the SDE in this study. In addition, the expenditure for housing in Korea is included in the SDE because it is strongly associated with public welfare that supports low-income residents through affordable housing construction and housing vouchers (Kim & Park, 2017).

- As for the Education expenditure, in Korea, the Ministry of Education (the central government) manages almost of all educational services. The local level of spending on education categories is not used for operational costs (salaries and benefits for public school employees) but is used as supplementary to school finances for improving school facilities, especially kitchen facilities for free lunches at school (Park, 2007). Although the education expenditure serves both advantaged and disadvantaged population groups, it is best suited for the SDE because it is especially critical for vulnerable populations (Cho & Kim, 2005; Moon et al., 2016).

- The Tourism and Culture subcategory covers various fields, including public arts, museums, arts-related educational programs, tax incentives for art businesses and individuals, as well as tourism support; however, its proportion is very low. There are multiple reasons for this category is considered a SDE category rather than a EDE

category. First, the spending on culture in Korea could not be separated from the education expenditure in the data until 2008. After 2008, the Korean government combined tourism, sports, and culture to establish the Ministry of Culture, Sports, and Tourism (MCST). Major spending on this subcategory is carried out by upper levels of government working with MCST, which tend to be more related to economic purposes such as attracting tourists by developing and maintaining historic heritages, museums, and cultural landscapes. However, at the local (district) level, it is more associated with the improvement of residents' quality of life by enhancing cultural accessibility, encouraging residents to experience public art and attend local cultural events, art exhibitions, performances, and workshops. Most expenditure is used for supporting performance exhibition facilities such as movie theaters and exhibition halls as well as community welfare facilities such as multi-purpose sports facilities. In the context of the role of local governments in Korea, tourism and culture expenditures are strongly associated with social welfare (Park, 2012).

The Environmental Protection was included as the SDE because of the unique interpretation of spending in this category in Korea. Until 2008, environmental protection spending was included in the Health and Amenities subcategory because the common view of that subcategory was strongly linked to public health. In the case of Seoul, most environmental management projects and related investments are carried out by the SMG, while the main responsibilities of local governments are associated with waste management, especially the wages of staff contracted for garbage collection and recycling. Besides, this category covers the general operating expenses as well as labor costs for sewage management, air and marine pollution management, natural resources protection, etc. (Kim & Lee, 2018; Park, 2012).

At the national level, health expenditures are related to spending on regulating food, pharmaceuticals, medical devices, and cosmetics in South Korea. In general, however, the health budget of local governments is used for supporting public health centers rather than maintaining food and drug safety (Ko, 2014). Thus, health expenditure is included in SDE.

This study examined whether the expenditure in local governments has changed as a result of the SPTS. The assumption in this study was that the SPTS increases/decreases the total budget of recipient/donor governments, thus having a negative/positive impact on the EDE and the SDE. In many empirical studies, two types of indicators, per-capita expenditures and the ratio of expenditure, are commonly used to measure a government's expenditure performance and policy choice (Jang, 2012). Per-capita expenditure is calculated by dividing the expenditures by the population, while the ratio of expenditure is calculated by dividing the individual expenditures by the aggregated expenditures. As such, these two variables are more likely to be influenced by denominators (the population number or total (aggregated) expenditures) as much as the numerator (Jang, 2012). Of these, the ratio of expenditure is not appropriate for this study because the SPTS directly affects the denominator (total expenditure) as well as the numerator, which is likely to result in either underestimating or overestimating the policy (SPTS) effect. For instance, as shown in Table 10, if a donor government changes the amount of expenditure on A from \$10 to \$5 when decreasing its budget from \$100 to \$50, the per capita indicator shows a negative effect of the SPTS (\$10 to \$5), whereas the ratio indicator shows no effect (10% in both cases). Likewise, if a recipient government changes the amount of expenditure on A from \$10 to \$20 when increasing its budget from \$100 to \$200, the

per capita indicator shows a positive effect of the SPTS (\$10 to \$20), while a ratio indicator shows no effect (10% in both cases). In short, measuring the effect of the SPTS as a percentage cannot be interpreted as affecting spending.

Table 10. Comparison between Per Capita and Percentage Changes in Expenditures

<b>Donor's example (total budget changes from \$100 to \$50)</b>			
	Before the SPTS	After the SPTS	Interpretation
Per capita of expenditure on A	\$10	\$5	Negatively affected
Ratio of expenditure on A	10%	10%	Not affected
<b>Recipient's example (total budget changes from \$100 to \$200)</b>			
	Before the SPTS	After the SPTS	Interpretation
Per capita of expenditure on A	\$10	\$20	Positively affected
Ratio of expenditure on A	10%	10%	Not affected

Consequently, to see a change in local spending policy and obtain a more accurate measure of its actual impact, per capita values instead of ratios are the better indicator to explain a local government's policy choice in relation to the SPTS. Thus, this study examined the per capita expenditures for two types of expenditures, the SDE and the EDE, from the pre- to the post-SPTS.

In terms of the methodology to measure these dependent variables, the general account of the final settlement was used. In addition, all monetary variables were deflated to the values of the year 2010 by the GDP deflator in South Korea. In addition, these variables were divided by the total population in order to express them in per capita terms. The budget data were collected from the Korea Census Bureau's

annual report of local government finances and the GDP and GDP deflator data were from Korea Census Bureau. Moreover, all dependent variables were natural log-transformed to consider unit adjustment among other variables and take the deviations of the budget across districts into account. Comparing the R-squared value, the log transformation and per capita term of expenditure data shows a better fit of the regression equation than the ratios.

#### **4.4.3 Independent and Control Variables**

This study aims to see the change in public spending of districts in Seoul due to the introduction of the Shared Property Tax System (SPTS). Therefore, the existence of SPTS is considered an independent variable. The program implementation is making a dummy variable because it is either implemented or not: years with the program was recorded as 1 and without the program as 0.

- Treat(ed) dummy variable: treatment group (Seoul) equals 1, control group equals 0.
- Post dummy variable: Before 2008 equals 0, after 2008 and 2008 equals 1.
- Donor dummy variable: Donors equal 1, Recipients equal 0.<sup>19</sup>

In addition, to control the factors that affect the spending decisions of local governments, two broad sets of variables were included, consisting of socio-economic (i.e. density, the number of establishments per 1,000, the share of population aged 15-64, the share of public assistance recipients), and political (i.e. ideology of the government, election period, voter turnout rates, the ruling party, electoral

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<sup>19</sup> Dummy variable where “1” indicates the donor that it contributes to the pool, while “0” indicates the recipient receiving the funds from the pool.

competition, etc.). These lists of control variables were identified from the previous literature (See Appendix). They were included into the model after performing two processes: The pairwise correlation matrix was used to detect the correlation between independent variables. Variance Inflation Factor (VIF) was also performed to detect the multicollinearity that refers to the correlation between one independent variable with a combination of multiple independent variables. The final set of variables is provided in Table 11.

Table 11. Definition of Independent and Dependent Variables

<b>Variable</b>	<b>Measure</b>	<b>Definition</b>
Year		2002-2013
ID		1-25 Treated group / 26-69 Control group
<b>Independent Variables</b>		
Post	Dummy	Before 2008 equals 0, After 2008 equals 1
Treat	Dummy	Treatment group equals 1, control group equals 0
Donor	Dummy	Donors equal 1, otherwise 0
Post* Treat (DID)	Interaction	Interaction Post and Treat
Post*Donor	Interaction	Interaction Post and Donor
Treat*Donor	Interaction	Interaction Treat and Donor
Post*Treat*Donor (DDD)	Interaction	Interaction Post, Treat, and Donor
<b>Socio-demographic Variables</b>		
Density (t-1)	Number	Size of the population of the region divided by the size of its territory (population per km <sup>2</sup> )
Esta (t-1)	Number	Number of establishment (expressed in per 1000 of population)
Young (t-1)	%	Proportion of population under 5 years
Recipient (t-1)	%	Proportion of public assistance recipient
<b>Political Variables</b>		
Election	Dummy	Year of the election of the head of districts (1 = 2002, 2006, 2010)
PreElecyear	Dummy	One year before the elections (1=2001, 2005, 2009, 2013)
PostElecyear	Dummy	One year after the elections (1=2003, 2007, 2011)
Vturnout	%	Number of votes cast in the most recent election divided by the number of registered voters
Powering	Dummy	The same political party that governs districts also governs national (1); The political party that governs the districts does not govern the (0)
Competition	%	Winner's votes – runner-up candidate's votes To see whether government party with absolute majority
Progress	Dummy	1 (Left): for parties defined as liberal, progressive, social democratic
<b>Dependent Variables</b>		
Ln SDE (t)	Per capita KRW	Natural log value for Social Development Expenditure (net expenditure settlement of general account) (t)
Ln EDE (t)	Per capita KRW	Natural log value for Economic Development Expenditure (net expenditure settlement of general account) (t)

## 4.5 Analysis Method

Measuring the effectiveness of the policy would be simple if the net-policy effect can be measured by subtracting what would have happened without the policy from what happened with the policy in effect (Wing et al., 2018).<sup>20</sup> However, this is impossible because the outcome of the treatment group without the policy is not observable in reality (Egami & Yamauchi, 2021). Further, simply comparing the difference between before and after policy outcomes is not a policy effect because these changes may be due to other influencing factors besides the policy impact (Lechner, 2011).

Thus, the counterfactual analysis method, Difference-in-Differences (DID), was used. DID is a method to estimate a net-policy effect on the outcomes by subtracting the difference between the outcomes of treated and controlled group in pre-intervention period, from the difference between the outcomes of two groups in post-intervention period (Lechner, 2011; Wing et al., 2018).<sup>21</sup> The control group represents an approximation of the counterfactual condition for the treatment group; it enables an estimation of the treatment effect by comparing the situation of a treatment group over time with the situation of an equivalent comparison group. DID allows the use of longitudinal data when outcomes can be observed in both groups over time (pre- and post- policy periods) and enables an estimation of the treatment effects over

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<sup>20</sup> It is called as before-and-after study that “compares outcomes before and after the intervention without the aid of a comparison or control group.”(John, 2011, p.161).

<sup>21</sup> Lechner (2011) states, “DiD could be an attractive choice when using research designs based on controlling for confounding variables or using instrumental variables is deemed unsuitable, and at the same time, pre-treatment information is available.” (p.167)

multiple time periods. When interpreting the estimated results using multiple time periods, the results can be understood as an aggregate effect over time, and an individual in a treatment group should be continuously treated during the multiple time periods (Callaway & Sant'Anna, 2018).

Table 12. Concept of Difference-in-Differences

	Treatment Group	Control Group	Difference between groups
Pre	$T_1$	$C_1$	$T_1 - C_1$
Post	$T_2$	$C_2$	$T_2 - C_2$
Difference across time	$T_2 - T_1$	$C_2 - C_1$	Difference-in-Differences $(T_2 - C_2) - (T_1 - C_1) = (T_2 - T_1) - (C_2 - C_1)$

T: treatment group    C: control group  
1: pre-treatment    2: post-treatment

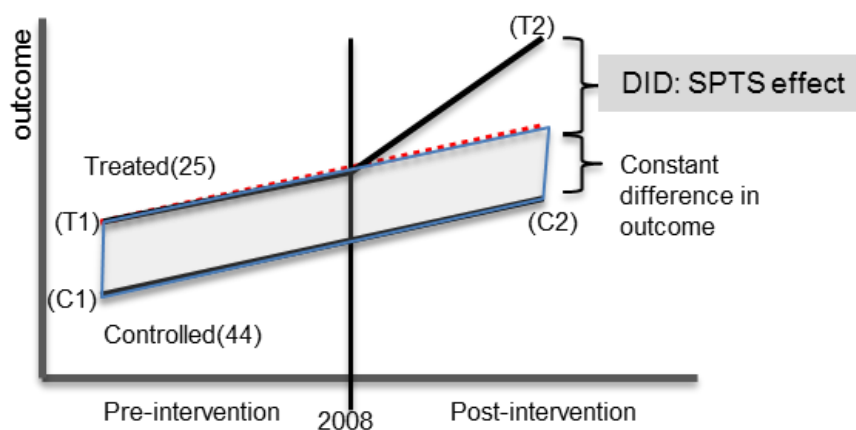


Figure 9. The Difference-in-Differences Model<sup>22</sup>

<sup>22</sup> This Figure is adapted from Columbia University Population Health Methods: Difference-in-Difference Estimation. Available online:

The DID should include an interaction term between post and treatment group dummy variable in a regression model.

$$Public\ Expenditure\ (st) = \beta_0 + \beta_1 Treat\ (s) + \beta_2 Post\ (t) + \beta_3(Treat * Post, DID) + \beta_4 Sociodemographic\ (st) + \beta_5 Political(st) + \varepsilon$$

- *Public Expenditure (st)* is the observed outcome in district *s* and period *t*
- *Post(t)* is an indicator for whether period *t* is in the post-treatment period of 2008 or later
- *Treat(s)* is an indicator for whether district *s* participated in the SPTS
- $\beta_3$  is the DID estimate of the treatment effect

Dependent variables, Public Expenditure (st) represents outcomes for individual (s) in the time (t). It includes Social Development Expenditure (SDE) and Economic Development Expenditure (EDE). Post (t) represents a dummy for the period after the SPTS implementation. Treat (t) represents a dummy for a district that adopted SPTS.

The DID model can only identify the SPTS impact at the group level, and not necessarily address the possibility that there may have been different trends in the donor's spending. Therefore, a triple difference (DDD) model was used. In a DDD model, treatment groups are broken down and analyzed to see whether 'Donor' affects policy outcomes by comparing the double-difference in Donor with the same double difference in the Recipient, as shown in Figure 10.

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<https://www.mailman.columbia.edu/research/population-health-methods/difference-difference-estimation>

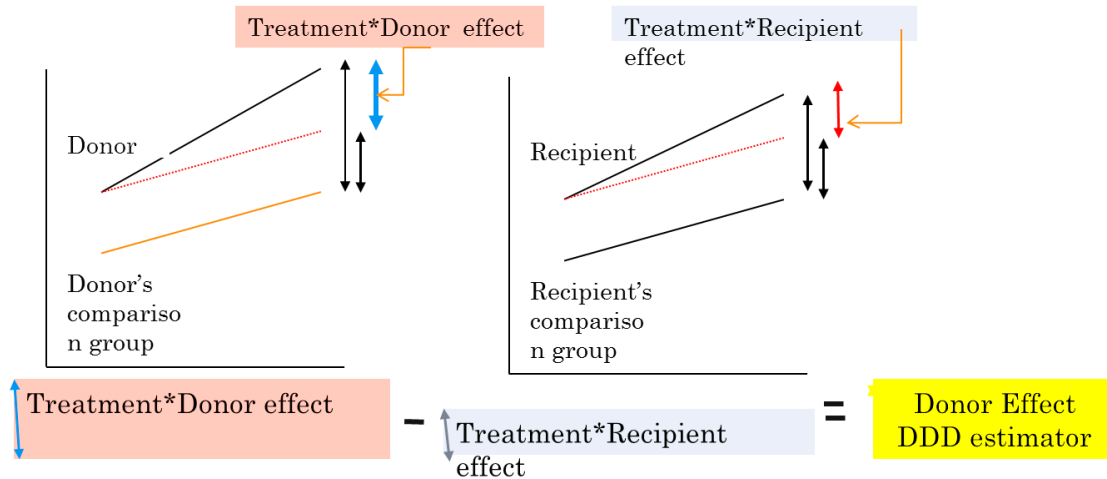


Figure 10. The Difference in Difference in Differences Model

To do this, a donor dummy variable was added to divide the samples into the groups that did not receive a transfer (donor) and their counterpart that received transfers (recipients). The benefit of the DDD model is that it can control the potential donor's public expenditure trend, which might be different from the recipient's trend. This study assumed that the donor would be affected by SPTS differently than recipients. To identify this in DDD analysis, four more interaction variables are added to the DID model:

$$\begin{aligned}
 \text{Public Expenditure}(st) = & \beta_0 + \beta_1 \text{Treat}(s) + \beta_2 \text{Post}(t) + \\
 & \beta_3 \text{Donor}(s) + \beta_4 (\text{Treat} * \text{Post}) + \beta_5 (\text{Treat} * \text{Donor}) + \beta_6 (\text{Donor} * \text{Post}) + \\
 & \beta_7 (\text{Treat} * \text{Post} * \text{Donor}, \text{DDD}) + \beta_8 \text{Sociodemographic}(st) + \\
 & \beta_9 \text{Political}(st) + \varepsilon
 \end{aligned}$$

- Donor(s) is a dummy variable set to 1 if a district's property revenue was contributed to the SPTS pool.
- $\beta_7$  is the DDD estimate of the Post\*Treat\*Donor effect.

- In this model, the effect of the policy is captured by  $\beta_7$ , which is the “difference-in-difference-in-differences” DDD estimator.

By adding four interaction variables to the DID model – the donor dummy variable, the interaction variables of donor and post, the interaction terms of treat and donors, and the main variable of interest, DDD, the triple interaction variable of post, treat and donors, could be estimated. The coefficient of DDD is the estimate of the Donor effect on the public expenditure, compared to the outcome of (recipients), after controlling for local characteristics and the influence of other underlying trends. In the DDD model, the donor is defined as a district where the property tax revenue collected is higher than the average in 2008. To check the robustness of the preferred model specification, this study reported alternative model specifications to the same data set for making comparisons.

**RESULTS****5.1 Descriptive Analysis**

Table 13 provides a detailed description of the data. The original data consists of a 12-year panel between 2002 and 2013 from 69 autonomous districts in Korea (828 observations in total). Only the monetary variables (EDE and SDE) were entered in the natural logs.

Table 13. Descriptive statistics of variables

Categories	Variable Name	Obs	Mean	Std. Dev.	Min	Max
Dependent Variables <sup>23</sup>	Ln SDE	828	12.770	0.463	11.495	13.960
	Ln EDE	828	11.195	0.624	9.872	13.868
Socio-demographic Variables	Density	828	11497.620	7077.873	289.492	29626.470
	Esta	828	83.233	66.187	35.586	528.510
	Young	828	4.740	1.162	2.564	10.439
	Recipient	828	2.840	1.376	0.611	7.959
Political Variables	Vturnout	828	48.087	5.342	35.205	83.450
	Powering	828	0.196	0.397	0.000	1.000
	Competition	828	26.417	23.899	0.070	100.000
	Progress	828	0.238	0.426	0.000	1.000

<sup>23</sup> Two dependent variables (Ln SDE and Ln EDE) are the natural logarithms of SDE/EDE per capita.

Prior to DID and DDD analysis, the line charts of time series data were used to identify the effectiveness of the SPTS. For example, the line charts show whether the SPTS brought about an immediate change or a change with a lag period. They also demonstrate whether the change shows a gradual trend or a trend with a sharp slope (move). In addition, these line charts help decide whether to include a time trend or a group-specific trend in the regression models (Smith, 2015, pp. 40-42).

Figure 11 are line charts that show the change in our two dependent variables, EDE and SDE, before and after the SPTS adoption. In the left graph, since the SPTS was adopted in 2008, the EDE of the treated group showed an upward trend by 2009 but then fell slightly in 2010 and fell more considerably in 2011, compared to the trend of the EDE of the control group. For SDE, both lines showed a sharp slope in 2009 and similar upward trends since 2002. In addition, as Figure 11 shows, the trend in EDE has been more affected than SDE: the gap between the control group and the treated group in EDE was not large by 2010, but that gap has been widening since 2011. The SDE has tended to be relatively stable in both groups since 2002. Although the gap narrowed in 2009, it soon widened by 2011 and then remained. Based on these line charts, it is not possible to determine whether the impact of SPTS on EDE and SDE occurred immediately.<sup>24</sup> The charts also show that the trend in SDE increases as the years progressed, while the trend in EDE does not show a consistent increase or decrease over the years. Thus, it is expected that using a regression model that

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<sup>24</sup> One possible reason why policy effect is not witnessed in 2008 is that there was ‘transition period’ during 2008-2010, to minimize the financial shock in treated group. As a result, it was assumed that its impacts on spending may not unfold immediately.

includes both unit-specific trends and time trends will yield more concise estimation results.

