Three Essays on Public Economics

By

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Abstract

This dissertation is a collection of three unrelated essays, and all of them are in the field of public economics.

Chapter 1 presents evidence that high-ranked public officials of the Ministry of Strategy and Finance in South Korea affect local budget allocation. Applying a regression on uniquely constructed panel dataset, I find that a growth rate of per capita National Subsidy, which is the sub-part of national budget susceptible to discretionary behaviors, increases about 6.5% in the hometown of high-ranked bureaucrats. To validate concerns about causal relations, I examine a battery of auxiliary robustness checks with reassuring results. Relative to existing literature, I do not find evidence of pork barrel caused by electoral politicians. My results suggest that South Korea's specific institutional characteristics affect the budget allocation, where the authority and initiative of budget formulation belong to the administration rather than the parliament. I also provide empirical evidence that enhancing transparency in the budget allocation system can alleviate concerns of the bureaucrat's hometown favoritism.

Chapter 2 examines the effect of school choice on student and public education by exploiting an application-based random assignment system via lottery in South Korea. I find little evidence that winning the lottery improves student's academic performances, class attitudes, and overall manners, which are considered to be quality-related indexes of public education. Student's school satisfaction increases significantly when the pupil is assigned to his preferred school, but this positive effect is not persistent over periods. The result is contrary to advocators' argument that school choice program can normalize public education through competition among schools. One possible reason for this result is that students may abuse school choice chance to achieve another purpose such as attending the nearby school, which is not related to

the government goal of improving public education. My paper suggests that school choice policy has not transformed into improving the overall quality of public education.

Policymakers around the world search for an optimal school schedule to enhance student's academic achievement. Under this environment, Chapter 3 investigates the effect of the 9 o'clock attendance policy on student's academic performance in South Korea. I find little evidence that delaying the school schedule positively affects pupil's performance when I control for an extensive list of characteristics or an individual fixed effect. My result implies that individual's omitted heterogeneities might confound results of previous literature which supports positive effects. I show that the effect of delaying the school starting time is likely to come from "a good bird" (self-selection effect) rather than "a late bird" (policy treatment effect). Therefore, we need to be cautious when interpreting the effect of postponing the school starting time, and more analysis and discussion are necessary on the education front.

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Chapter 1

Bureaucrat's Hometown Favoritism in Budget Allocation

1.1 Introduction

After pioneers paved a way of explaining socioeconomic factors on the budgeting problem (Downs, 1957; Wildavsky, 1964; Wililamson, 1964; Niskanen, 1971), there has been much theoretical and empirical research which examines the effect of *people* on the budgeting process (Alesina and Perotti, 1995; Levitt and Snyder, 1995; Svorny and Marcal, 2002; Costa, Rodriguez, and Luna, 2003; Grossman and Helpman, 2008; Berry, Burden, and Howell, 2010; Brollo and Nannichini, 2011; Migueis, 2013). They are commonly focusing on individual's incentive problem. From politician's perspective, elected local politicians have a high incentive to secure more budgets to benefit their jurisdiction, and by doing so, they increase a possibility of reelection in return (Rogoff, 1990; Pelzman, 1992; Brender, 2003; Brender and Drazen, 2008; Brollo and Nannicini, 2011). From bureaucrat's viewpoint, a few of literature exists which theoretically shows that the executives are concerned about their career path after retirement, and it may lead them to distort the budget allocation (Holmstrom, 1982; Dewartripont, Jewitt, and Tirole, 1998; Alesina and Tabellini, 2007). However, empirical papers examining the effect of bureaucrats on the budget allocation are rare compared to those of politicians.

South Korea provides an interesting environment related to the budget allocation. First, the

annual government budget in South Korea is mainly determined through interactions between the government and the parliament. In particular, the administration, led by the Ministry of Strategy and Finance, has the authority and initiative in budgeting procedure. The government formulates a draft of the annual budget, which the parliament finalizes afterward. This process is different from many other countries including the United States where the budgeting power belongs to the parliament from the beginning.