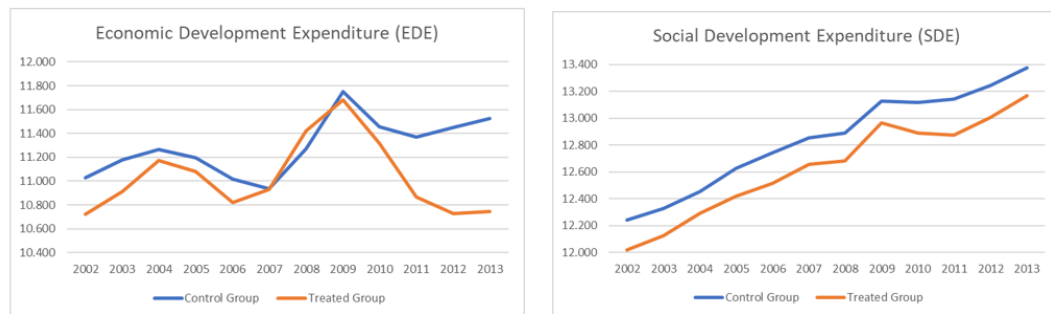


Figure 11. The Trend of EDE and SDE (Control Group and Treated Group)<sup>25</sup>

Figure 12 shows the SDE and EDE trends for recipient and donor groups from 2002 to 2013. The trend of EDE (left graph) changed more than the trend of SDE (right graph). The recipient's EDE showed a similar trend to that of the donor, but in 2011 it was significantly reduced compared to the donor's EDE. The SDE of both groups showed similar trends since 2002, but the gap between the SDE of recipient and donor groups increased in 2009. Also, the graph of SDE showed temporary slope changes during the period of 2008–2011. These graphs imply two conclusions: 1) The trend of SDE increases over time. The pattern of this trend is consistent, with a slight increase in 2008 when the SPTS was adopted. In addition, the trends of both groups (recipient and donor) appear similar during this period. 2) Despite the ups and downs

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<sup>25</sup> In order to overcome the global economic crisis in 2009, expansionary fiscal policy was implemented through a temporary expansion of government spending and tax cuts to stimulate the economy.

in EDE, there is no consistent increase or decrease. The trends of both groups' EDE were very similar until 2009, but the gap between the two increases over time from 2011. This finding indicates the need to consider time trends and other control variables in a regression model.

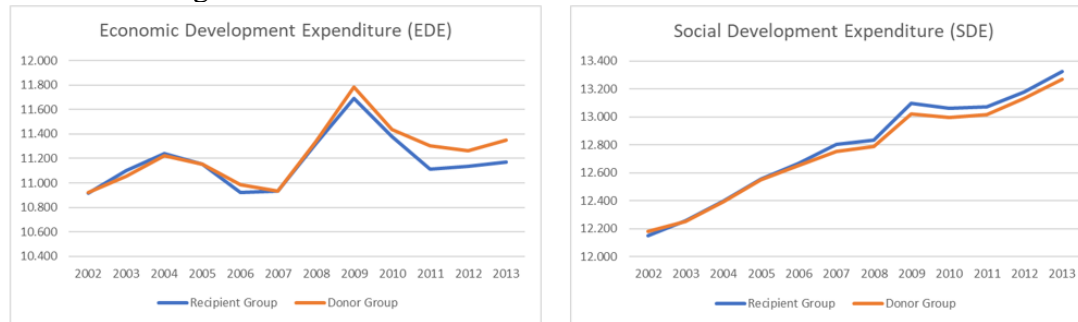


Figure 12. The trend of EDE and SDE (Recipient Group and Donor Group)

Figure 13 shows the changed values in EDE and SDE, separated into four groups: control, treated, recipient, and donor. In the left graph of SDE, when looking at the control group as a standard, it shows that the donor group seems the most distant. This implies that the donor group's SDE would be the most affected after the SPTS policy is adopted. The Figure on the right, based on the control group as a standard, shows that the EDE of the three groups is lowered.

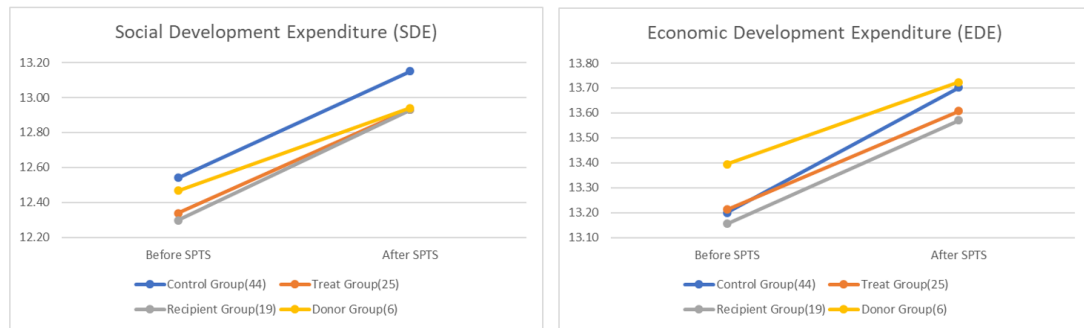


Figure 13. Comparisons on the two expenditures for pre- and post- policy between groups – control, treatment, donor and recipient groups

## 5.2 Difference-in-differences Results

The difference-in-differences model is a two-way fixed-effects regression that estimates the effect of intervention by controlling for two unmeasured confounders (the unit-specific/locality effects and time-specific effects) (Wing et al., 2018). To demonstrate the robustness of DID results, each Table of regression results presents another set of regressions' estimators. Columns 1 and 2 show the results from basic OLS specifications but Column 2 includes covariates. Column 3 presents the results of a fixed-effect model that includes locality effect and covariates, while Column 4 shows the results of a two-way fixed-effect model that includes time effect and locality effect. Column 5 presents the results of a two-way fixed-effect model that includes locality effect, time effect, and covariates (The only difference between columns 4 and 5 is including individual covariates to the specification).<sup>26</sup>

<sup>26</sup> A set of estimates of regression coefficients from alternative models was listed to confirm the robust result indirectly. If the estimates do not differ significantly, then we can assume a strong result (Lu & White, 2014). In addition, after performing Hausman test and LM test, a fixed model was selected as the most appropriate regression model

The research questions of this study are: how does the SPTS effect on the donor-recipient combined group's expenditure choices (EDE and SDE)? and How do donor/recipient groups respond to the SPTS? Do those effects differ between donor and recipient districts? To answer the first research question, the DID was employed and the results are presented in Table 14; all the interaction terms between Post and Treat (DID estimator) of EDE are negative, and the estimated elasticities are statistically significant across all specifications. The most positive value of the estimated EDE elasticity across all specifications is -0.138 and the most negative point estimate is -0.179, which is in line with the expectations as well as prior empirical research findings, that HFE has the disincentive effects on the fiscal imperative for local economic development, reducing the expenditure on economic growth-enhancing functions. Based on the results of our preferred specification (column 5), there was a significant negative association between the EDE and the SPTS: the average EDE of the treat group is about 12.9% ( $\beta = -0.138$ ; 95% CI = -0.289, 0.013;  $p = .073$ ) lower during the six years (2008–2013) compared to the case where the SPTS was not introduced.<sup>27</sup>

In addition, it was hypothesized that the SPTS would result in a decrease in EDE, thus freeing districts to spend more of their budgets on SDE. To test this hypothesis, the analysis was repeated but using a different dependent variable, the SDE. As shown in Table 15, SDE does not produce consistent results compared to the results of EDE; some of the point estimates in the specifications, including the control

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(Frondel & Vance, 2010). <https://openaccess.nhh.no/nhh-xmlui/bitstream/handle/11250/2652016/0120.pdf?sequence=1>

<sup>27</sup>  $\exp(-0.138) - 1 = -0.129$ . The 95% CI and p-value were reported in Appendix G.

variables (columns 2, 3, and 5) are positive and significant, while the rest of the point estimates in the specification, not including control variables (columns 1 and 4), are negative and insignificant. These results imply that the SDE is influenced by a set of control variables and including control variables in a regression model is a better way to obtain a precise and statistically significant estimate of the SPTS effect on SDE.

Regarding these results and the preferred specification,<sup>28</sup> it can be concluded that the SPTS had a weak positive effect on SDE (+1%) in the treated group (donor-recipient combined group) during the period of 2008 to 2013 ( $\beta = 0.010$ ; 95% CI = -0.045, 0.065;  $p = 0.711$ ).<sup>29</sup> Although the value of DID is low and statistically insignificant ( $p = 0.711$ ), this result is consistent with the income-effect hypothesis as well as the normative premises offered as policy rationales for the HFE schemes, HFE has a positive effect on the recipient districts' services that provide for the immediate needs of their residents.

Table 16 is a summary of the DID results of EDE and SDE in the final preferred specification that includes time-and locality-specific trends, as well as a set of control variables. The average EDE of the donor-recipient combined group (25 districts in Seoul) were reduced by 12.9%, while their average SDE increased by 1.0% with the SPTS during the period of 2008–2013. The magnitude and statistical

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<sup>28</sup> The inclusion of time, locality-specific trends, and a set of control variables.

<sup>29</sup> This estimate is not statistically significant, but it does not mean that SPTS has no effect on SDE. Ferreira and Patino (2015) stated "P-values depend upon both the magnitude of association and the precision of the estimate (the sample size). If the magnitude of effect is small and clinically unimportant, the p-value can be "significant" if the sample size is large. Conversely, an effect can be large, but fail to meet the  $p < 0.05$  criterion if the sample size is small." (p.485)

significance of the coefficients implied that EDE was more related to the implementation of the SPTS than SDE. In sum, this study found that the effect of the SPTS appears differently according to the two types of expenditure, which is consistent with the theories and experimental results from other previous studies. In addition, these results confirmed that SPTS had a stronger causal relationship with EDE than SDE. The SPTS effect on SDE is marginally positive.

Table 14. Double-difference regression results for the impact of SPTS on EDE

Variation of Interest	(1) RE	(2) RE	(3) FE	(4) FE	(5) FE
Post	0.366*** (0.029)	0.357*** (0.044)	0.419*** (0.070)	0.475*** (0.071)	0.428*** (0.126)
Treated	-0.164 (0.128)	0.065 (0.112)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
<b>DID (Post#Treated)</b>	<b>-0.179*** (0.049)</b>	<b>-0.141*** (0.049)</b>	<b>-0.173** (0.077)</b>	<b>-0.179** (0.072)</b>	<b>-0.138* (0.076)</b>
_cons	11.104*** (0.077)	10.656*** (0.290)	11.050*** (0.730)	10.916*** (0.035)	10.451*** (0.720)
sigma_u	0.493	0.291	0.612	0.505	0.554
sigma_e	0.338	0.307	0.307	0.297	0.287
rho	0.680	0.474	0.799	0.743	0.789
N	828	828	828	828	828
R-squared (within)	0.190	0.327	0.342	0.383	0.431
R-squared (between)	0.057	0.371	0.285	0.057	0.027
R-squared (overall)	0.101	0.357	0.000	0.150	0.066
Time effect	No	No	No	Yes	Yes
Locality effect	No	No	Yes	Yes	Yes
Control Variables	No	Yes	Yes	No	Yes
Wald chi <sup>2</sup>	chi <sup>2</sup> (3)= 181.46***	chi <sup>2</sup> (14)= 407.18***			
F-stat. (P-value)			F(13,68)= 42.59***	F(12,68)= 46.89***	F(20,68)= 39.11***
Corr(u_i, Xb)	0(assumed)	0(assumed)	-0.421	0.030	-0.206

Note: \*, \*\*, \*\*\* mean that coefficients of variables are statistically significant under 10%, 5%, 1% critical values respectively

Post denotes the period before/after the SPTS, Treated denotes a district that adopted the SPTS, and DID is an interaction term of Post and Treated.

Column (1) and (2) are Random Effect (RE) regression, while (3), (4), and (5) are Fixed Effect (FE) regression models. In model (3), (4), and (5), standard errors are robust clustered at the id level and reported in the parentheses.

The p-values of Wald chi<sup>2</sup> in models (1) and (2) are significant at the 1% level, and the p-values of the F test in models (3)-(5) are significant at the 1% level. This means that the null hypothesis is rejected in which the RE model and the FE model are better than the OLS model to produce unbiased estimates. According to Hausman test, the locality effects in the data set are correlated with the other explanatory variables and cannot be taken as random effects. This shows, therefore, that the FE estimators will be more consistent and efficient than the RE estimators.

Table 15. Double-difference regression results for the impact of SPTS on SDE

Variation of Interest	(1) RE	(2) RE	(3) FE	(4) FE	(5) FE
Post	0.608*** (0.019)	0.264*** (0.022)	0.174*** (0.044)	0.657*** (0.030)	0.696*** (0.060)
Treated	-0.203*** (0.069)	0.111** (0.048)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
<b>DID (Post#Treated)</b>	<b>-0.016 (0.032)</b>	<b>0.054** (0.025)</b>	<b>0.075** (0.031)</b>	<b>-0.016 (0.029)</b>	<b>0.010 (0.027)</b>
_cons	12.542*** (0.042)	13.009*** (0.139)	13.150*** (0.356)	12.162*** (0.020)	12.618*** (0.199)
sigma_u	0.261	0.113	0.326	0.284	0.180
sigma_e	0.218	0.148	0.148	0.099	0.092
rho	0.588	0.370	0.830	0.891	0.794
N	828	828	828	828	828
R-squared (within)	0.676	0.843	0.853	0.934	0.944
R-squared (between)	0.128	0.629	0.471	0.128	0.604
R-squared (overall)	0.471	0.743	0.603	0.589	0.817
Time effect	No	No	No	Yes	Yes
Locality effect	No	No	Yes	Yes	Yes
Control Variables	No	Yes	Yes	No	Yes
Wald	chi <sup>2</sup> (3)= 1589.37	chi <sup>2</sup> (14)= 3744.18			
F-stat. (P-value)			F(13,68)= 208.03	F(12,68) =339.8	F(20,68)= 280.65
Corr(u_i, Xb)	0(assumed)	0(assumed)	-0.614	0.004	-0.033

Note: \*, \*\*, \*\*\* mean that coefficients of variables are statistically significant under 10%, 5%, 1% critical values respectively

Post denotes the period before/after the SPTS, Treated denotes a district that adopted the SPTS, and DID is an interaction term of Post and Treated.

Column (1) and (2) are Random Effect (RE) regression, while (3), (4), and (5) are Fixed Effect (FE) regression models. In model (3), (4), and (5), standard errors are robust clustered at the id level and reported in the parentheses.

The p-values of Wald chi<sup>2</sup> in models (1) and (2) are significant at the 1% level, and the p-values of the F test in models (3)-(5) are significant at the 1% level. This means that the null hypothesis is rejected in which the RE model and the FE model are better than the OLS model to produce unbiased estimates. According to Hausman test, the locality effects in the data set are correlated with the other explanatory variables and cannot be taken as random effects. This shows, therefore, that the FE estimators will be more consistent and efficient than the RE estimators.

Table 16. Difference-in-Differences Model Results (EDE, SDE)

	<b>FE robust EDE</b>	<b>FE robust SDE</b>
Post	0.428*** (0.126)	0.696*** (0.060)
Treated	omitted	omitted
<b>DID (Post#Treated)</b>	<b>-0.138* (0.076)</b>	<b>0.010 (0.027)</b>
_cons	10.451*** (0.720)	12.618*** (0.199)
sigma_u	0.554	0.180
sigma_e	0.287	0.092
rho	0.789	0.794
N	828	828
R-squared (within)	0.447	0.946
R-squared (between)	0.116	0.531
R-squared (overall)	0.009	0.790
Time effect	Yes	Yes
Locality effect	Yes	Yes
Control Variables	Yes	Yes
F-stat. (P-value)	F (21,68)=40.25***	F (21,68)=297.66***
Corr(u_i, Xb)	-0.432	-0.043

\*, \*\*, \*\*\* mean that coefficients of variables are statistically significant under 10%, 5%, 1% critical values respectively.

Post denotes the period before/after the SPTS, Treated denotes a district that adopted the SPTS, and DID is an interaction term of Post and Treated

### 5.3 Triple Difference Results

DID analysis cannot verify the assumption that the SPTS effects may appear differently depending on the characteristics of donor and recipient. The triple difference results show a precisely estimated effect of the SPTS on both the donor and recipient, respectively. These results, shown in Table 17 and 18, examine how donors respond relative to recipient groups and compare that with how donor groups change relative to the case where the SPTS was not introduced. To verify this, a DDD model was used by adding four additional variables to the DID model: "Donor" is a dummy variable to be controlled between the two groups (donor and recipient);<sup>30</sup> the interaction variable of "Donor" and "Post"; the interaction variable of "Donor" and "Treatment"; and the triple interaction variable of "Donor," "Post," and "Treatment." All other control variables are kept the same as those used in the DID model. Whereas the DID revealed the average effect of the SPTS on the spending of the treated group (donor-recipient combined), the DDD focuses on identifying the differentiated impact of the SPTS on the spending of the donor group and the recipient group by estimating the coefficient on the triple interaction term, which is the DDD estimator in the specifications.<sup>31</sup> If the coefficient of the DDD turns out to be positive, for example, we could say that the SPTS has a more positive effect on donors than recipients over a specified period. In other words, the DDD estimator shows whether the characteristic of the donor affects the change in dependent variables (EDE and SDE).

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<sup>30</sup> dummy variable where "1" indicates the donor that it contributes to the pool, while "0" indicates the recipient receiving the funds from the pool.

<sup>31</sup> DDD refers to changes in outcome for donor group relative to changes in outcome for recipient group.

Table 17 shows the results of the DDD model of EDE. While the coefficient value of DID is all negative and statistically significant, the coefficient value of DDD (the main variable of interest) is positive and statistically insignificant across all specifications.<sup>32</sup> The value of the DDD estimates in column 5, the preferred specification results, 0.130, means that the SPTS has positive effect on the EDE in the donor group, compared to the recipient group (95% CI = - 0.164, 0.424; p = 0.381).

Combining the DDD estimators with the DID estimator, it indicates that the EDE of the donor group was reduced only by 3.6% ( $-0.167 + 0.130 = -0.037$ ) because of the SPTS, while the that of the recipient group was reduced by 15.4% ( $\beta = -0.167$ ; 95% CI = - 0.354, 0.019; p = 0.078), suggesting that the SPTS has a negative effect for both groups' EDE, but more negative effect in recipient group.<sup>33</sup>

Table 18 presents the result of an analysis of SDE. The DID estimators for SDE are all positive across all specifications, but only some point estimates are statistically significant (columns 2 and 3). However, the main interest of estimator, the coefficients of DDD for SDE are negative across all specifications, but only some point estimates (columns 1, 4, and 5) are statistically significant. The preferred specification in this study (column 5) indicates that the coefficient of DDD is -0.119 (95% CI = - 0.219, - 0.019; p = 0.020), meaning that the SPTS has a negative effect on

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<sup>32</sup> A statistical insignificance (a higher p-value) may imply that the effect size or the sample size is too small to detect substantial difference between the donor group and the recipient group after the SPTS implementation.

<sup>33</sup> The total SPTS effect on Donor's EDE is calculated by adding the DDD estimate to the DD estimate (Hang et al., 2020). However, it should be interpreted cautiously because the DID coefficient is statistically significant but not the DDD coefficient. However, the important finding here is that the SPTS effect on EDE was negative in both groups (donor and recipient).

the SDE in donor group compared to the recipient group. Finally, referencing the sum of DID and DDD estimators, -7.5% (0.041- 0.119= - 0.078) of SDE in the donor group was reduced with the SPTS, while the SDE of the recipient group increased by 4.2% with the SPTS ( $\beta = 0.041$ ; 95% CI = - 0.032, 0.114;  $p = 0.265$ ).<sup>34</sup>

In summary, as described in Table 19, this confirms that there is a differentiated effect of the SPTS on donor and recipient groups. The average EDE of donor local governments in Seoul was reduced by 3.6%, but their SDE decreased 7.5% with the SPTS during the period of 2008–2013. This means that the donor group decreased their SDE more than EDE. However, the estimated results of the recipient group are somewhat different from the results of the donor group. The average EDE of recipient group was reduced by 15.4%, while their average SDE increased 4.2% with the SPTS during the period of 2008–2013, which means that the recipient group increased their SDE more than EDE

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<sup>34</sup> The DID estimator for SDE across all specification had a positive value, although the preferred specification's estimator was not statistically significant.

Table 17. Triple-difference regression results for the impact of SPTS on EDE

Variation of Interest	(1) RE	(2) RE	(3) FE	(4) FE	(5) FE
Post	0.350*** (0.041)	0.337*** (0.052)	0.404*** (0.075)	0.459*** (0.082)	0.416*** (0.122)
Treated	-0.313** (0.157)	0.080 (0.131)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
<b>DID (Post#Treated)</b>	<b>-0.203*** (0.060)</b>	<b>-0.153** (0.061)</b>	<b>-0.179* (0.097)</b>	<b>-0.203** (0.089)</b>	<b>-0.167* (0.094)</b>
Donor	-0.171 (0.153)	-0.237** (0.104)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
Post#Donor	0.338 (0.059)	0.065 (0.058)	0.031 (0.111)	0.034 (0.089)	0.006 (0.101)
Treated#Donor	0.451 (0.282)	-0.073 (0.201)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
<b>DDD (Post#Treated#Donor)</b>	<b>0.132 (0.109)</b>	<b>0.091 (0.105)</b>	<b>0.059 (0.159)</b>	<b>0.132 (0.146)</b>	<b>0.130 (0.147)</b>
_cons	11.185*** (0.106)	10.861*** (0.302)	11.069*** (0.742)	10.916*** (0.035)	10.472*** (0.733)
sigma_u	0.487	0.296	0.574	0.502	0.512
sigma_e	0.338	0.307	0.307	0.296	0.286
rho	0.675	0.481	0.777	0.774	0.762
N	828	828	828	828	828
R-squared (within)	0.194	0.332	0.343	0.387	2.433
R-squared (between)	0.105	0.402	0.135	0.076	0.022
R-squared (overall)	0.135	0.379	0.017	0.158	0.150
Time effect	No	No	No	Yes	Yes
Locality effect	No	No	Yes	Yes	Yes
Control Variables	No	Yes	Yes	No	Yes
Wald chi <sup>2</sup> / F-stat. (P-value)	chi <sup>2</sup> (7)= 189.09***	chi <sup>2</sup> (18)= 420.46***	F(15,68)= 38.80***	F(14,68)= 40.51***	F(22,68)= 35.48***
Corr(u_i, Xb)	0(assumed)	0(assumed)	-0.290	0.039	-0.066

\*, \*\*, \*\*\* mean that coefficients of variables are statistically significant under 10%, 5%, 1% critical values respectively.

Post denotes the period before/after the SPTS, Treated denotes a district that adopted the SPTS, DID denotes an interaction between Post and Treated, Donor denotes a district's property revenue is higher than the average in a region, and DDD denotes an interaction between Post, Treated, and Donor.

In model (3), (4), and (5), standard errors are robust clustered at the id level and reported in the parentheses (1) and (2) are Random Effect regression, while (3), (4), and (5) are Fixed Effect regression models.

The p-values of Wald chi<sup>2</sup> in model (1) and (2) are significant at 1% level, and the p-values of F test in model (3)-(5) are significant at 1% level, meaning that the null hypothesis is rejected which Random Effect (RE) model and Fixed Effect(FE) model is better than OLS model. According to Hausman test, the locality effects in the data set are correlated with the other explanatory variables and cannot be taken as random effects. Thus, it shows that the FE estimators will be more consistent and efficient than RE estimators.

Table 18. Triple-difference regression results for the impact of SPTS on SDE

Variation of Interest	(1) RE	(2) RE	(3) FE	(4) FE	(5) FE
Post	0.615*** (0.026)	0.260*** (0.026)	0.181*** (0.049)	0.664*** (0.039)	0.700*** (0.068)
Treated	-0.316*** (0.084)	0.158*** (0.056)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
<b>DID (Post#Treated)</b>	<b>0.016 (0.039)</b>	<b>0.073** (0.031)</b>	<b>0.076* (0.043)</b>	<b>0.016 (0.035)</b>	<b>0.041 (0.036)</b>
Donor	-0.152* (0.082)	0.007 (0.044)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
Post#Donor	-0.015 (0.378)	0.005 (0.029)	-0.016 (0.055)	-0.015 (0.037)	0.008 (0.036)
Treated#Donor	0.322** (0.151)	-0.141 (0.086)	0.000 (omitted)	0.000 (omitted)	0.000 (omitted)
<b>DDD (Post#Treated#Donor)</b>	<b>-0.144** (0.070)</b>	<b>-0.066 (0.053)</b>	<b>-0.019 (0.071)</b>	<b>-0.144*** (0.050)</b>	<b>-0.119** (0.050)</b>
_cons	12.614*** (0.056)	13.041*** (0.145)	13.140*** (0.364)	12.162*** (0.020)	12.608*** (0.205)
sigma_u	0.255	0.115	0.328	0.285	0.182
sigma_e	0.217	0.148	0.148	0.097	0.091
rho	0.580	0.378	0.831	0.897	0.802
N	828	828	828	828	828
R-squared (within)	0.679	0.844	0.853	0.937	0.946
R-squared (between)	0.185	0.637	0.441	0.001	0.604
R-squared (overall)	0.495	0.747	0.592	0.586	0.814
Time effect	No	No	No	Yes	Yes
Locality effect	No	No	Yes	Yes	Yes
Control Variables	No	Yes	Yes	No	Yes
Wald chi <sup>2</sup>	(7)=	(18)=	F(15,68)=	(14,68)=4	F(22,68)=4
/F-stat. (P-value)	1613.16	3784.96	202.80	61.69	25.35
Corr(u_i, Xb)	0(assumed)	0(assumed)	-0.599	-0.004	0.084

\*, \*\*, \*\*\* mean that coefficients of variables are statistically significant under 10%, 5%, 1% critical values respectively.

Post denotes the period before/after the SPTS, Treated denotes a district that adopted the SPTS, DID denotes an interaction between Post and Treated, Donor denotes a district that lost their revenue due to the SPTS, DDD denotes an interaction between Post, Treated, and Donor.

In model (3), (4), and (5), standard errors are robust clustered at the id level and reported in the parentheses (1) and (2) are Random Effect regression, while (3), (4), and (5) are Fixed Effect regression models.

The p-values of Wald chi<sup>2</sup> in model (1) and (2) are significant at 1% level, and the p-values of F test in model (3)-(5) are significant at 1% level, meaning that the null hypothesis is rejected which Random Effect (RE) model and Fixed Effect(FE) model is better than OLS model. According to Hausman test, the locality effects in the data set are correlated with the other explanatory variables and cannot be taken as random effects. Thus, it shows that the FE estimators will be more consistent and efficient than RE estimators.

Table 19. Triple-difference regression results (EDE and SDE)

Variation of Interest	FE robust EDE	FE robust SDE
Post	0.416*** (0.122)	0.700*** (0.068)
<b>DID (Post#Treated)</b>	<b>-0.167* (0.094)</b>	<b>0.041 (0.036)</b>
Post#Donor	0.006 (0.101)	0.008 (0.036)
<b>DDD (Post#Treated#Donor)</b>	<b>0.130 (0.147)</b>	<b>-0.119** (0.050)</b>
_cons	10.472*** (0.733)	12.608*** (0.205)
sigma_u	0.512	0.182
sigma_e	0.286	0.091
rho	0.762	0.802
N	828	828
R-squared (within)	2.433	0.946
R-squared (between)	0.022	0.604
R-squared (overall)	0.150	0.814
Time effect	Yes	Yes
Locality effect	Yes	Yes
Control Variables	Yes	Yes
F-stat. (P-value)	F(23,68)=36.84	F(23,68)=447.50
Corr(u_i, Xb)	-0.334	0.039

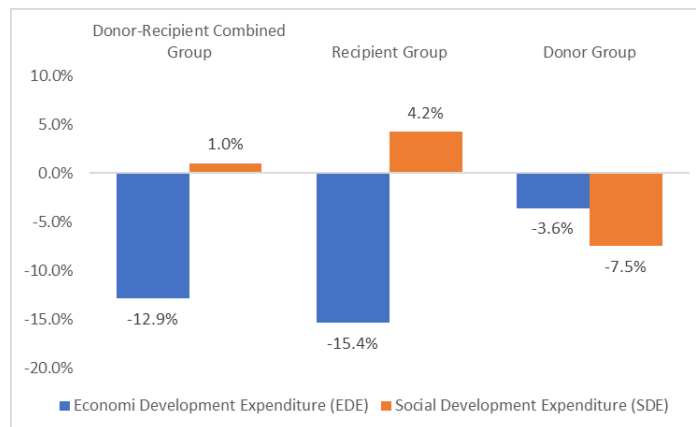


Figure 14. Results Summary

## Chapter 6

### CONCLUSION

#### 6.1 Summary

HFE has been expected to not only mitigate fiscal imbalance between jurisdictions, but also encourage the efficient allocation of public resources. However, the role of HFE in the allocation of financial resources has not been revealed empirically. How does HFE influence the spending pattern of local governments? Do the recipient governments change their investments and policy priorities because of HFE? The most dominant assumption is that HFE is a disincentive for transfer-receiving governments to focus on growth-enhancing policies. Empirical studies that validate this disincentive effect on local government spending are rare, and it's even rarer to examine how the expenditure decisions of two groups (donor and recipient) differ.

This research investigated how local governments' expenditure decisions changed as a result of the Horizontal Fiscal Equalization (HFE), aiming to fill two main knowledge gaps in the literatures of local public finance and political economy of local economic development. First, this study tested the widely known assumptions that HFE may moderate 'fiscal imperative' that forces local government to stimulate economic activity which generates local tax revenue. Second, it tested the possibility that the impact of the HFE varies depending on the statuses of donors/recipients. In

other words, the donor and recipient respond to the HFE differently on their expenditure choices since HFE produced a positive income effect for recipient governments but a negative income effect for donor governments.

A case of the Shared Property Tax System (SPTS) in Seoul, South Korea was analyzed. In 2008, Seoul Metropolitan Government (SMG) introduced the SPTS that collects 50 percent of the property tax from 25 districts in Seoul and redistributes it equally. The SPTS is the first HFE program introduced in Korea, and due to a short history of implementation, not much research has been done on the SPTS impact. Previous studies mainly focused on whether SPTS has reduced the fiscal disparity while less focused on how local governments modify their tax and expenditure policies with the SPTS.

This study presented empirical findings on the impact of the SPTS on local spending, especially two types- Economic Development Expenditure (EDE) and Social Development Expenditure (SDE) to see how local governments change their policy priorities in respond to the SPTS. The samples were grouped into three, donor district group, recipient district group, and donor-recipient combined group. The Difference-In-Differences (DID) method was employed which compares the public spending patterns between the treatment group and the control group, after controlling for local characteristics and other underlying trends. In addition, the triple-difference (DDD) method was used to evaluate the SPTS effects at the donor and recipient level. For these two analyses, the annual data from the local districts in Seoul and its comparison group (44 districts from six metropolitan cities in Korea) was collected and sampled, spanning public expenditures, socio-economic, and political data between 2002 and 2013.

The analysis results from this study allowed us to conclude as followings: First, consistent with the fiscal imperative (reduced motivational effect) hypothesis, the DID model indicated that local government in Seoul didn't prioritize their economic development spending. The donor-recipient combined group's EDE was reduced by close to 13 percent ( $\beta = -0.138$ ; 95% CI = -0.289, 0.013;  $p = 0.073$ ). The DDD results also confirmed that EDE declined in both donor and recipient districts after SPTS implementation: the donor group's EDE and the recipient group's EDE were reduced by close to 4 percent and 15 percent, respectively. These results indicate that the effect of HFE does not depart from the prevailing theories of the Vertical Fiscal Equalization programs, meaning that such fiscal equalization program is likely to moderate fiscal imperative to undertake economic development activities.

Second, based on the DDD results, empirical evidence confirmed that the impact of the SPTS varied depending on the statuses of donors/recipients. The results of DDD modeling revealed that the donor group reduced their EDE and SDE by almost 4 percent and 8 percent, respectively. In contrast, the recipient group reduced their EDE by close to 15 percent, while their SDE increased by close to 4 percent. These results show how differently the SPTS might influence spending depending on the donor/recipient status, and specifically reconfirmed that the results of DDD modeling are consistent with the income-effect hypothesis as well as the normative premises offered as policy rationales for HFE schemes, recipient districts tended to increase their SDE after the SPTS was implemented: The recipient group shifted their relative expenditure priorities away from economic development and toward social development services. On the other hand, donor group showed the contrasting results: they paid less attention to their social development spending.

Third, DDD results showed that the recipient group reduced EDE (close to -15%) rather than increase. This result was not consistent with expectations of the income hypothesis, indicating that the reduced EDE is possibly due to the SPTS's income effect was not substantially large enough to raise their EDE, or due to the motivation to spend on economic development was lowered much more significant than expected. For further investigation into this, follow-up studies to examine how spending choice are determined by the relative influence of income and motivational effects are essential.

Taken together, these results indicate that the effect of the current horizontal revenue sharing scheme in Seoul (the SPTS) did not increase spending for economic development, but, in fact, reduces it overall. In addition, such a tendency was stronger among the recipients than the donors. These results show that although it is still too early to fully observe the long-term impact of the SPTS on Seoul's economic and social development patterns, the effects so far are consistent with the behavioral premises of HFE claimed by the advocates that HFE contribute to improving both efficiency and equity within metropolitan areas by reducing inter-municipal economic development competition and investing more in services that serve the immediate needs of their residents.

## **6.2 Limitations of the Study**

To our knowledge, this is the first study looking at SPTS by examining the incentive effect on spending choice as part of SPTS economic effect. The findings of this research warrant further study to assess the efficacy of current SPTS practice and to validate the results using other analytical methods. Some limitations still exist,

however, which should be mentioned for future research. First, the SPTS effect on spending may turn out to have a statistically smaller effect than expected. This is mainly because SMG was running the SPTS smoothly by having a three year transition period in order to prevent significant changes in the revenue at the district level: the ultimate goal of the SPTS was sharing 50% of property tax revenue with all districts; however, a portion of property taxes to be collected into the pool was started at 40% in 2008, then increased to 45% in 2009, and again to 50% since 2010. In addition, SMG provided additional financial assistance to the donor districts during the first three years to alleviate any financial shock from the SPTS.<sup>35</sup> These three years' financial supplements gave donor communities time to modify their fiscal management plans for the SPTS. This transition period would mitigate the initial effect of the SPTS. In this study, there was no separate distinction a transitional period of SPTS operation, and it was regarded as an inseparable part of policy design. Thus, the impact of the HFE in Seoul (SPTS) would be weaker than the impact of other HFE practices having no transition periods. This transition period impact remains to be determined by future research.<sup>36</sup> Another possibility that the SPTS impact was found to be smaller than expected is that the amount of the SPTS fund is not sufficient to produce impressive results: while analyzing the spending effect of the SPTS, it was confirmed that the SPTS fund given to the recipients acted as a substitute for other

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<sup>35</sup> SMG provided subsidies as additional financial assistance to the donor districts in first three years to alleviate any financial shock from the SPTS (60% of decreased amounts of Donors in 2008, 40% in 2009, and 20% in 2010).

<sup>36</sup> If the transitional period should be thought of as the lag time to allow the intervention to take effect, segmented regression analysis could be considered (Bernal et al., 2017)

vertical transfers provided by the SMG: In general, vertical revenue sharing is allocated on the basis of districts' financial need, and the amount of local owned revenue is considered as criteria for qualification for receiving vertical revenue sharing as well as the amount to be received. The matter is that the SPTS (horizontal fiscal equalization or revenue sharing in Seoul, Korea) has been distributed before the vertical transfers. By increasing the amount of local revenue in recipient districts, the SPTS changed their eligibility for receiving vertical revenue sharing. Some districts lost the chance to receive vertical transfers altogether because their revenue exceeded the eligibility threshold, and some districts received fewer vertical transfers than they had previously because funds provided by the SPTS reduced their financial need. As a result, some recipient district's budget seemed to not increase, but rather decline after the implementation of the SPTS (The more a district received from the SPTS fund, the lower their chance to received other transfers). Thus, for future research, it remains to be seen how the SPTS changed the amounts of other transfers coming from the upper level of governments as well as the local budget. For example, the first STPS impact on recipient governments' revenue would be positive but it could be ultimately turned out to be negative after receiving fewer vertical transfers.

An important caveat for interpreting our study is that the sample for analysis was limited to the period of 2002 – 2013 (that is, six years of pre- and six years of post-policy). What this means is that the study could underestimate policy impact if the SPTS requires a long time to take effect. In setting the time frames before and after the intervention, this study marks 2002 as the starting point because of the data availability, and 2013 as the endpoint based on the recommendation by Bernal et al. (2017) and Zhang et al. (2011), who suggest that statistical power can be increased

when the length of observation periods is equal in before and after the intervention (rather than just having more observation periods). Regarding the policy impact's dependence on the length of exposure, the result of this study is from the medium-term (six-year), not from the long-term results. Further, it should be noted that the size and statistical significance of the effects found here may not be applicable if the range of the observation period deviates from the time frame mentioned above. Future research will be required to verify and compare the results of this study.

Another important limitation is that this study selected 44 districts as a control group that exhibited similar pre-treatment trends. 44 districts are considered an appropriate control group in this study for three reasons: (1) in many previous studies in Korea, control groups (districts in six metropolitan areas) and treatment groups (districts in Seoul) in this study have been grouped into one experimental group that shares similar historical and political contexts affecting local government expenditure decisions. (2) a visual inspection verified that time trends in outcomes prior to the SPTS are graphically similar between the treatment and control groups, as would be appropriate for the DID analysis. (3) statistical testing was performed and confirmed the similarity of pre-treatment trends.<sup>37</sup> To use DID analysis, it is important to justify the reasons for choosing the control group, because (as) the outcome of control group acts as a proxy for the counterfactual outcome in a case where the treated group would not have had policy intervention (Ryan et al, 2015). Although this study proved its

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<sup>37</sup> When choosing a control group, the underlying size/levels of the outcomes are not critical. Rather, the exogenous forces affecting both the treated and control groups should be equally applied in the post-intervention period (Angrist & Krueger, 1999; Autor, 2003).

appropriateness using two methods – a visual inspection and statistical testing<sup>38</sup> – the findings may not be consistent with studies that have used different control groups.<sup>39</sup> These limitations of selecting a control group in DID model suggest future research to apply other methods of selecting a control group, such as the propensity score matching method. Or alternatively, future research could consider the decomposition analysis that does not require a control group selection.

A final limitation to be considered would be that there may be measurement errors when aggregating the individual spending item into developmental and redistributive categories. With no clear-cut, universally accepted way of placing an individual spending item within larger spending areas, this study applied some judgments based on Korea's specific context and data availability, aligning with recent empirical works in Korea along with two famous theoretical models (Kneller et al., 1999; Peterson, 1981). In addition, the spending data were reported as a "per capita term"; the statistical results would be different in a study using the ratio or the volume of expenditures. To better understand the implications of the effect of SPTS on spending, future research must address the challenge of how to classify the spending data and define them. Also, future research could consider different ways of measurement of dependent variables: this study used natural (base e) logs of spending

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<sup>38</sup> Statistical tests of the similarity of pre-treatment trends were performed, suggested by Autor, D. (2003) and Yamamoto and Teppei (2016).