Second, South Korea's hometown favoritism culture can also influence the bureaucrat's decision-making. Why does the bureaucrat make a different treatment to his hometown? In their seminal book *Identity Economics*, Akerlof and Kranton (2013) address that a person's self-perception affects economic behavior. Applying their explanation in South Korea's context, hometown is one of the most important personal traits which formulates the identity and plays a significant role in building social connections. The existence of demographic identity has been explained many times in the field of sociology and anthropology, and the results show that connection via sharing demographic background is crucial in both private and public life. A few of papers extend these studies to examine a central role of hometown ties in resource allocation based on the culture of favor exchange (Mun, et al., 1989; Lim, et al., 1995; Lee and Park, 2000). These associations are used to form a within-group network and strengthen their connections. Hometown alumni network, dormitory, and scholarship (referred as *hyangwoo-hoe*, *hyangto-haksa*, and *hyangto-scholarship* respectively) are good examples of Korean society where people are still seeking to reinforce the demographic identity and inspire a sense of fellowship. The existence of these networks indicates that the bureaucrat is likely to have hometown preference in dealing with public affairs. Even without assuming strong demographic self-image, the bureaucrat's career benefits through exploiting his demographic identity may influence the decision making. That is, the bureaucrat may transfer more funds to his hometown in exchange for personal perks in the future (Choi, 2016; Carozzi and Repetto,

2016, Bertrand, Burgess, Chawla, and Xu, 2017). To be real, it is not unusual for high-profile central governmental bureaucrats to begin a new career as politician or bureaucrat in their hometown.[1] As they are frequently considered as the symbol of social success in hometown, the birthplace implicitly supports them with expectations of more social benefits and more favorable budget allocations.

Considering these environments, high-ranked public officials, especially members of the Ministry of Strategy and Finance who are in charge of national budgeting, can possess hometown preference, so they are likely to allocate more funds to their hometown. Much narrative evidence about bureaucrats' hometown-biased budget allocation exists over the press and civic groups. They show concerns that annual local budgets are inappropriately misdirected due to high-affiliated bureaucrats' territorial favoritism. Based on these speculations, some studies have tried to examine the effect of either bureaucrats or politicians on annual local budget formulation (Choi and Kim, 2008; Hur and Kwon, 2009; Kim, 2010; Kang, 2015). However, previous studies dealing with the budget allocation contain limitations. First, there is surprisingly little empirical literature on the local budget allocation using actual data of bureaucrats. Most studies concentrate on politicians and do not give much emphasis to bureaucrats. Above all, no study has analyzed the impact of bureaucrats of the Ministry of the Strategy and Finance on the budgeting process. The major structure of the finalized budget is highly likely to be constituted by public officials of the Ministry of Strategy and Finance since the budget draft is primarily formulated by them. It implies that the government budget can be affected by the bureaucrat's discretion from the start (Choi and Yang, 2015). Second, some literature applies a pooled OLS estimation to infer a causal relation of high-ranked executives on the budget (Choi and Lee, 2011; Hur and Kim, 2014). However, they are not enough to infer the causal linkage

[1] According to Choi (2016), about 96% of high-ranked bureaucrats resign their position before reaching mandatory retirement age (which is much higher compared to 21% of low-ranked public officials), and their decision is not affected by economic conditions. Moreover, 83% of high-ranked executives succeed to have another job after retirement within a year, and they have averagely three jobs for 8.5 years afterward.

since these studies do neither account for unobserved determinants specific to each region nor reflect a time-specific trend. Therefore, other econometric methods are necessary to clarify the relations.