<sup>39</sup> The strength of the statistical power of the DID analysis depends on the control group selection and its legitimacy, therefore, the results in this study should be interpreted with caution.

per capita, but future research could consider the percent of individual spending in total spending, or the percent changes of spending as dependent variables.

### **6.3 Recommendations for Future Research**

A further investigation of the SPTS impact on local spending would be highly recommended. The DID and DDD models used here would be applied to other empirical studies with different ways of definitions and measurements of spending variables. First, instead of SDE (Social Development Expenditure) or EDE (Economic development Expenditure) that were used in this study, future studies can use different definitions and different classifications of individual expenditures. In addition, following research could be done by looking at the income and motivational effects of the SPTS on various fiscal factors such as a change in tax base/rate/revenue/expenditure/debt, fiscal competition, fiscal capacity, fiscal disparity, fiscal sustainability, the degree of fiscal autonomy or local dependency upon transfers, and tax effort.

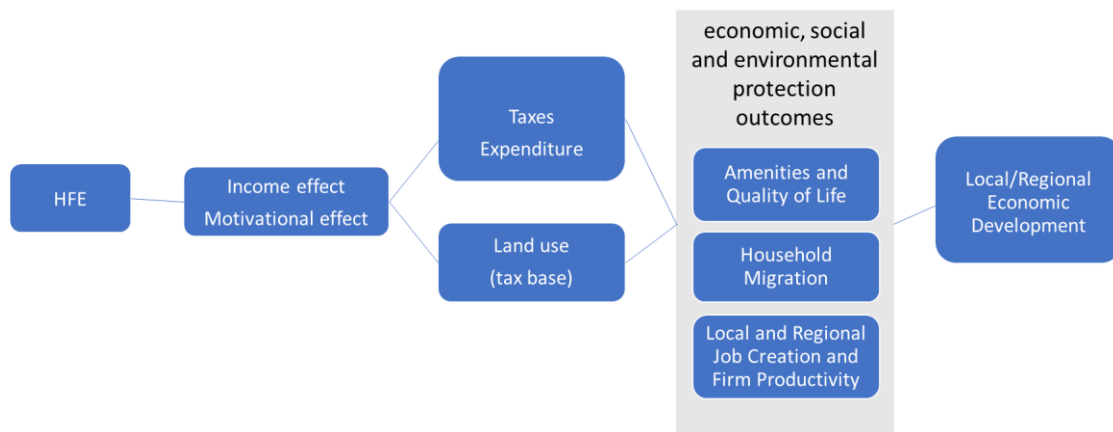
To ensure if the findings in this study is generalizable or applicable to other HFE programs, a highly recommended study would be the research that look at other cases of HFE implementations. For example, there are some cases where they have operated the tax sharing in Minnesota, Alabama, Iowa, West Virginia, Florida, etc. Also, future studies are recommended to analyze a mandatory HFE program that imposes constraints on how shared tax should be used by recipients. For example, mandatory based HFE programs are mainly focused on their intended regional outcomes, especially on public education, health, transportation, and police service (Benson et al., 2012). Thus, the impact of mandatory-based HFE on spending side

would be different with what the SPTS affected spending priorities.<sup>40</sup> By doing same analytical modeling and assumption that were used in this study, further studies could explain how the design and/or context of HFE might change the effects.

More work is recommended to examine the additional linkages from the tax policy to the social and economic outcomes in the network of causes and effects on the regional economy. This study found the causal effect of Horizontal Fiscal Equalization (HFE) on the spending side. However, as with the previous research that addressed the HFE's causal effect on revenue and land use, such a finding was the only one specific portion of the larger network of causal associations that connects the fiscal equalization policies to broader, policy, economic, and social outcomes. To this end, follow-up studies are needed on creating a structural model that encompasses the path of changes in fiscal policy and other economic development indicators, as shown in Figure 15.

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<sup>40</sup> Some revenue sharing programs include a strict regulation on the use of transfers. For instance, the collected taxes in West Virginia should be used only for economic development, infrastructure improvements, and operating cost for regional jail. Also, Florida restricts the use of shared taxes only for the state-planning mandate and the shared taxes returned if local governments do not comply with the rule (Benson et al., 2012; The Florida Senate, 2006; p.19).



Note. Partially adapted from “Integrating regional economic development analysis and land use economics. In *The Oxford Handbook of Land Economics*,” by Partridge & Rickman, 2014, Oxford: Oxford University Press, pp. 23-51.

Figure 15. The Role of HFE As an Economic Development Strategy

To better understand the impact of HFE on economic development, I would like to propose a study using causal modeling such as path analysis, factor analysis, or Structural Equation Modeling (SEM) for the following reasons. First, as shown in Figure 1, fiscal policy can affect economic growth through two main pathways: (1) it directly affects economic growth through changes in tax, expenditure, and tax base (land use) and (2) it indirectly affects economic growth through changes in growth factors, such as jobs, population, and business productivity (caused by taxation, expenditures, and land use). Therefore, even if the fiscal policy regarding revenue and expenditure has a negative impact on economic growth, the policy's impact on economic growth could be positive if the economic growth factor affected by the change in revenue and expenditures has a large and positive impact on economic growth. In other words, to better understand the impact of HFE, causal modeling will help overcome the limitations of previous studies, such as the public finance studies

that focused on the impact of HFE on tax side, and regional studies dealing with the impact of HFE on land use side. Causal modeling is also useful because of the nature of HFE. HFE aims to increase equity in the short term and inclusive economic development in the long term. Policies to alleviate imbalances, such as HFE, generally have positive and negative effects on economic growth simultaneously. Causal modeling technique can help determine where the HFE policy specifically affect negatively and positively, and how the positive side effects can be maximized while minimizing the negative side effects.

In addition, it would be beneficial to conduct research with an in-depth interview with a group of experts such as officials with related government agencies. Research-based on these interviews, unlike quantitative research that mainly aims to measure the policy outcomes, can focus on description as well as evaluation. In other words, a qualitative study will be more helpful in understanding how and why these results occurred. For example, by interviewing donor and recipient governments' policymakers who are involved in the SPTS policy in Seoul, researchers could address the following questions: (1) how did they put the HFE program into their budgeting policies and practices? (2) what specific expenditure priorities changed? (3) why did they change their expenditure priorities? Rather than evaluating only, in-depth interviews research will be able to have a complete understanding of the process of making financial decisions in what environment and in what process. Thus, it could be useful in describing and providing guidance on how to maximize the economic effect of HFE policy.

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## Appendix A

### VISUALIZING AND ASSESSING PARALLEL TREND ASSUMPTIONS

#### The Parallel Trend Plot

The parallel trend was tested by two methods. First, the outcome trends of treatment and control groups were visually displayed. Figure 16 and 17 shows trends of two dependent variables – EDE and SDE. These graphs confirm that the outcome of SDE have similar trends in pre-treatment periods and the difference between the treated group and control group is constant before the treatment. For the EDE, its trends look less parallel, relatively compared to SDE, but has similar directions. Therefore, further testing was necessary to ensure that the selected group (control) provides adequate counterfactual of the trend that the treated group would have followed if they had not received the treatment.



Figure 16. Social Development Expenditure (2002-2013) (per capita, natural log)



Figure 17. Economic Development Expenditure (2002-2013) (per capita, natural log)

### Statistical test for the parallel trend before treatment

To check the validity of the parallel trend assumption, I used a regression model that estimates the coefficient of the interaction term between pre-treatment time and treatment group dummy variables. According to the studies by Hartman and Hidalgo (2018), Son and Lee (2018), and Egami and Yamauchi (2021), the estimated results must satisfy the following three conditions. First, the p-value of the coefficient should be greater than 0.05. If the outcome trends between the treatment and control groups are the same before the treatment, then the coefficient of the pretreatment period should be insignificant. Second, the coefficient of the pretreatment period (lead effect) should be close to zero, which means that the difference between the outcomes of the treatment and control groups is not large. Conversely, if the coefficients of the pretreatment period are larger than zero and significant, it may mean that the parallel trends assumption is violated (Egami & Yamauchi, 2021). Third, the 95% equivalence

confidence interval  $[-v, v]$  should contain zero. Zero contained means that the difference in mean outcomes between the treated and control could be zero with 95% confidence (Son & Lee, 2018).

As shown in the equation below, these three characteristics can be checked by adding the three interactions terms of the time dummies “before the treatment” with the treatment indicator into the DID model ( $\beta_3, \beta_4, \beta_5$ ).

$$y_{it} = \beta_0 + \beta_1 D_i + \beta_2 P_t + \beta_3 (D_i * Y_{t-3}) + \beta_4 (D_i * Y_{t-2}) + \beta_5 (D_i * Y_{t-1}) + \beta_6 (D_i * Y_t) + \varepsilon_{it}^{41}$$

$y_{it}$  denotes an observed outcome of unit  $i$  at time  $t$

$D_i$  equals 1 if unit  $i$  is exposed to the treatment, otherwise, it is 0.

$P_t$  equals 1 if the treatment is active in unit  $i$  at time  $t$ , otherwise, it is 0

$Y_t$  denotes the year dummies

Additionally, as a robustness check, the treatment effect could be checked by adding the interaction terms between post-treatment time and treatment group dummy variables (Autor, 2003; Son & Lee, 2018). With an equation below, it is assumed that the treatment effect is statistically significant when the coefficient of interaction terms between post-treatment time and treatment group dummy variables (lag effects)-  $\beta_6, \beta_7, \beta_8,$  and  $\beta_9$  are statistically significant and the values are not zero.

$$y_{it} = \beta_0 + \beta_1 D_i + \beta_2 P_t + \beta_3 (D_i * Y_{t-3}) + \beta_4 (D_i * Y_{t-2}) + \beta_5 (D_i * Y_{t-1}) + \beta_6 (D_i * Y_t) + \beta_7 (D_i * Y_{t+1}) + \beta_8 (D_i * Y_{t+2}) + \beta_9 (D_i * Y_{t+3}) + \varepsilon_{it}^{42}$$

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<sup>41</sup> The regression equation was adapted from the study of Son & Lee (2018)

<sup>42</sup> The regression equation was adapted from the study of Son & Lee (2018)

Table 20 reports the statistical test results, including the coefficient, robust standard error, p-value, and 95% equivalence confidence interval. As the visual presentation in Figure 16 and Figure 17. suggests, parallel trends assumption is plausibly satisfied since the trends of SDE for the treated group and those in the control group were not statistically different: each coefficient is close to zero and insignificant, and the 95% equivalence confidence interval includes 0, during the pre-treatment periods (2005–2007). For EDE, the test results provide relatively less clear evidence for the parallel trends as shown in Table 20. The results of 2005\*treat and 2006\*treat satisfy the parallel trends assumption, however, the results of 2007\*treat is less clear. The 95% equivalence confidence interval does not include 0 [0.044, 0.399], the coefficient value is not close to zero relatively, and the p-value is 0.016 indicating a 1.6% chance of concluding that the EDE trend between the treatment and control groups are same in 2007. Regarding the post treatment estimation results, Table 20. shows that the coefficient of the post-treatment period of EDE during the period from 2009 to 2013 is statistically significant, which confirms that the SPTS influences the EDE. In contrast, the estimations of SDE show that coefficients in 2009 and 2011 are significant while the coefficients in 2010, 2012, 2013 are insignificant.

Table 20. The testing results of the parallel trends assumption for SDE and EDE

	SDE				EDE				
	Coef.	Robust S.E.	P>t	[95% Conf. Interval]		Coef.	Robust S.E.	P>t	[95% Conf. Interval]
DID (2008* TREAT)	-0.010	0.037	0.785	[-0.084, 0.064]	DID (2008* TREAT)	0.370	0.094	0.000	[0.183, 0.557]
Pre-treatment					Pre-treatment				
2005* TREAT	-0.011	0.024	0.637	[-0.059, 0.037]	2005* TREAT	0.102	0.072	0.161	[-0.042, 0.245]
2006* TREAT	-0.033	0.029	0.256	[-0.090, 0.024]	2006* TREAT	0.025	0.088	0.780	[-0.150, 0.199]
2007* TREAT	0.001	0.030	0.974	[-0.060, 0.062]	2007* TREAT	0.221	0.088	0.015	[0.044, 0.397]
Post-treatment					Post-treatment				
2009* TREAT	0.044	0.019	0.024	[0.006, 0.082]	2009* TREAT	-0.217	0.057	0.000	[-0.330, -0.103]
2010* TREAT	-0.023	0.021	0.276	[-0.064, 0.018]	2010* TREAT	-0.285	0.078	0.001	[-0.441, -0.129]
2011* TREAT	-0.063	0.026	0.017	[-0.115, -0.011]	2011* TREAT	-0.650	0.073	0.000	[-0.796, -0.505]
2012* TREAT	-0.035	0.027	0.193	[-0.088, 0.018]	2012* TREAT	-0.872	0.090	0.000	[-1.051, -0.692]
2013* TREAT	0.001	0.030	0.971	[-0.060, 0.062]	2013* TREAT	-0.928	0.092	0.000	[-1.112, -0.744]
_cons	12.162	0.021	0.000	[12.121, 12.203]	cons	10.916	0.034	0.000	[10.848, 10.985]
Year Effect		Included			Year Effect		Included		
R-sq Within		0.935			R-sq Within		0.496		
Between		0.128			Between		0.057		
overall		0.592			Overall		0.174		
Corr (u, I, Xb)		0.007 ***			Corr (u, I, Xb)		0.013***		
Rho		0.891			Rho		0.781		
F-test		F(20, 68)= 280.31			F-test		F(20, 68)= 50.34		

Std. Err. adjusted for 69 clusters in id

Although a graph of the outcomes in the absence of program looked like a parallel lines and the statistical testing results proved that the both treated group and control group follow same trend in pre-treatment period, it is potential to the parallel trend assumption not plausible because of the possibility that unobserved time-varying effects can affect the outcome of program (Wing et al, 2018). Previous studies have

addressed this issue with three ways as follows: First is to add (time-varying) covariates into regression specification to not only relax the parallel trends assumption, but also make DID estimates more robust. After adjusting for the observed covariates, assume that the trends in the two groups can be conditionally parallel (Jeon, 2019; Lim, 2019; Lee, 2016; Naoki & Soichiro, 2021; Lee, 2012) Second is to use Propensity-Score Matching (PSM) that construct the control group by matching the each individual unit of treated group with one of control group individually, based on determinants of the outcome variable in the absence of program (Lee et al, 2015; Park & Kim, 2011; Sohn, 2018). Third is to add a group-specific time trend into regression model (Angrist & Pischket, 2008; Park & Park, 2015). In this study, adding covariates into regression model was employed.

## Appendix B

### CONTROL VARIABLE SELECTION

The selection of controlled variables was primarily made from the previous studies prior to the regression analysis and modified secondly after examination of the pairwise correlation coefficient and Variance Inflation Factor (VIF). Table 21 shows which factors have been discussed as the determinants of government spending in the empirical studies in Korea. Regarding factors influencing local fiscal expenditure, recent Korean studies have showed a trend considering both socio-economic and political factor as dependent variable that influenced total size of public expenditure or the composition of public expenditure (Yoon, 2014). First, the socioeconomic factors have been emphasized with the claim that the size of government spending is influenced by the demographic characteristic since it represents local demand side of the public sector. Expanding a pioneering study of Fabricant (1952)<sup>43</sup> as well as Bahl & Saunders (1965), previous studies expanded the number of variables as shown in Table 21. Seven demographic variables were selected in this study as follows: (1)

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<sup>43</sup> Fabricant (1952) examined those changes in per capita income, population density, and urbanization (urban population) are strongly associated with change in the public expenditures. Later, Bahl and Saunders (1965) added changes in per capita federal grants as a determinant of public expenditures.

population density, (2) the proportion of working population (age 15-64), (3) the number of establishments/employees (expressed in per 1,000 of population), (4) the proportion of people aged under 5, (5) the proportion of the elderly over 65, (6) the proportion of the standard assistance (welfare) recipient/people with disabilities. Since the data, per capita income commonly selected as most influencing factor of public expenditure, is not measured at local(district) level, the study of Jung (2019) and others used the number of local business establishments, local workers, and proportion of population aged 15 to 64, as proxy variables. The socio-demographic variables were one year lagged (t-1), because the budget decisions for fiscal year t are made by reflecting the socio-demographic conditions in year t-1, as described by the study of Choi et al (2016).

Second, with respect to political factors, previous studies investigated the importance of the state/local political characteristic on public expenditure in terms of the supply side of the public sector. Inspired by the studies of Nordhaus (1975)<sup>44</sup> and Hibbs (1977), Choi (2017) and other studies have revealed various political indicators as shown in Table 21. In this study, five political factors were selected as follows: (1) political ideology (conservative or progressive), (2) whether if the same political party

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<sup>44</sup> Nordhaus (1975) explored that politician in power tend to manipulate the economy (by change in policies) to increase the re-election probability because choice of voter in election would be influenced by the economic condition prior to election (opportunistic political model), while Hibbs (1977) claimed that the different partisan composition of governments (left-and right-wing governments) resulted in different policy as well as economic outcomes (partisan political model).

that governs autonomous districts also governs national, (3) voter turnout rate, (4) winner-loser gap (it can be calculated by subtracting a winner's votes to runner-up candidate's votes, showing whether government party with absolute majority), (5) electoral cycles. (one year prior to, the year, the one year after elections). Unlike the demographic factors, the political variables were not lagged.

Table 21. List of control variables used in previous studies

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
<b>Socio-demographic factors</b>																		
Population density	0	0		0	0					0	0		0		0			0
Total population	0		0			0	0		0		0	0	0	0		0		0
The ratio/number of the elderly population (age over 65)	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0
% over 65 years old																		
Number of business establishments/employment	0		0								0	0			0			0
Jurisdiction Size			0									0						0
The ratio/number of infants (age under 5)		0		0					0			0			0	0		0
Number of recipients of basic livelihood/people with disability	0	0		0		0		0				0	0		0			0
Number of civil servants												0			0			0
<b>Political Factors</b>																		
Political ideology (conservative, progressive)			0	0	0	0	0	0		0		0						0
Whether the party matches (the ruling party)				0	0	0	0	0		0								0
Voter turnout rate				0			0						0	0				0
Winner's vote (highest voter turnout)							0						0					0
Winner-loser Gap								0					0			0		0
Election year/previous year						0		0						0				

Source: A. Chung (2019), B. Jang (2012), C. Choi et al (2012), D. Choi (2017), E. Choi & Park (2014), F. Moon & Lee (2015), G. Choi (2010), H. Im et al (2018), I. Ryu (2008), J. Jung & Kang, K. Bok (2018), L. Choi et al (2013), M. Choi (2004), N. Yoo & Kim, (2020), O. Park & Geum (2016), P. Jeon & Song (2014), Q. Kwon (2016), and R. Shin (2007).

## Appendix C

### PANEL UNIT ROOT TESTING OF MONETARY VARIABLES

This study used a sample of 69 autonomous districts using an annual series, which was taken from the Bureau of Budget in Korea, throughout the 2002-2013 period. All monetary variables have been deflated to the values of the year 2010 by the GDP deflator in Korea. In addition, these variables are divided by the total population to obtain per capita terms. Before the analysis, two tests (Levin, Lin and Chu(LLC) and Im, Pesaran and Shin(IPS)) were conducted to determine whether these variables were stationary. As shown in Table 22, the whole series (level variable) except one result of IPS test for SDE the unit-root null hypotheses were rejected at 99 percent critical value. Hence, based on these tests, the dependent variables at level were deemed stationary, thus, allowing them to be estimated.

Table 22. Panel Unit Root Test of the Variables Involved

Level Variable (per capita)		Levin, Lin and Chu (LLC)		Im, Pesaran and Shin (IPS)	
		Panel means included	Panel mean + Time trend included	Panel means included	Panel mean + Time trend included
Ln SDE	Statistic	-6.9008	-14.8851	3.9332	-5.4009
	(p-value)	(0.0000)	(0.0000)	(1.0000)	(0.0000)
Ln EDE	Statistic	-9.1049	-10.5692	-4.4952	-2.3404
	(p-value)	(0.0000)	(0.0000)	(0.0000)	(0.0096)

## **Appendix D**

### **MULTICOLLINEARITY TEST (CORRELATION MATRIX AND VARIANCE INFLATION FACTOR)**

Multicollinearity generally occurs when independent variables in a regression model are highly correlated with one another. The high degree of multicollinearity can cause the high variance of the coefficient estimates, leading to unreliable and unstable estimates of regression coefficients (an incorrect sign or an invalid coefficient value). To detect the multicollinearity, the pairwise correlation matrix and Variance Inflation Factor (VIF) were used. The pairwise correlation matrix helped to look at the correlations among pairs of variables. And VIF was used in detecting the case that the pairwise correlations are small but linear dependence exists among multiple variables.

First, looking at pairwise correlations, and found that the correlation value of the three pairs is larger than 0.7 (e.g., Emp & Esta, Conserv & Progress, Aging & Young), and the value of the correlation between Density and Work is larger than 0.5. Considering the results of the correlation matrix and VIF, as shown in Table 24 and Table 25, the multicollinearity was alleviated by removing four of these variables from among the four pairs of variables (Emp, Conserv, Aging, and Work) according to the following criteria for variable omission: Omit a variable if (1) it has the highest Variance Inflation Factor (VIF) ( $> 5$ ), (2) it has a high correlation with other independent variables while a low correlation with the dependent variable, and (3) it is less easy to interpret if the difference between the values of the correlation coefficient is not large. To check if a set of control variables was properly chosen, the estimation

results of the final regression model were compared to the regression model that included the omitted set of variables and confirmed no significant difference from the result of the main regression model in this study (see Table 26 and 27).<sup>45</sup>

Table 23. Pairwise Correlation Matrix of Variables

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<sup>45</sup> The political ideology of a party can be considered as an important factor explaining the difference in local government policy making. According to Connolly and Mason (2016), Lee (2006), and Rim et al. (2018), the liberal party favors an expansion in public expenditure and especially increases social welfare and equality-related services over other spending. Conservative spending priorities are opposed to this approach.

	EDE	SDE	Post	Treat	Donor	Work	Aging	Young	Assisted	Density	Emp	Esta	Elecyear	PreElecyear	PostElecyear	Vturnout	Powering	Comp	Conserv	Progress	DID	DDD
EDE	1.000																					
SDE	0.510	1.000																				
Post	0.651	0.241	1.000																			
Treat	-0.219	-0.196	0.000	1.000																		
Donor	-0.035	0.044	0.000	-0.234	1.000																	
Work	-0.066	-0.138	0.111	0.453	-0.128	1.000																
Aging	0.784	0.384	0.530	-0.059	-0.167	0.100	1.000															
Young	-0.527	-0.162	-0.465	-0.046	0.160	-0.509	-0.710	1.000														
Assisted	0.601	0.268	0.202	-0.533	-0.063	-0.236	0.590	-0.369	1.000													
Density	-0.293	-0.361	-0.017	0.675	-0.358	0.533	0.008	-0.217	-0.403	1.000												
Emp	0.361	0.458	0.055	0.141	0.191	0.120	0.322	-0.219	0.085	-0.075	1.000											
Esta	0.354	0.387	0.009	0.065	0.060	0.118	0.385	-0.276	0.190	-0.005	0.931	1.000										
Elecyear	-0.186	-0.098	-0.193	0.000	0.000	-0.029	-0.145	0.141	-0.006	0.004	-0.021	-0.012	1.000									
PreElecyear	0.254	0.166	0.193	0.000	0.000	0.029	0.150	-0.093	0.010	-0.004	0.015	0.012	-0.333	1.000								
PostElecyear	-0.093	-0.118	-0.193	0.000	0.000	-0.028	-0.049	-0.004	-0.003	0.001	-0.002	-0.005	-0.333	-0.333	1.000							
Vturnout	0.451	0.388	0.470	0.197	-0.154	0.134	0.437	-0.329	0.024	0.027	0.302	0.208	-0.133	0.044	0.044	1.000						
Powering	0.118	0.097	0.073	-0.099	0.129	-0.053	0.119	0.031	0.176	-0.148	0.085	0.090	0.032	-0.011	-0.011	0.054	1.000					
Comp	-0.016	0.001	-0.076	-0.233	0.169	-0.073	0.020	-0.037	0.249	-0.160	-0.055	-0.032	0.092	-0.031	-0.031	-0.232	-0.024	1.000				
Conserv	-0.144	0.005	-0.101	-0.031	0.089	0.088	-0.079	-0.122	-0.022	0.039	-0.110	-0.102	0.000	0.000	0.000	-0.280	-0.242	0.273	1.000			
Progress	0.139	-0.035	0.122	0.134	-0.047	-0.110	0.053	0.177	-0.041	-0.036	0.077	0.048	-0.015	0.005	0.005	0.252	0.325	-0.200	-0.864	1.000		
DID	0.165	-0.052	0.470	0.624	-0.146	0.293	0.217	-0.226	-0.270	0.419	0.120	0.037	-0.091	0.091	-0.091	0.341	-0.137	-0.103	-0.129	0.201	1.000	
DDD	0.079	0.093	0.213	0.283	0.266	0.181	0.092	-0.118	-0.174	0.069	0.353	0.211	-0.041	0.041	-0.041	0.174	0.029	-0.020	0.021	0.006	0.453	1.000

Notes: Work: proportion of population between 15 and 64 years of age, Aging: proportion of population over 65 years of age, Young: proportion of population under 5 years of age, Assisted: proportion of public assistance recipient, Density: size of the population of the region divided by the size of its territory (population per km<sup>2</sup>), Emp: number of employees (expressed in per 1000 of population), Esta: number of establishment (expressed in per 1000 of population), Elecyear: Year of election of the head of districts (1 = 2002, 2006, 2010, 2014), PreElecyear: the previous year of the election (2001, 2005, 2009, 2013) PostElecyear: the year after election (2003, 2007, 2011), Vturnout: number of votes cast (valid or invalid) in the most recent election divided by the number of registered voters, Powering: 1 if the same political party that governs autonomous districts also governs national, Comp: Winner's votes - runner-up candidate's votes (to see whether government party with absolute majority), Conserv: 1 for parties defined as conservative, Progress: 1 for parties defined as liberal, progressive, social democratic.

Table 24. The result of Pairwise Correlation (coefficient  $\geq 0.5$ )

Coefficient Value	Pair of Variables		C.C	Coefficient Value	Pair of Variables		C.C
0.7 and over	Esta	Emp	0.931	0.5-0.6	Aging	Assisted	0.590
	Progress	Conserv	-0.864		Density	Work	0.533
	Aging	SDE	0.784		Assisted	Treat	-0.533
	Aging	Young	-0.710		Aging	Post	0.530
0.6 - 0.7	Treat	Density	0.675	Young	SDE	-0.527	
	Post	SDE	0.651	Young	Work	-0.509	
	Treat	DID	0.624	SDE	EDE	0.510	
	Assisted	SDE	0.601				

C.C : Correlation Coefficient

Table 25. VIF Results of Independent Variables

All variables included			Final set of variables		
Variable	VIF	1/VIF	Variable	VIF	1/VIF
Emp	10.420	0.096	YoungPOP	2.650	0.378
Esta	10.280	0.097	WorkPOP	2.120	0.471
Progress	4.590	0.218	AssistedPOP	2.070	0.482
Conserv	4.470	0.224	DENSITY	1.670	0.600
Aging	4.130	0.242	Elecyear	1.540	0.647
Young	3.850	0.259	PostElecyear	1.500	0.665
Assisted	2.930	0.341	PreElecyear	1.500	0.665
Work	2.340	0.427	Vturnout	1.390	0.720
Density	2.010	0.498	Progress	1.330	0.754
Vturnout	1.760	0.570	Powering	1.190	0.840
Elecyear	1.550	0.643	Competition	1.170	0.852
PostElecyear	1.520	0.659	ESTAper1000	1.130	0.887
PreElecyear	1.520	0.659			
Competition	1.240	0.807			
Powering	1.210	0.825			
Mean VIF	3.590		Mean VIF	1.610	

Table 26. Comparing Regression Coefficients Between Models Using Different set of Control Variables (Dependent Variable: EDE)

EDE	Coef.		EDE	Coef.	
Post	0.286	0.172	Post	0.416***	0.122
DID	-0.139	0.090	DID	-0.167*	0.094
Post*Donor	-0.015	0.095	Post*Donor	0.006	0.101
DDD	0.150	0.133	DDD	0.130	0.147
Aging	-0.048	0.043	Young	-0.057	0.064
Assisted	0.008	0.061	Assisted	-0.059	0.048
Work	0.036**	0.014	Density	0.000	0.000
Emp	0.000	0.000	Esta	0.001	0.004
Elecyer	-0.217***	0.065	Elecyer	0.176***	0.056
PreElecyer	0.090**	0.043	PreElecyer	0.049	0.030
PostElecyer	-0.011	0.036	PostElecyer	0.010	0.036
Vturnout	0.012**	0.005	Vturnout	0.013*	0.007
Powering	0.094**	0.042	Powering	0.122**	0.047
Competition	0.001	0.001	Competition	0.002**	0.001
Conserv	0.177***	0.055	Progress	-0.224***	0.054
Time Effect	Yes		Time Effect	Yes	
_cons	8.184***	1.157	_cons	10.472	0.733
sigma_u	0.675		sigma_u	0.512	
sigma_e	0.284		sigma_e	0.286	
rho	0.849		Rho	0.762	
N	828		N	828	
R-squared (within)	0.441		R-squared (within)	0.433	
R-squared (between)	0.369		R-squared (between)	0.022	
R-squared (overall)	0.004		R-squared (overall)	0.150	
corr(u_i, Xb)	-0.546		corr(u_i, Xb)	-0.066	
F-stat. (P-value)	F(22, 68)=36.51		Wald	F(22,68)=35.48	

Note: \*, \*\*, \*\*\* mean that coefficients of variables are statistically significant under 10%, 5%, 1% critical values respectively. The difference between Model 1 and Model 2 was that Model 1 included Aging, Assisted, Work, Emp as demographic factors, while Model 2 included Young, Assisted, Density, and Esta as demographic factors. Also, Model 1 included Conserv as political variables, while Model 2 included Progress as political variable.

Notes: Work: proportion of population aged 15-64, Aging: proportion of population over 65 years of age, Young: proportion of population under 5 years of age, Assisted: proportion of public assistance recipient, Density: size of the population of the region divided by the size of its territory (population per km<sup>2</sup>), Emp: number of employees (expressed in per 1000 of population), Esta: number of establishment (expressed in per 1000 of population), Elecyer: Year of election of the head of districts, PreElecyer: the previous year of the election, PostElecyer: the year after election, Vturnout: number of votes cast in the most recent election divided by the number of registered voters, Powering: 1 if the same political party that governs autonomous districts also governs national, Comp: Winner's votes – runner-up candidate's votes, Conserv: 1 for parties defined as conservative, Progress: 1 for parties defined as liberal, progressive, social democratic.

Table 27. Comparing Regression Coefficients Between Models Using Different set of Control Variables (Dependent Variable: SDE)

Model 1			Model 2		
Variables	Coef.		Variables	Coef.	
Post	0.768***	0.071	Post	0.700***	0.068
DID	0.053	0.036	DID	0.041	0.036
Post*Donor	0.007	0.036	Post*Donor	0.008	0.036
DDD	-0.161***	0.048	DDD	-0.119**	0.050
Aging	-0.017	0.017	Young	-0.069***	0.026
Assisted	0.088***	0.027	Assisted	0.057**	0.021
Work	0.017***	0.006	Density	0.000	0.000
Emp	0.000	0.000	Esta	0.002	0.001
Elecyear	-0.237***	0.027	Elecyear	-0.142***	0.014
PreElecyear	0.161***	0.014	PreElecyear	0.146***	0.008
PostElecyear	-0.124***	0.012	PostElecyear	-0.114***	0.008
Vturnout	-0.002	0.002	Vturnout	-0.003	0.002
Powering	0.003	0.012	Powering	0.007	0.014
Competition	0.001*	0.000	Competition	0.001**	0.000
Conserv	0.003	0.014	Progress	0.000	0.016
Time Effect	Yes		Time Effect	Yes	
_cons	11.032***	0.491	_cons	12.608**	0.205
				*	
sigma_u	0.232		sigma_u	0.182	
sigma_e	0.091		sigma_e	0.091	
rho	0.866		Rho	0.802	
N	828		N	828	
R-squared (within)	0.945		R-squared (within)	0.946	
R-squared (between)	0.427		R-squared (between)	0.604	
R-squared (overall)	0.721		R-squared (overall)	0.814	
corr(u_i, Xb)	0.099		corr(u_i, Xb)	0.084	
F-stat. (P-value)	(22,68)=459.44		F-stat. (P-value)	(22,68)=425.35	

Note: \*, \*\*, \*\*\* mean that coefficients of variables are statistically significant under 10%, 5%, 1% critical values respectively. The difference between Model 1 and Model 2 is that Model 1 included Aging, Assisted, Work, Emp as demographic factors, while Model 2 included Young, Assisted, Density, and Esta as demographic factors. Also, Model 1 included Conserv as political variables, while Model 2 included Progress as political variable.

Notes: Work: proportion of population aged 15-64, Aging: proportion of population over 65 years of age, Young: proportion of population under 5 years of age, Assisted: proportion of public assistance recipient, Density: size of the population of the region divided by the size of its territory (population per km<sup>2</sup>), Emp: number of employees (expressed in per 1000 of population), Esta: number of establishment (expressed in per 1000 of population), Elecyear: Year of election of the head of districts, PreElecyear: the previous year of the election, PostElecyear: the year after election, Vturnout: number of votes cast in the most recent election divided by the number of registered voters, Powering: 1 if the same political party that governs autonomous districts also governs national, Comp: Winner's votes – runner-up candidate's votes, Conserv: 1 for parties defined as conservative, Progress: 1 for parties defined as liberal, progressive, social democratic.

**Appendix D**  
**DESCRIPTIVE DATA**

Table 28 provides a detailed description of the data for different subsamples – the control, treatment, recipient, and donor group, separately pre and post treatment. Most of the treated group are defined as recipient districts (19 out of 25). The share of the elderly (aged 65 or more), public assistance recipients, and working population (aged 15–64) are the proportion terms (percent). Only the monetary variables were entered in natural logs.

Table 28. Statistical tables of means, counts, standard deviations

		Control Group		Treated Group		Recipient		Donor	
		Before	After	Before	After	Before	After	Before	After
		SPTS	SPTS	SPTS	SPTS	SPTS	SPTS	SPTS	SPTS
POP	M	277,517.0	279,846.2	407,777.2	409,062.5	413629.9	410246.3	389243.6	405313.9
	S.D	(134515.2)	(139327.0)	(120369.8)	(129033.4)	(100403.4)	(107052.8)	(169321.1)	(184011.8)
Work	M	73.67	74.36	75.98	76.08	75.75	75.93	76.73	76.56
	S.D	(2.36)	(1.81)	(1.62)	(1.23)	(1.36)	(1.16)	(2.12)	(1.32)
Aging	M	7.23	10.14	6.85	9.84	6.8	9.87	6.99	9.76
	S.D	(2.18)	(3.13)	(1.38)	(1.78)	(1.23)	(1.62)	(1.78)	(2.24)
Young	M	5.35	4.21	5.16	4.18	5.26	4.21	4.84	4.1
	S.D	(1.42)	(0.99)	(0.63)	(0.43)	(0.58)	(0.43)	(0.67)	(0.41)
Assisted	M	3.06	3.72	1.69	2.05	1.78	2.15	1.39	1.72
	S.D	(1.15)	(1.45)	(0.70)	(0.73)	(0.70)	(0.69)	(0.62)	(0.76)
Density	M	8070.55	7722.96	17869.17	17801.14	19258.46	19074.50	13469.78	13768.83
	S.D	(5423.90)	(5081.63)	(5214.22)	(5141.15)	(4909.84)	(4927.20)	(3423.41)	(3483.68)
Emp	M	359.50	395.70	464.18	517.22	298.74	346.65	988.06	1057.37
	S.D	(225.96)	(258.43)	(534.58)	(561.90)	(246.85)	(281.31)	(805.23)	(832.93)
Esta	M	78.89	81.13	89.32	88.49	67.67	69.50	157.86	148.62
	S.D	(48.56)	(48.83)	(92.81)	(84.99)	(38.72)	(40.37)	(159.61)	(143.51)
Vturnout	M	44.77	49.83	47.00	51.96	46.64	51.80	48.14	52.45
	S.D	(5.78)	(5.12)	(2.34)	(2.57)	(2.25)	(2.75)	(2.29)	(1.86)
Comp	M	34.70	26.53	16.86	21.19	13.91	20.25	26.19	24.19
	S.D	(30.42)	(21.96)	(15.64)	(14.15)	(12.87)	(11.84)	(19.70)	(19.69)
SDE	M	12.54	13.15	12.34	12.93	12.30	12.47	13.15	12.94
	S.D	(0.40)	(0.30)	(0.33)	(0.28)	(0.29)	(0.42)	(0.30)	(0.40)
EDE	M	11.10	11.47	10.94	11.13	10.87	11.15	11.47	11.47
	S.D	(0.64)	(0.64)	(0.45)	(0.54)	(0.41)	(0.51)	(0.64)	(0.51)
SDE%	M	0.53	0.58	0.42	0.52	0.43	0.40	0.58	0.46
	S.D	(0.09)	(0.08)	(0.06)	(0.08)	(0.06)	(0.06)	(0.08)	(0.07)
EDE%	M	0.13	0.12	0.11	0.09	0.11	0.11	0.12	0.12
	S.D	(0.06)	(0.05)	(0.03)	(0.04)	(0.03)	(0.03)	(0.05)	(0.06)
Obs.		264	264	150	150	114	114	36	36

Notes: Work: proportion of population aged 15-64, Aging: proportion of population over 65 years of age, Young: proportion of population under 5 years of age, Assisted: proportion of public assistance recipient, Density : size of the population of the region divided by the size of its territory (population per km2), Emp: number of employees (expressed in per 1000 of population), Esta: number of establishment (expressed in per 1000 of population), Vturnout: number of votes cast in the most recent election divided by the number of registered voters, Comp: Winner's votes – runner-up candidate's votes.

## Appendix E

### MEANS OF DEMOGRAPHIC DATA AND ITS TREND BY YEAR (2002-2016)

Table 29. Population ages 65 and above (left) and Working population (15-64) (right)

Year	Population ages 65 and above (% of total population)				Working population (15-64) (% of total population)			
	Control Group	Treat Group	Recipient	Donor	Control Group	Treat Group	Recipient	Donor
2002	6.25	5.93	5.83	6.25	73.54	76.31	75.74	78.10
2003	6.58	6.17	6.13	6.30	73.56	75.60	75.60	75.61
2004	6.96	6.56	6.53	6.66	73.65	76.07	75.86	76.76
2005	7.40	7.02	6.98	7.14	73.70	76.05	75.85	76.68
2006	7.83	7.44	7.41	7.55	73.74	75.91	75.70	76.57
2007	8.33	7.96	7.93	8.04	73.86	75.95	75.74	76.65
2008	8.99	8.60	8.60	8.59	74.01	76.03	75.82	76.71
2009	9.45	9.04	9.04	9.03	74.02	75.92	75.72	76.55
2010	9.92	9.51	9.53	9.43	74.21	76.00	75.82	76.57
2011	10.41	10.23	10.25	10.16	74.39	76.12	75.97	76.59
2012	10.74	10.51	10.56	10.39	74.74	76.23	76.13	76.55
2013	11.36	11.18	11.25	10.97	74.81	76.18	76.11	76.40
2014	11.98	11.77	11.85	11.53	74.59	75.90	75.85	76.07
2015	12.62	12.38	12.45	12.14	74.36	75.68	75.65	75.75
2016	13.16	12.90	13.00	12.59	74.10	75.44	75.43	75.48
Obs.	44	25	19	6	44	25	19	6

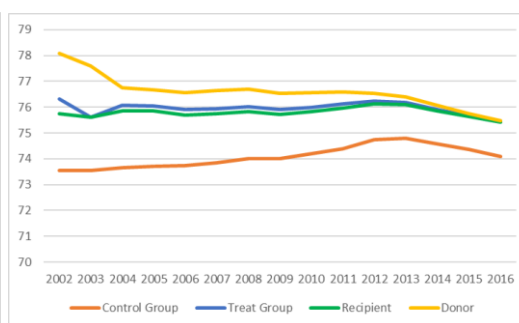
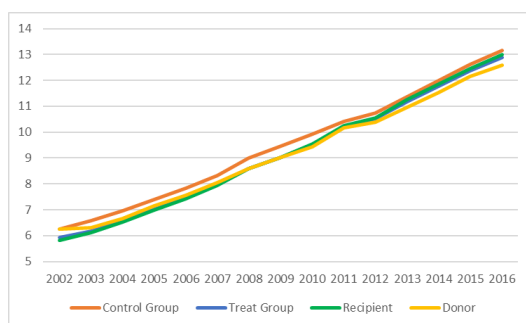


Table 30. Total population (left) and Density (right)

	% of public assistance recipients (t-1)				Density (t-1)			
	Control Group	Treatment Group	Recipient	Donor	Control Group	Treatment Group	Recipient	Donor
2002	2.90	1.64	1.74	1.33	8227.8	17932.8	19305.5	13586.0
2003	2.74	1.52	1.61	1.24	8189.2	17972.5	19295.0	13784.5
2004	2.83	1.54	1.63	1.23	8135.7	17870.1	19222.8	13586.8
2005	3.00	1.66	1.75	1.36	8027.3	17818.2	19235.6	13329.6
2006	3.36	1.82	1.91	1.52	7964.2	17802.2	19239.9	13249.6
2007	3.54	1.94	2.03	1.64	7879.1	17819.2	19252.0	13282.3
2008	3.65	2.02	2.11	1.73	7823.1	17816.6	19210.1	13403.9
2009	3.69	2.03	2.12	1.74	7787.1	17816.0	19175.7	13510.3
2010	3.86	2.12	2.22	1.78	7706.4	17761.1	19030.1	13742.5
2011	3.88	2.12	2.24	1.76	7659.6	17724.3	18943.6	13863.1
2012	3.70	2.03	2.14	1.68	7695.6	17892.4	19103.6	14057.0
2013	3.56	1.98	2.10	1.63	7666.0	17796.5	18983.9	14036.1
2014	3.48	2.02	2.14	1.64	7629.5	17693.1	18901.1	13867.8
2015	3.43	2.07	2.20	1.67	7577.2	17595.9	18807.7	13758.5
2016	4.21	2.61	2.79	2.04	7546.2	17486.4	18671.8	13732.9
Total	3.46	1.94	2.05	1.60	7834.3	17786.5	19091.9	13652.7
	44	25	19	6	44	25	19	6

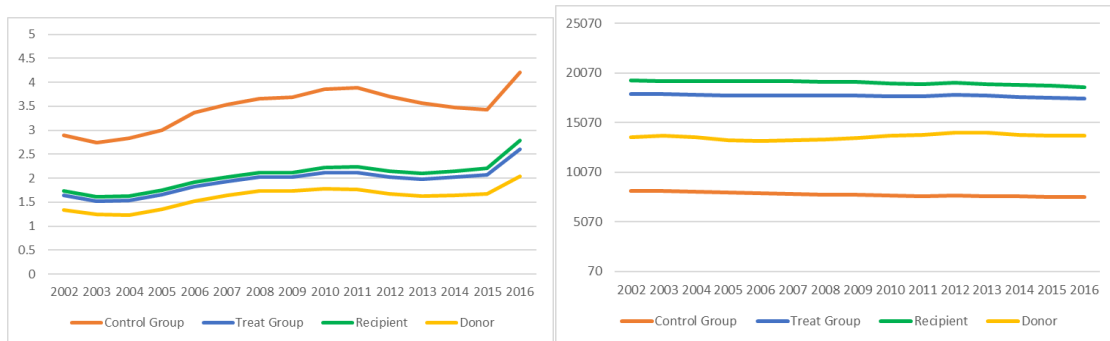


Table 31. Population ages 65 and above (left) and Working population (15-64) (right) (% of total population)

Year	Population ages 65 and above (% of total population)				Working population (15-64) (% of total population)			
	Control Group	Treat Group	Recipient	Donor	Control Group	Treat Group	Recipient	Donor
2002	6.25	5.93	5.83	6.25	73.54	76.31	75.74	78.10
2003	6.58	6.17	6.13	6.30	73.56	75.60	75.60	75.61
2004	6.96	6.56	6.53	6.66	73.65	76.07	75.86	76.76
2005	7.40	7.02	6.98	7.14	73.70	76.05	75.85	76.68
2006	7.83	7.44	7.41	7.55	73.74	75.91	75.70	76.57
2007	8.33	7.96	7.93	8.04	73.86	75.95	75.74	76.65
2008	8.99	8.60	8.60	8.59	74.01	76.03	75.82	76.71
2009	9.45	9.04	9.04	9.03	74.02	75.92	75.72	76.55
2010	9.92	9.51	9.53	9.43	74.21	76.00	75.82	76.57
2011	10.41	10.23	10.25	10.16	74.39	76.12	75.97	76.59
2012	10.74	10.51	10.56	10.39	74.74	76.23	76.13	76.55
2013	11.36	11.18	11.25	10.97	74.81	76.18	76.11	76.40
2014	11.98	11.77	11.85	11.53	74.59	75.90	75.85	76.07
2015	12.62	12.38	12.45	12.14	74.36	75.68	75.65	75.75
2016	13.16	12.90	13.00	12.59	74.10	75.44	75.43	75.48
Total	9.46	9.15	9.16	9.12	74.08	75.96	75.80	76.47
Obs.	44	25	19	6	44	25	19	6

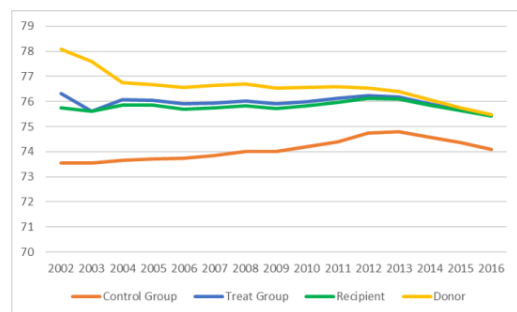
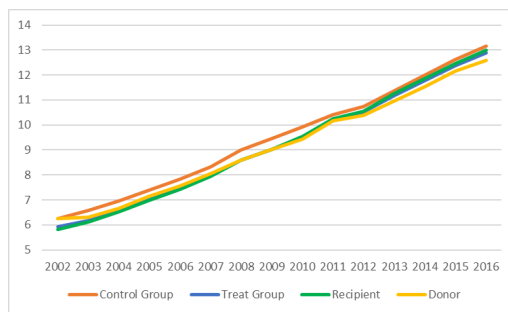
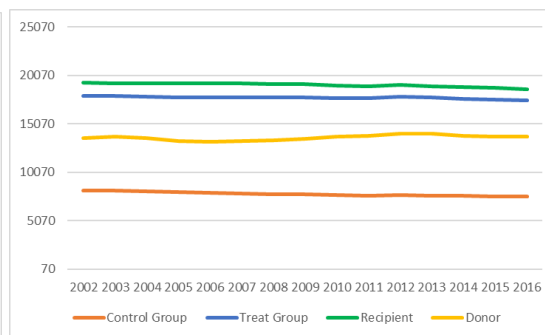
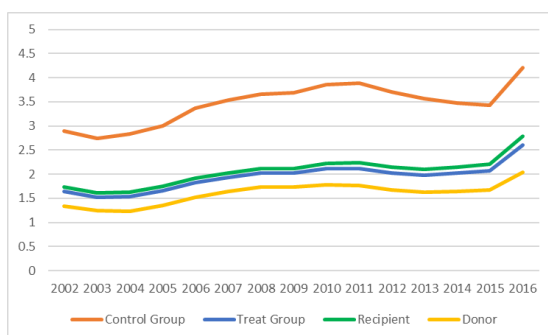


Table 32. The share of public assistance recipients (left) and Density (right)

	% of public assistance recipients (t-1)				Density (t-1)			
	Control Group	Treat Group	Recipient	Donor	Control Group	Treat Group	Recipient	Donor
2002	2.90	1.64	1.74	1.33	8227.8	17932.8	19305.5	13586.0
2003	2.74	1.52	1.61	1.24	8189.2	17972.5	19295.0	13784.5
2004	2.83	1.54	1.63	1.23	8135.7	17870.1	19222.8	13586.8
2005	3.00	1.66	1.75	1.36	8027.3	17818.2	19235.6	13329.6
2006	3.36	1.82	1.91	1.52	7964.2	17802.2	19239.9	13249.6
2007	3.54	1.94	2.03	1.64	7879.1	17819.2	19252.0	13282.3
2008	3.65	2.02	2.11	1.73	7823.1	17816.6	19210.1	13403.9
2009	3.69	2.03	2.12	1.74	7787.1	17816.0	19175.7	13510.3
2010	3.86	2.12	2.22	1.78	7706.4	17761.1	19030.1	13742.5
2011	3.88	2.12	2.24	1.76	7659.6	17724.3	18943.6	13863.1
2012	3.70	2.03	2.14	1.68	7695.6	17892.4	19103.6	14057.0
2013	3.56	1.98	2.10	1.63	7666.0	17796.5	18983.9	14036.1
2014	3.48	2.02	2.14	1.64	7629.5	17693.1	18901.1	13867.8
2015	3.43	2.07	2.20	1.67	7577.2	17595.9	18807.7	13758.5
2016	4.21	2.61	2.79	2.04	7546.2	17486.4	18671.8	13732.9
Total	3.46	1.94	2.05	1.60	7834.3	17786.5	19091.9	13652.7
	44	25	19	6	44	25	19	6



**Appendix F**  
**THE PROPERTY TAX REVENUE DATA**

Table 33. The Property Tax Revenue Before and After the SPTS in 2008

Property taxes Year: 2008	Before the SPTS			After the SPTS applied			Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	9242.6	6398.3	15640.9	9242.6	6398.3	15640.9	0.0
Gangnam	1,951.4	1,313.6	3,265.0	1,951.4	255.9	2,207.3	-1,057.7
Seocho	1,106.2	750.4	1,856.6	1,106.2	255.9	1,362.1	-494.5
Songpa	947.0	640.5	1,587.5	947.0	255.9	1,203.0	-384.5
Jung	478.0	329.4	807.3	478.0	255.9	733.9	-73.4
Yeongdeugpo	423.6	292.8	716.4	423.6	255.9	679.5	-36.9
Yongsan	392.5	270.9	663.4	392.5	255.9	648.4	-15.0
Jongno	357.4	248.5	605.9	357.4	255.9	613.4	7.4
Yangcheon	339.2	237.2	576.3	339.2	255.9	595.1	18.7
Gangdong	328.1	228.2	556.3	328.1	255.9	584.1	27.7
Gangseo	312.0	202.4	514.5	312.0	255.9	568.0	53.5
Mapo	278.7	195.0	473.8	278.7	255.9	534.7	60.9
Gwangn	221.0	158.1	379.1	221.0	255.9	476.9	97.8
Seongdong	206.5	147.2	353.7	206.5	255.9	462.4	108.7
Guro	201.7	144.2	345.9	201.7	255.9	457.6	111.8
Dondaemun	199.9	143.0	343.0	199.9	255.9	455.9	112.9
Seongbuk	196.6	141.0	337.7	196.6	255.9	452.6	114.9
Dongjak	192.5	138.5	331.0	192.5	255.9	448.4	117.4
Gwanak	189.8	136.0	325.8	189.8	255.9	445.7	119.9
Nowon	184.2	132.4	316.6	184.2	255.9	440.2	123.5
Seodaemun	157.8	114.6	272.4	157.8	255.9	413.7	141.3
Eunpyong	134.0	99.0	233.0	134.0	255.9	389.9	156.9
Junrang	116.6	87.4	204.1	116.6	255.9	372.6	168.5
Dobong	115.8	86.8	202.6	115.8	255.9	371.7	169.1
Geumcheon	112.5	84.8	197.4	112.5	255.9	368.5	171.1
Gangbuk	99.7	76.1	175.9	99.7	255.9	355.7	179.8
Total	9,242.6	6,398.3	15,640.9	9,242.6	6,398.3	15,640.9	0.0

Source: Kwon (2012)'s study and Seoul Statistical Yearbook (Unit: 100 million KRW, Collected amount)

Note: the SPTS pool refers to the 40% of property tax revenue except for unpaid property taxes and taxes levied on boats and aircrafts.

Table 34. The Property Tax Revenue Before and After the SPTS in 2009

Property taxes Year: 2009	Before the SPTS			After the SPTS applied			Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	8596.5	6637.3	15233.8	8596.5	6637.3	15233.8	0.0
Gangnam	1613.1	1319.3	2932.4	1613.1	265.5	1878.6	-1053.8
Seocho	866.8	701.6	1568.5	866.8	265.5	1132.3	-436.2
Songpa	748.2	603.1	1351.3	748.2	265.5	1013.7	-337.6
Jung	482.4	378.5	860.8	482.4	265.5	747.9	-113.0
Yeongdeugpo	393.0	306.2	699.2	393.0	265.5	658.5	-40.7
Yongsan	361.7	281.8	643.6	361.7	265.5	627.2	-16.4
Jongno	357.7	277.2	634.9	357.7	265.5	623.2	-11.7
Gangdong	307.5	235.3	542.8	307.5	265.5	573.0	30.2
Gangseo	309.9	217.8	527.7	309.9	265.5	575.3	47.7
Mapo	284.5	218.5	503.0	284.5	265.5	550.0	47.0
Yangcheon	261.1	199.5	460.6	261.1	265.5	526.6	66.0
Seongdong	226.1	167.9	394.0	226.1	265.5	491.6	97.6
Dondaemun	222.0	164.8	386.8	222.0	265.5	487.5	100.7
Guro	220.2	163.4	383.7	220.2	265.5	485.7	102.1
Gwangn	219.5	163.5	383.0	219.5	265.5	485.0	102.0
Seongbuk	210.8	156.0	366.8	210.8	265.5	476.3	109.5
Gwanak	210.6	155.1	365.7	210.6	265.5	476.1	110.4
Nowon	208.9	153.8	362.7	208.9	265.5	474.4	111.7
Dongjak	208.1	153.2	361.4	208.1	265.5	473.6	112.3
Seodaemun	175.1	126.3	301.4	175.1	265.5	440.6	139.2
Eunpyong	163.7	116.8	280.5	163.7	265.5	429.2	148.7
Junrang	142.2	99.1	241.3	142.2	265.5	407.7	166.4
Geumcheon	140.2	97.5	237.7	140.2	265.5	405.7	168.0
Dobong	136.3	94.5	230.7	136.3	265.5	401.8	171.0
Gangbuk	126.9	86.7	213.5	126.9	265.5	392.4	178.8

Source: Kwon (2012)'s study and Seoul Statistical Yearbook (Unit: 100 million KRW, Collected amount)

Note: the SPTS pool refers to the 45% of property tax revenue except for unpaid property taxes and taxes levied on boats and aircrafts.

Table 35. The Property Tax Revenue Before and After the SPTS in 2010

Property taxes Year: 2010	Before the SPTS		After the SPTS applied			Change	
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)		After the SPTS (C+D)
Total	7831.6	8139.1	15970.6	7831.6	8139.0	15970.6	-0.1
Gangnam	1676.9	1688.5	3365.5	1676.9	325.6	2002.5	-1363.0
Seocho	890.2	907.2	1797.4	890.2	325.6	1215.8	-581.6
Songpa	769.6	781.9	1551.5	769.6	325.6	1095.2	-456.3
Jung	420.1	436.6	856.7	420.1	325.6	745.7	-111.0
Yeongdeugpo	360.7	374.1	734.7	360.7	325.6	686.3	-48.5
Yongsan	338.0	350.9	688.9	338.0	325.6	663.5	-25.3
Jongno	304.8	317.6	622.4	304.8	325.6	630.4	8.0
Gangdong	277.2	290.8	567.9	277.2	325.6	602.7	34.8
Mapo	253.9	266.3	520.2	253.9	325.6	579.5	59.2
Gangseo	264.4	251.7	516.1	264.4	325.6	590.0	73.9
Yangcheon	245.6	258.4	504.0	245.6	325.6	571.1	67.2
Seongdong	186.8	199.7	386.5	186.8	325.6	512.4	125.9
Gwangn	177.9	192.1	370.0	177.9	325.6	503.4	133.4
Guro	175.3	188.5	363.8	175.3	325.6	500.9	137.1
Dondaemun	174.0	186.8	360.8	174.0	325.6	499.6	138.8
Seongbuk	168.0	181.5	349.6	168.0	325.6	493.6	144.0
Gwanak	166.0	179.2	345.2	166.0	325.6	491.6	146.4
Dongjak	165.7	179.1	344.8	165.7	325.6	491.2	146.5
Nowon	164.5	177.7	342.3	164.5	325.6	490.1	147.9
Seodaemun	138.4	149.9	288.3	138.4	325.6	464.0	175.7
Eunpyong	127.8	141.6	269.4	127.8	325.6	453.3	184.0
Geumcheon	104.3	117.2	221.5	104.3	325.6	429.8	208.4
Junrang	98.8	113.1	211.9	98.8	325.6	424.3	212.5
Dobong	95.4	108.3	203.7	95.4	325.6	420.9	217.2
Gangbuk	87.2	100.6	187.9	87.2	325.6	412.8	224.9

Source: Kwon (2012)'s study and Seoul Statistical Yearbook (Unit: 100 million KRW, Collected amount)

Note: the SPTS pool refers to the 50% of property tax revenue except for unpaid property taxes and taxes levied on boats and aircrafts

Table 36. The Property Tax Revenue Before and After the SPTS in 2011 (a)

Property taxes Year: 2011	Before the SPTS			After the SPTS applied			Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	8,331.6	8,302.6	16,634.2	8,331.6	8,302.5	16,634.1	0.0
Gangnam	1,684.9	1,684.9	3,369.8	1,684.9	332.1	2,017.0	-1,352.8
Seocho	929.0	928.9	1,857.9	929.0	332.1	1,261.1	-596.8
Songpa	793.4	792.8	1,586.2	793.4	332.1	1,125.5	-460.7
Jung	445.7	445.5	891.2	445.7	332.1	777.8	-113.4
Yeongdeugpo	376.1	375.6	751.8	376.1	332.1	708.2	-43.5
Yongsan	369.8	369.8	739.6	369.8	332.1	701.9	-37.7
Jongno	320.8	320.9	641.7	320.8	332.1	652.9	11.2
Gangdong	299.5	299.4	599.0	299.5	332.1	631.6	32.7
Mapo	283.1	282.2	565.4	283.1	332.1	615.2	49.9
Gangseo	277.8	251.5	529.3	277.8	332.1	609.9	80.6
Yangcheon	262.8	263.1	525.9	262.8	332.1	594.9	69.1
Seongdong	205.4	205.5	410.9	205.4	332.1	537.5	126.7
Gwangn	198.1	198.1	396.2	198.1	332.1	530.2	134.0
Dondaemun	193.6	193.2	386.8	193.6	332.1	525.7	138.9
Guro	192.3	192.6	384.9	192.3	332.1	524.4	139.6
Seongbuk	188.8	188.8	377.6	188.8	332.1	520.9	143.3
Dongjak	187.2	187.2	374.4	187.2	332.1	519.3	144.9
Gwanak	182.4	182.3	364.7	182.4	332.1	514.5	149.8
Nowon	181.8	181.8	363.5	181.8	332.1	513.9	150.4
Eunpyong	151.1	151.1	302.2	151.1	332.1	483.2	181.0
Seodaemun	151.0	151.2	302.1	151.0	332.1	483.1	180.9
Geumcheon	129.5	129.1	258.5	129.5	332.1	461.6	203.1
Junrang	117.2	117.2	234.4	117.2	332.1	449.3	214.9
Dobong	108.3	108.3	216.6	108.3	332.1	440.4	223.8
Gangbuk	101.9	101.9	203.8	101.9	332.1	434.0	230.3

Source: Kwon (2012)'s study

Note: the SPTS pool refers to the 50% of property tax revenue except for unpaid property taxes and taxes levied on boats and aircrafts

Table 37. The Property Tax Revenue Before and After the SPTS in 2011 (b)

Property taxes Year: 2011	Before the SPTS		After the SPTS applied				Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	8,441	8,441	16,882	8,441	8,441	16,882	0
Gangnam	1,711	1,711	3,421	1,711	338	2,048	-1,373
Seocho	950	950	1,899	950	338	1,287	-612
Songpa	798	798	1,595	798	338	1,135	-460
Jung	454	454	908	454	338	792	-116
Yeongdeugpo	381	381	761	381	338	718	-43
Yongsan	374	374	748	374	338	712	-36
Jongno	330	330	660	330	338	668	8
Gangdong	305	305	609	305	338	642	33
Mapo	287	287	573	287	338	624	51
Gangseo	257	257	513	257	338	594	81
Yangcheon	267	267	533	267	338	604	71
Seongdong	208	208	415	208	338	545	130
Gwangn	202	202	404	202	338	540	136
Dondaemun	196	196	392	196	338	534	142
Guro	197	197	393	197	338	534	141
Seongbuk	193	193	386	193	338	531	145
Dongjak	194	194	388	194	338	532	144
Gwanak	186	186	371	186	338	523	152
Nowon	185	185	369	185	338	522	153
Eunpyong	153	153	306	153	338	491	185
Seodaemun	154	154	308	154	338	492	184
Geumcheon	129	129	258	129	338	467	209
Junrang	121	121	242	121	338	459	217
Dobong	111	111	221	111	338	448	227
Gangbuk	105	105	209	105	338	442	233

Source: SMG' official announcement in 2011.

Note: urban planning related taxes have merged into property tax in 2011<sup>46</sup>

<sup>46</sup> <https://m.mt.co.kr/renew/view.html?no=2011091810444111795&googleamp> and <https://go.seoul.co.kr/news/newsView.php?id=20110919012008>

Table 38. The Property Tax Revenue Before and After the SPTS in 2012 (a)

Property taxes Year: 2012	Before the SPTS			After the SPTS applied			Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	8,788.8	8,764.7	17,553.5	8,788.8	8,764.7	17,553.5	0.0
Gangnam	1,724.1	1,723.4	3,447.5	1,724.1	350.6	2,074.7	-1,372.9
Seocho	996.2	991.7	1,987.9	996.2	350.6	1,346.8	-641.1
Songpa	809.6	809.5	1,619.1	809.6	350.6	1,160.2	-458.9
Jung	472.9	473.1	946.0	472.9	350.6	823.4	-122.5
Yeongdeugpo	395.7	395.5	791.3	395.7	350.6	746.3	-45.0
Yongsan	395.5	395.2	790.7	395.5	350.6	746.1	-44.6
Jongno	346.3	346.1	692.4	346.3	350.6	696.8	4.5
Gangdong	315.8	315.7	631.5	315.8	350.6	666.4	34.9
Mapo	307.7	306.8	614.4	307.7	350.6	658.2	43.8
Gangseo	299.0	280.7	579.7	299.0	350.6	649.5	69.8
Yangcheon	272.3	272.2	544.5	272.3	350.6	622.8	78.4
Seongdong	226.7	226.7	453.4	226.7	350.6	577.3	123.9
Guro	212.9	213.6	426.4	212.9	350.6	563.4	137.0
Gwangn	212.4	212.4	424.8	212.4	350.6	563.0	138.2
Dondaemun	204.7	204.5	409.3	204.7	350.6	555.3	146.0
Seongbuk	203.1	203.1	406.2	203.1	350.6	553.7	147.5
Dongjak	201.6	201.6	403.2	201.6	350.6	552.2	149.0
Gwanak	193.7	193.7	387.4	193.7	350.6	544.3	156.9
Nowon	188.1	188.3	376.3	188.1	350.6	538.6	162.3
Eunpyong	165.3	165.3	330.6	165.3	350.6	515.9	185.3
Seodaemun	160.5	160.5	320.9	160.5	350.6	511.1	190.1
Geumcheon	137.1	137.4	274.5	137.1	350.6	487.7	213.2
Junrang	126.3	126.2	252.5	126.3	350.6	476.8	224.4
Dobong	113.7	113.8	227.4	113.7	350.6	464.2	236.8
Gangbuk	107.8	107.8	215.6	107.8	350.6	458.4	242.8

Source: Kwon (2012)'s study

Note: the SPTS pool refers to the 50% of property tax revenue except for unpaid property taxes and taxes levied on boats and aircrafts

Table 39. The Property Tax Revenue Before and After the SPTS in 2012 (b)

Property taxes Year: 2012	Before the SPTS			After the SPTS applied			Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	8,331.60	8,302.6	16633.9	8,331.6	8,358.0	16689.1	55.2
Gangnam	1,684.9	1,684.9	3369.8	1,684.9	334.3	2019.2	-1350.6
Seocho	929.0	928.9	1857.9	929.0	334.3	1263.3	-594.6
Songpa	793.4	792.8	1586.2	793.4	334.3	1127.7	-458.5
Jung	445.7	445.5	891.2	445.7	334.3	780.0	-111.2
Yeongdeugpo	376.1	375.6	751.7	376.1	334.3	710.4	-41.3
Yongsan	369.8	369.8	739.6	369.8	334.3	704.1	-35.5
Jongno	320.8	320.9	641.7	320.8	334.3	655.1	13.4
Gangdong	299.5	299.4	598.9	299.5	334.3	633.8	34.9
Mapo	283.1	282.2	565.3	283.1	334.3	617.4	52.1
Gangseo	277.8	251.5	529.3	277.8	334.3	612.1	82.8
Yangcheon	262.8	263.0	525.8	262.8	334.3	597.1	71.3
Seongdong	205.4	205.4	410.8	205.4	334.3	539.7	128.9
Gwangn	198.1	192.5	390.6	192.3	334.3	532.4	141.8
Dondaemun	193.6	198.1	391.7	198.1	334.3	527.9	136.2
Guro	192.3	193.2	385.5	193.6	334.3	526.6	141.1
Seongbuk	188.8	188.8	377.6	188.8	334.3	523.1	145.5
Dongjak	187.2	187.2	374.4	187.2	334.3	521.5	147.1
Gwanak	182.4	182.3	364.7	182.4	334.3	516.7	152.0
Nowon	181.8	181.7	363.5	181.8	334.3	516.1	152.6
Eunpyong	151.1	151.1	302.2	151.1	334.3	485.4	183.2
Seodaemun	151.0	151.2	302.2	151.0	334.3	485.3	183.1
Geumcheon	129.5	129.0	258.5	129.5	334.3	463.8	205.3
Junrang	117.2	117.2	234.4	117.2	334.3	451.5	217.1
Dobong	108.3	108.3	216.6	108.3	334.3	442.6	226.0
Gangbuk	101.9	101.8	203.7	101.9	334.3	436.2	232.5

Source: Bae et al (2012)'s study

Note: the SPTS pool refers to the 50% of property tax revenue except for unpaid property taxes and taxes levied on boats and aircrafts

Table 40. The Property Tax Revenue Before and After the SPTS in 2015

Property taxes Year: 2015	Before the SPTS			After the SPTS applied			Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	9,487.4	9,445.6	18,933.0	9,487.4	9,445.6	18,933.0	-
Gangnam	1,853.9	1,851.1	3,705.0	1,853.9	377.8	2,231.7	-1,473.3
Seocho	1,032.5	1,032.1	2,064.6	1,032.5	377.8	1,410.3	-654.2
Songpa	867.4	867.0	1,734.4	867.4	377.8	1,245.2	-489.2
Jung	532.1	531.8	1,064.0	532.1	377.8	910.0	-154.0
Yeongdeugpo	430.6	430.4	861.0	430.6	377.8	808.5	-52.5
Yongsan	386.5	386.4	772.9	386.5	377.8	764.3	-8.6
Jongno	380.0	379.7	759.7	380.0	377.8	757.8	-1.9
Mapo	364.2	364.3	728.5	364.2	377.8	742.1	13.6
Gangseo	380.4	345.7	726.1	380.4	377.8	758.2	32.2
Gangdong	321.5	321.3	642.8	321.5	377.8	699.3	56.5
Yangcheon	272.0	271.8	543.9	272.0	377.8	649.9	106.0
Seongdong	246.4	246.2	492.6	246.4	377.8	624.2	131.6
Guro	227.6	227.8	455.3	227.6	377.8	605.4	150.1
Gwangn	227.5	227.4	454.9	227.5	377.8	605.3	150.4
Dongjak	219.3	219.3	438.6	219.3	377.8	597.2	158.6
Seongbuk	217.9	216.9	434.7	217.9	377.8	595.7	161.0
Dondaemun	215.0	214.9	430.0	215.0	377.8	592.9	162.9
Gwanak	207.5	207.4	414.8	207.5	377.8	585.3	170.4
Nowon	199.0	198.9	398.0	199.0	377.8	576.9	178.9
Eunpyong	192.5	192.4	384.9	192.5	377.8	570.3	185.4
Seodaemun	177.1	176.8	353.9	177.1	377.8	554.9	201.0
Geumcheon	159.9	159.6	319.5	159.9	377.8	537.7	218.2
Junrang	142.0	141.9	283.9	142.0	377.8	519.8	235.9
Gangbuk	118.1	118.0	236.1	118.1	377.8	495.9	259.8
Dobong	116.4	116.4	232.8	116.4	377.8	494.3	261.4

Source: SMG internal data

Table 41. The Property Tax Revenue Before and After the SPTS in 2016

Property taxes Year: 2016	Before the SPTS			After the SPTS applied			Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	10,177.9	10,120.2	20,298.1	10,177.9	10,120.2	20,298.1	-
Gangnam	2,001.2	2,000.6	4,001.8	2,001.2	404.8	2,406.0	-1,595.8
Seocho	1,124.4	1,123.7	2,248.1	1,124.4	404.8	1,529.2	-718.9
Songpa	945.8	945.5	1,891.2	945.8	404.8	1,350.6	-540.7
Jung	580.4	580.3	1,160.7	580.4	404.8	985.2	-175.5
Yeongdeugpo	443.2	443.0	886.3	443.2	404.8	848.0	-38.2
Yongsan	418.9	418.9	837.8	418.9	404.8	823.7	-14.1
Jongno	391.7	391.4	783.1	391.7	404.8	796.5	13.4
Mapo	387.0	386.8	773.7	387.0	404.8	791.8	18.0
Gangseo	424.2	370.8	795.0	424.2	404.8	829.0	34.0
Gangdong	340.9	340.6	681.5	340.9	404.8	745.7	64.2
Yangcheon	288.4	288.3	576.6	288.4	404.8	693.2	116.6
Seongdong	261.5	261.3	522.8	261.5	404.8	666.3	143.5
Guro	238.9	238.8	477.7	238.9	404.8	643.7	166.0
Gwangn	243.1	243.0	486.1	243.1	404.8	647.9	161.8
Dongjak	235.8	235.7	471.5	235.8	404.8	640.6	169.1
Seongbuk	224.6	224.5	449.1	224.6	404.8	629.4	180.3
Dondaemun	240.4	240.3	480.7	240.4	404.8	645.2	164.5
Gwanak	218.7	218.6	437.3	218.7	404.8	623.5	186.2
Nowon	208.3	208.2	416.5	208.3	404.8	613.1	196.6
Eunpyong	208.8	208.7	417.5	208.8	404.8	613.6	196.1
Seodaemun	190.8	190.6	381.4	190.8	404.8	595.6	214.2
Geumcheon	163.6	163.5	327.1	163.6	404.8	568.4	241.3
Junrang	151.2	151.2	302.4	151.2	404.8	556.0	253.6
Gangbuk	122.0	121.7	243.7	122.0	404.8	526.8	283.1
Dobong	124.3	124.2	248.4	124.3	404.8	529.1	280.6

Source: SMG internal data

Table 42. The Property Tax Revenue Before and After the SPTS in 2017

Property taxes Year: 2017	Before the SPTS		After the SPTS applied				Change
	District (A)	SMG (B)	Before the SPTS (A+B)	District (C)	SMG (D)	After the SPTS (C+D)	
Total	10,868.1	10,799.5	21,667.6	10,868.1	10,799.5	21,667.6	-
Gangnam	2,144.8	2,144.6	4,289.4	2,144.8	432.0	2,576.8	- 1,712.6
Seocho	1,239.7	1,239.3	2,479.0	1,239.7	432.0	1,671.7	- 807.3
Songpa	994.5	994.3	1,988.8	994.5	432.0	1,426.5	- 562.3
Jung	580.6	580.4	1,161.0	580.6	432.0	1,012.5	- 148.0
Yeongdeugpo	475.1	474.8	949.8	475.1	432.0	907.0	- 42.8
Yongsan	457.9	457.9	915.7	457.9	432.0	889.8	- 25.9
Jongno	410.8	418.1	828.9	410.8	432.0	842.8	13.9
Mapo	426.5	426.3	852.9	426.5	432.0	858.5	5.6
Gangseo	475.0	403.1	878.2	475.0	432.0	907.0	28.9
Gangdong	366.8	366.7	733.5	366.8	432.0	798.8	65.3
Yangcheon	312.2	312.0	624.2	312.2	432.0	744.1	120.0
Seongdong	295.6	295.5	591.1	295.6	432.0	727.6	136.5
Guro	251.8	251.6	503.4	251.8	432.0	683.7	180.3
Gwangn	251.2	251.1	502.3	251.2	432.0	683.2	180.9
Dongjak	252.8	252.8	505.6	252.8	432.0	684.8	179.2
Seongbuk	237.8	237.5	475.3	237.8	432.0	669.8	194.5
Dondaemun	236.2	235.3	471.5	236.2	432.0	668.2	196.7
Gwanak	227.2	227.1	454.3	227.2	432.0	659.2	204.9
Nowon	219.8	219.7	439.6	219.8	432.0	651.8	212.3
Eunpyong	219.9	219.8	439.8	219.9	432.0	651.9	212.1
Seodaemun	206.1	205.8	411.8	206.1	432.0	638.0	226.2
Geumcheon	172.3	172.3	344.6	172.3	432.0	604.3	259.7
Junrang	156.4	156.3	312.7	156.4	432.0	588.4	275.6
Gangbuk	128.6	128.6	257.2	128.6	432.0	560.6	303.4
Dobong	128.6	128.5	257.1	128.6	432.0	560.6	303.4

Source: SMG internal data

## Appendix G

### RESULTS OF ANALYSIS ON CONTROL VARIABLES

Table 43 shows the estimates of the SPTS effect and other control variables on the two dependent variables (EDE and SDE). The results show that Post had a positive and statistically significant impact on both expenditures. The coefficient value of Post on SDE (1st column in Table 43), for example, is 0.696, which means that SDE of all groups (treated and control group) increased approximately by 101% ( $\beta = 0.696$ ; 95% CI = 0.576, 0.817;  $p < .001$ ), and EDE increased 53% ( $\beta = 0.428$ ; 95% CI = 0.176, 0.680;  $p < .001$ ) since 2008.<sup>47</sup>

Looking at the coefficient of demographic variables, SDE is more influenced by the demographic factors than EDE. For SDE, socio-economic variables (population share of the young aged under 5 (young) and population share of public assistance recipients) had significant impact. For example, an increase in the percentage of the young population and that of people who receive public assistance would impact on SDE by close to -7% ( $\beta = -0.073$ ; 95% CI = -0.125, -0.022;  $p = .006$ ) and +5% ( $\beta = 0.054$ ; 95% CI = 0.013, 0.095;  $p = .010$ ), respectively. In contrast, the percentage of the people who receive public assistance reduced EDE by close to -5% ( $\beta = -0.057$ ;

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<sup>47</sup>  $e^{0.696} = 2.01$  and  $e^{0.428} = 1.53$

95% CI = - 0.149, 0.034; p = .212)<sup>48</sup>, meaning that the share of public assistance recipients has a negative impact on EDE while a positive impact on SDE.

In terms of the political factors, among the variables representing the electoral cycle, ‘preelection’<sup>49</sup> (the year prior to election) only has a positive effect on both EDE ( $\beta = 0.052$ , 95% CI = - 0.008, 0.112; p = .091), and SDE ( $\beta = 0.144$ ; 95% CI = 0.128, 0.160; p < .000). ‘Election’ and ‘Post-election’ year dummy variables have opposite impact on SDE and EDE. During election years and the years following election, EDE is higher than other years, while SDE is lower than other years. These findings confirm the existence of an influence of political electoral cycles in government budgets, in which politicians raise expenditure to increase their reelection probabilities (as claimed by the political cycle theory). The ‘ruling party’ is a dummy variable that is 0 in a case that a head’s political party of local government is out of power and 1 when that a head’s political party is in power. Based on the analytical results (Table 44), where the governing parties at the national level also controlled the local government’s EDE is greater than where the governing party at national level is not governing at district levels ( $\beta = 0.129$ ; 95% CI = 0.041, 0.217; p = .005).

In addition, in our results, the rise in voter turnout (the percent of a state’s voting eligible population that participated in each year’s election) and the higher voting competition of previous elections (the gap between the electorate and the

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<sup>48</sup>  $e^{-0.057} = 0.945$

<sup>49</sup> These electoral cycle related variables are dummy variables. When interpreting the coefficient of the dummy variables, ‘exp’ should be applied. For example, the coefficient value of ‘election’ in the estimation having ‘Ln SDE’ as a dependent variable is 0.0350. Since  $\exp(0.035) = 1.03562$ , it could be interpreted that the SDE will be 3.56% higher for the election years than the non-election years.

second place) increase EDE ( $\beta = 0.002$ ; 95% CI = 0.000, 0.004;  $p = 0.029$ ). Although the value of coefficient is small, the result is consistent with the finding of Geon (2014) that as the competition of the elections was relaxed, the overall budget and capital expenditures decreased. Likewise, the variable, voter turnout, had a positive effect on EDE ( $\beta = 0.013$ ; 95% CI = 0.000, 0.026;  $p = 0.054$ ) while negative effect on SDE ( $\beta = - 0.003$ ; 95% CI = - 0.008, 0.002;  $p = 0.265$ ).

Table 43. Double Difference Regression Results for the Impact of SPTS on SDE  
(Control Variable Coefficients Reported)

Dependent Variable: SDE	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
Post	0.696	0.060	11.540	0.000	0.576 0.817
DID	0.010	0.027	0.370	0.711	-0.045 0.065
Young	-0.073	0.026	-2.850	0.006	-0.125 -0.022
Assisted	0.054	0.021	2.640	0.010	0.013 0.095
Density	0.000	0.000	-0.930	0.354	0.000 0.000
Estab	0.002	0.001	3.250	0.002	0.001 0.004
Elecyear	-0.140	0.014	-9.740	0.000	-0.169 -0.111
PreElecyear	0.144	0.008	18.170	0.000	0.128 0.160
PostElecyear	-0.113	0.008	-13.800	0.000	-0.129 -0.096
Vturnout	-0.003	0.003	-1.120	0.265	-0.008 0.002
Powering	0.002	0.015	0.110	0.909	-0.028 0.032
Competition	0.001	0.000	2.520	0.014	0.000 0.002
Progress	0.006	0.016	0.360	0.719	-0.026 0.038
2003	0.036	0.032	1.130	0.262	-0.027 0.099
2004	0.056	0.032	1.750	0.084	-0.008 0.120
2005	0.037	0.039	0.940	0.348	-0.041 0.114
2006	0.395	0.033	11.920	0.000	0.329 0.462
2007	0.458	0.046	9.930	0.000	0.366 0.550
2008	-0.346	0.015	-23.620	0.000	-0.376 -0.317
2009	-0.239	0.017	-14.110	0.000	-0.272 -0.205
_cons	12.618	0.199	63.480	0.000	12.221 13.015
sigma_u	0.180				R-squared (within) 0.944
sigma_e	0.092				R-squared (between) 0.604
rho	0.794				R-squared (overall) 0.817
N	828	F(20,68)= 280.65			corr(u_i, Xb) -0.033

Note: Treated, 2010, 2011, 2012, 2013 were automatically omitted.

Table 44. Double Difference Regression Results for the Impact of SPTS on EDE  
(Control Variable Coefficients Reported)

Dependent Variable: EDE	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
Post	0.428	0.126	3.380	0.001	0.176 0.680
DID	-0.138	0.076	-1.820	0.073	-0.289 0.013
Young	-0.053	0.061	-0.870	0.389	-0.175 0.069
Assisted	-0.057	0.046	-1.260	0.212	-0.149 0.034
Density	0.000	0.000	0.290	0.771	0.000 0.000
Estab	0.000	0.003	-0.010	0.993	-0.007 0.007
Elecyear	0.174	0.054	3.200	0.002	0.065 0.283
PreElecyear	0.052	0.030	1.720	0.091	-0.008 0.112
PostElecyear	0.009	0.035	0.240	0.809	-0.062 0.079
Vturnout	0.013	0.007	1.960	0.054	0.000 0.026
Powering	0.129	0.044	2.930	0.005	0.041 0.217
Competition	0.002	0.001	2.230	0.029	0.000 0.004
Progress	-0.231	0.053	-4.340	0.000	-0.337 -0.125
2003	0.321	0.079	4.060	0.000	0.163 0.478
2004	0.483	0.089	5.440	0.000	0.306 0.661
2005	0.347	0.097	3.590	0.001	0.154 0.540
2006	0.018	0.083	0.220	0.827	-0.148 0.184
2007	0.074	0.111	0.660	0.511	-0.149 0.296
2008	0.092	0.067	1.370	0.174	-0.042 0.225
2009	0.440	0.070	6.330	0.000	0.301 0.579
_cons	10.451	0.720	14.510	0.000	9.014 11.888
sigma_u	0.554				R-squared (within) 0.431
sigma_e	0.287				R-squared (between) 0.027
rho	0.789				R-squared (overall) 0.066
N	828	F(20,68)=39.11			corr(u_i, Xb) -0.206

Note: Treated, 2010, 2011, 2012, 2013 were automatically omitted.

Table 46. Triple Difference Regression Results for the Impact of SPTS on SDE  
(Control Variable Coefficients Reported)

Dependent Variable: SDE	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
Post	0.700	0.068	10.250	0.000	0.564 0.836
DID	0.041	0.036	1.120	0.265	-0.032 0.114
Post*Donor	0.008	0.036	0.220	0.825	-0.063 0.079
DDD	-0.119	0.050	-2.380	0.020	-0.219 -0.019
Young	-0.069	0.026	-2.690	0.009	-0.120 -0.018
Assisted	0.057	0.021	2.660	0.010	0.014 0.100
Density	0.000	0.000	-0.570	0.569	0.000 0.000
Estab	0.002	0.001	2.030	0.046	0.000 0.003
Elecyear	-0.142	0.014	-10.000	0.000	-0.171 -0.114
PreElecyear	0.146	0.008	18.410	0.000	0.130 0.162
PostElecyear	-0.114	0.008	-13.570	0.000	-0.131 -0.098
Vturnout	-0.003	0.002	-1.140	0.257	-0.008 0.002
Powering	0.007	0.014	0.460	0.646	-0.022 0.035
Competition	0.001	0.000	2.360	0.021	0.000 0.002
Progress	0.000	0.016	0.000	1.000	-0.033 0.033
2003	0.039	0.031	1.240	0.220	-0.024 0.102
2004	0.058	0.032	1.800	0.077	-0.006 0.122
2005	0.037	0.039	0.960	0.342	-0.040 0.115
2006	0.401	0.033	12.000	0.000	0.334 0.468
2007	0.464	0.047	9.920	0.000	0.371 0.558
2008	-0.348	0.014	-24.730	0.000	-0.376 -0.320
2009	-0.243	0.016	-14.780	0.000	-0.276 -0.211
_cons	12.608	0.205	61.360	0.000	12.198 13.018
sigma_u	0.182				R-squared (within) 0.946
sigma_e	0.091				R-squared (between) 0.604
rho	0.802				R-squared (overall) 0.814
N	828		F(22,68)=425.35		corr(u_i, Xb) 0.0844

Note: Treated, 2010, 2011, 2012, 2013 were automatically omitted.

Table 45. Triple Difference Regression Results for the Impact of SPTS on EDE  
(Control Variable Coefficients Reported)

Dependent Variable: EDE	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
Post	0.416	0.122	3.420	0.001	0.173 0.659
DID	-0.167	0.094	-1.790	0.078	-0.354 0.019
Post*Donor	0.006	0.101	0.060	0.955	-0.195 0.206
DDD	0.130	0.147	0.880	0.381	-0.164 0.424
Young	-0.057	0.064	-0.880	0.382	-0.185 0.072
Assisted	-0.059	0.048	-1.220	0.226	-0.155 0.037
Density	0.000	0.000	0.150	0.879	0.000 0.000
Estab	0.001	0.004	0.210	0.832	-0.006 0.008
Eleceyear	0.176	0.056	3.160	0.002	0.065 0.286
PreEleceyear	0.049	0.030	1.620	0.110	-0.011 0.109
PostEleceyear	0.010	0.036	0.290	0.776	-0.062 0.083
Vturnout	0.013	0.007	1.940	0.056	0.000 0.026
Powering	0.122	0.047	2.590	0.012	0.028 0.217
Competition	0.002	0.001	2.280	0.026	0.000 0.004
Progress	-0.224	0.054	-4.150	0.000	-0.332 -0.116
2003	0.317	0.079	4.010	0.000	0.159 0.474
2004	0.480	0.088	5.470	0.000	0.305 0.656
2005	0.346	0.095	3.630	0.001	0.155 0.536
2006	0.012	0.083	0.140	0.889	-0.153 0.176
2007	0.065	0.109	0.600	0.553	-0.153 0.284
2008	0.093	0.068	1.380	0.171	-0.041 0.228
2009	0.445	0.070	6.330	0.000	0.305 0.585
_cons	10.472	0.733	14.290	0.000	9.009 11.934
sigma_u	0.512				R-squared (within) 0.433
sigma_e	0.286				R-squared (between) 0.022
rho	0.762				R-squared (overall) 0.150
N	828		F(22,68)=35.48		corr(u_i, Xb) -0.066

Note: Treated, 2010, 2011, 2012, 2013 were automatically omitted.

## Appendix H

### ALTERNATIVE DEPENDENT VARIABLES DESCRIPTION

(1) Social Development Expenditure (GDP deflator applied, 10 million KRW)

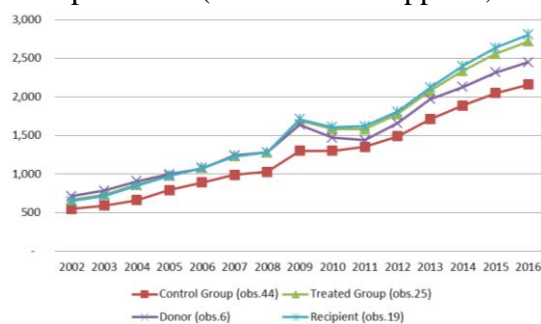


Table 47. Social Development Expenditure (GDP deflator applied, 10 million KRW)

	Control Group (obs.44)	Treated Group (obs.25)	Donor (obs.6)	Recipient (obs.19)
2002	545	666	714	651
2003	589	732	782	717
2004	662	861	907	847
2005	791	978	998	972
2006	889	1,080	1,070	1,080
2007	989	1,230	1,240	1,230
2008	1,030	1,280	1,280	1,280
2009	1,300	1,690	1,640	1,710
2010	1,300	1,580	1,470	1,610
2011	1,350	1,580	1,440	1,620
2012	1,490	1,780	1,660	1,810
2013	1,710	2,080	1,970	2,120
2014	1,890	2,340	2,130	2,400
2015	2,050	2,560	2,320	2,640
2016	2,160	2,720	2,450	2,810

(2) Ln Social Development Expenditure (per capita, GDP deflator applied)

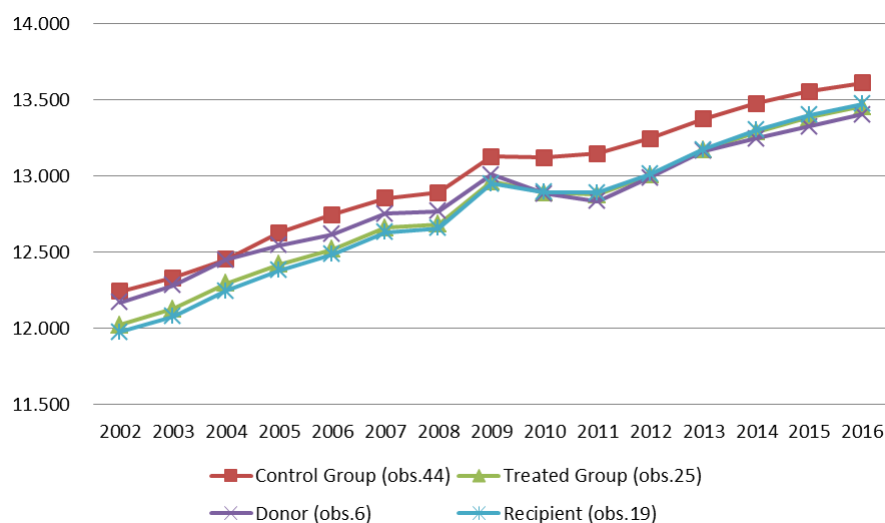


Table 48. Ln (Social Development Expenditure) (per capita, GDP deflator applied)

	Control Group (obs.44)	Treated Group (obs.25)	Donor (obs.6)	Recipient (obs.19)
2002	12.242	12.022	12.170	11.975
2003	12.331	12.126	12.281	12.077
2004	12.454	12.293	12.450	12.244
2005	12.627	12.420	12.545	12.381
2006	12.745	12.517	12.615	12.486
2007	12.853	12.658	12.750	12.629
2008	12.888	12.683	12.767	12.656
2009	13.126	12.964	13.007	12.950
2010	13.119	12.891	12.883	12.893
2011	13.145	12.876	12.833	12.890
2012	13.245	13.005	12.987	13.010
2013	13.375	13.170	13.163	13.173
2014	13.476	13.286	13.244	13.300
2015	13.555	13.383	13.326	13.401
2016	13.611	13.455	13.404	13.471

(3) Economic Development Expenditure (GDP deflator applied, 10 million KRW)

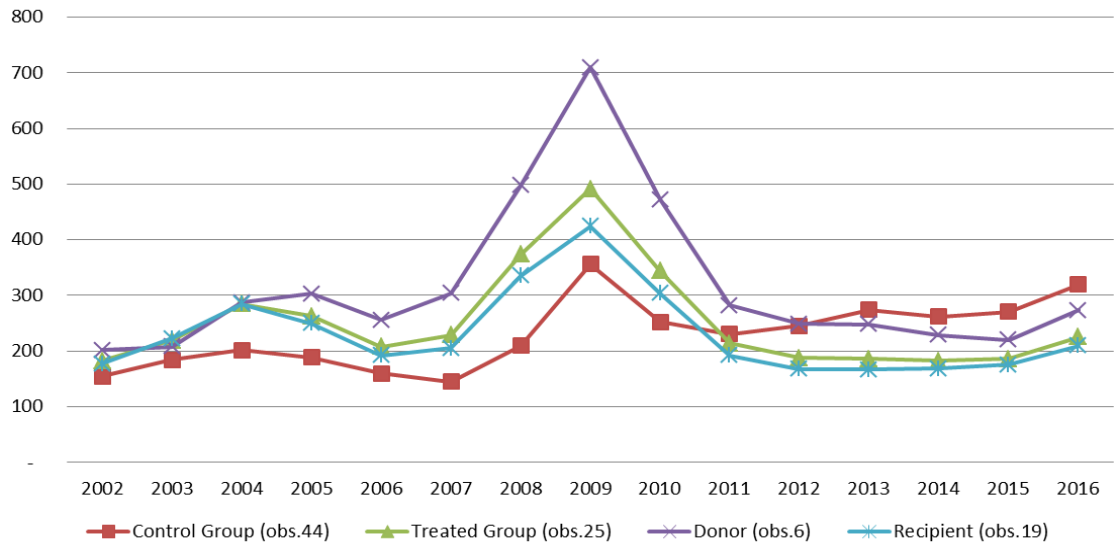


Table 49. Economic Development Expenditure (GDP deflator applied, 10 million KRW)

	Control Group (obs.44)	Treated Group (obs.25)	Donor (obs.6)	Recipient (obs.19)
2002	155	183	202	177
2003	184	219	208	223
2004	202	285	287	285
2005	189	263	303	250
2006	160	208	256	192
2007	145	229	304	205
2008	210	374	498	335
2009	356	492	710	424
2010	252	344	472	304
2011	231	214	282	192
2012	245	188	249	168
2013	274	186	248	167
2014	262	183	229	169
2015	271	186	220	176
2016	320	225	273	210

(4) Economic Development Expenditure (per capita, GDP deflator applied)

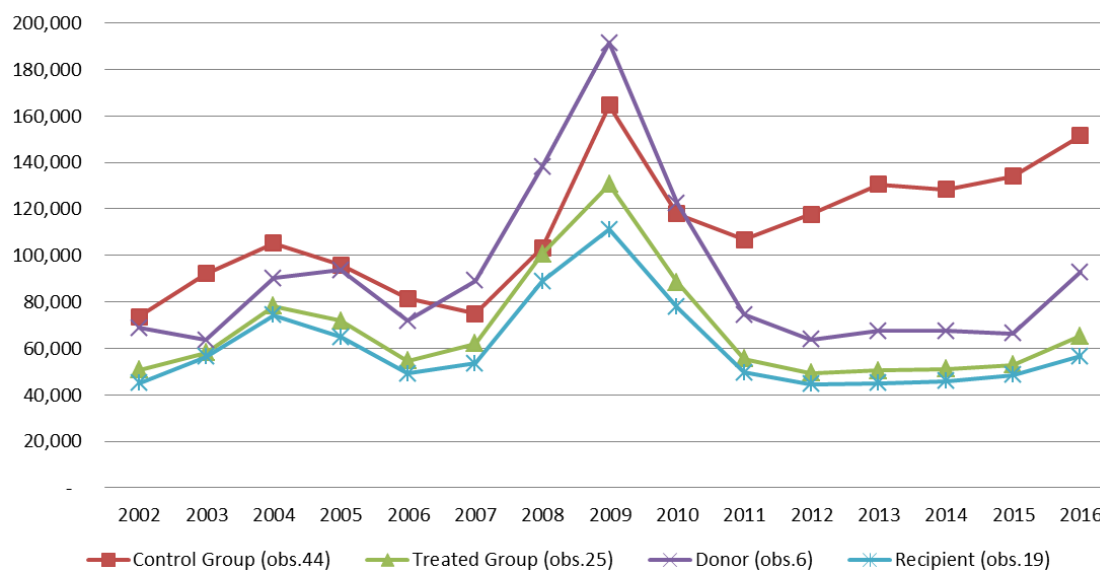


Table 50. Economic Development Expenditure (GDP deflator applied, per capita)

	Control Group (obs.44)	Treated Group (obs.25)	Donor (obs.6)	Recipient (obs.19)
2002	73,543	50,721	68,854	44,995
2003	92,231	57,988	63,446	56,264
2004	105,286	78,094	90,099	74,302
2005	95,931	71,788	93,588	64,904
2006	81,323	54,647	71,787	49,235
2007	74,914	62,055	88,959	53,559
2008	103,277	100,660	138,111	88,834
2009	164,556	130,482	191,500	111,213
2010	117,814	88,504	122,495	77,770
2011	106,652	55,565	74,510	49,582
2012	117,673	49,262	63,834	44,660
2013	130,486	50,370	67,389	44,995
2014	128,267	51,037	67,515	45,834
2015	133,993	52,785	66,459	48,467
2016	151,488	65,227	92,669	56,562

(5) Ln (Economic Development Expenditure) (per capita, GDP deflator applied)

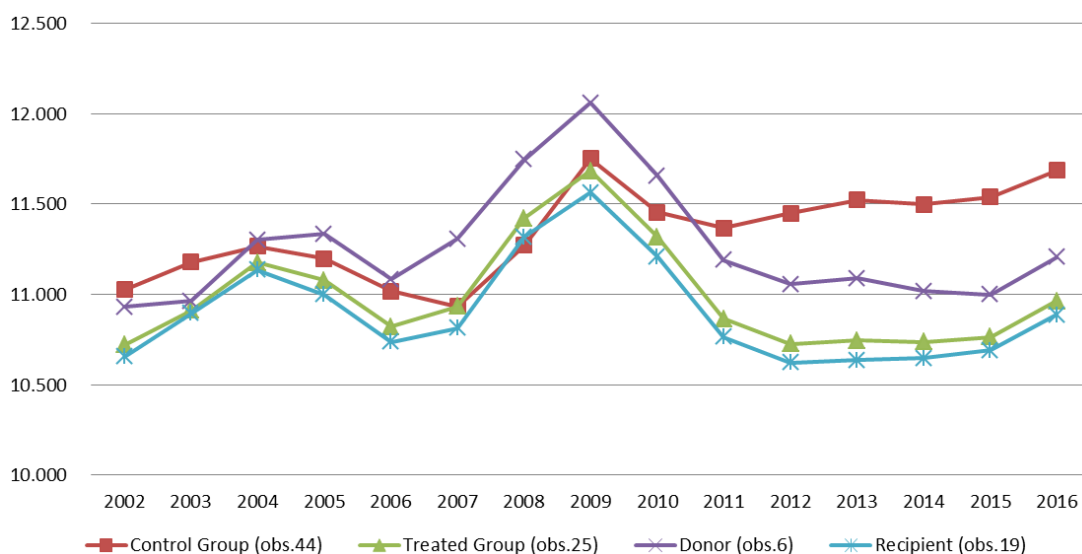


Table 51. Ln (Economic Development Expenditure) (per capita, GDP deflator applied)

	Control Group (obs.44)	Treated Group (obs.25)	Donor (obs.6)	Recipient (obs.19)
2002	11.027	10.721	10.930	10.655
2003	11.180	10.912	10.963	10.895
2004	11.266	11.175	11.300	11.136
2005	11.199	11.079	11.336	10.998
2006	11.017	10.820	11.084	10.737
2007	10.933	10.932	11.308	10.814
2008	11.273	11.421	11.746	11.319
2009	11.751	11.683	12.059	11.564
2010	11.453	11.317	11.656	11.210
2011	11.367	10.866	11.191	10.763
2012	11.449	10.726	11.055	10.622
2013	11.524	10.745	11.089	10.636
2014	11.497	10.737	11.019	10.648
2015	11.540	10.765	10.998	10.691
2016	11.686	10.963	11.205	10.886