The purpose of this research is to find how the local budget, especially the National Subsidy which is a sub-part of government budget and vulnerable to discretionary behaviors by bureaucrats or politicians, is allocated to each local district. I seek to resolve the question whether the bureaucrat's demographic background magnifies his parochial behavior on the budgeting. I find robust evidence of hometown favoritism in budget allocation during the 2008-2015 period. A growth rate of per capita National Subsidy increases by 6.5% in the local district when the public official from this local district occupies a high-ranked position in the Ministry of Strategy and Finance. However, contrary to popular belief, the result is different in the case of politicians. There is no clear evidence that politicians affect the local budget when they are members of the budget committee in the National Assembly. My results are strong, and estimated pattern of sensitivity checks support the hypothesis. There is no evidence that high-ranked public officials in other ministries affect the budget allocation, which demonstrates that seizing the authority and initiative is crucial in influencing the budget allocation. I examine another possibility of a politician's influence on the budgeting process, but the result still indicates that the power of politicians is weak and insignificant. Bureaucrats' effect is noticeable in the countryside where hometown favoritism is strong, which substantiates the existence of hometown preference. A falsification test shows that a higher growth rate of per capita National Subsidy occurs only in the specific year when hometown ties are effective. All of these results imply that the budget allocation is related to bureaucrat's hometown favoritism.

A few papers exploit the existence of hometown favoritism on resource allocation, but my paper is different from them in several perspectives. To my knowledge, it is the first

empirical study to bridge the relationship between the bureaucrat's hometown favoritism and the local budget allocation using an example of the democratic regime. First, whereas Carozzi and Repetto (2016) and Five and Halse (2016) find hometown bias in local funding among electoral politicians who need to obtain votes from their districts, my study is different from them since I focus on bureaucrats who do not even have reelection incentive. Thus, I can examine the hometown preference more clearly. Second, I use the local budget which is precisely measurable as a dependent variable. From this point, my paper is distinguishable from Franck and Rainer (2012), Hodler and Raschky (2014), Kung and Zhou (2017), Fisman, Shi, Wang, and Xu (2018), and Xu, Bertrand, and Burgess (2018).[2] Third, I extend the argument of Do, Nguyen, and Tran (2017) that hometown favoritism is observed even in the democratic nation. My paper is similar to Gehring and Schneider (2018) which examine that the nationality of EU Commissioners for Agriculture affects the budget allocation in favor of his country.[3]

Overall, my paper contributes to growing literature on linking personal identity to public outcomes. The study is crucial to policy-making in many ways. The allocation of the national budget should be based on both efficiency and equity from a national perspective. Hence, the distortive budget allocation due to local favoritism implies a failure of the government. In the latter part of this paper, I present suggestive evidence that enhancing transparency in the budget allocation can be an effective way to prevent this issue. I also show theoretically

[2]Franck and Rainer (2012) adopt data from 18 African countries, and their study indicates that the primary education and infant mortality of ethnic groups were influenced by changes in the leaders' ethnicity, which explains Africa's underdevelopment. Hodler and Raschky (2014) find that subnational regions have more intense nighttime light when they are the birth region of the current political leader by using their panel of 38,427 subnational regions from 126 countries with yearly observations from 1992 to 2009. And they argue that this provides evidence for regional favoritism. Kung and Zhou (2017) find that death rate decreases in the hometowns of Central Committee members of Chinese Communist Party, and they attribute it to members' influential power on the shipment of grain. My paper is different from Fisman, Shi, Wang, and Xu (2018) which focus on personnel management rather than budget allocation, and they analyze the effect of hometown ties to a fellow selection of the Chinese Academies of Sciences and Engineering. Xu, Bertrand, and Burgess (2018) apply independently developed bureaucratic performance measures, and they find that home state allocated officers perform worse than comparable officers who are allocated to non-home states using the case of Indian Administrative Service (IAS).

[3]However, it has a limitation to infer a causal linkage since the selection of EU Commissioners for Agriculture can be correlated to budget level across countries. I can complement the study by exploiting a management rule where bureaucrats are assigned to a position regardless of budget level across local districts.

that how the budget allocation can be affected by the institutional set-up, and it will help to rearrange the budgeting role between the government and the parliament.[4]

This paper is organized as follows. Section 1.2 introduces background knowledge of South Korea. Section 1.3 describes an empirical strategy. Section 1.4 presents empirical results and Section 1.5 shows various robustness tests. Section 1.6 discusses why bureaucrats have such influential power and how a new transparent system can resolve the hometown favoritism. In Section 1.7, I conclude my paper with policy implication.

1.2 Background of the Study

1.2.1 Budgeting Characteristics

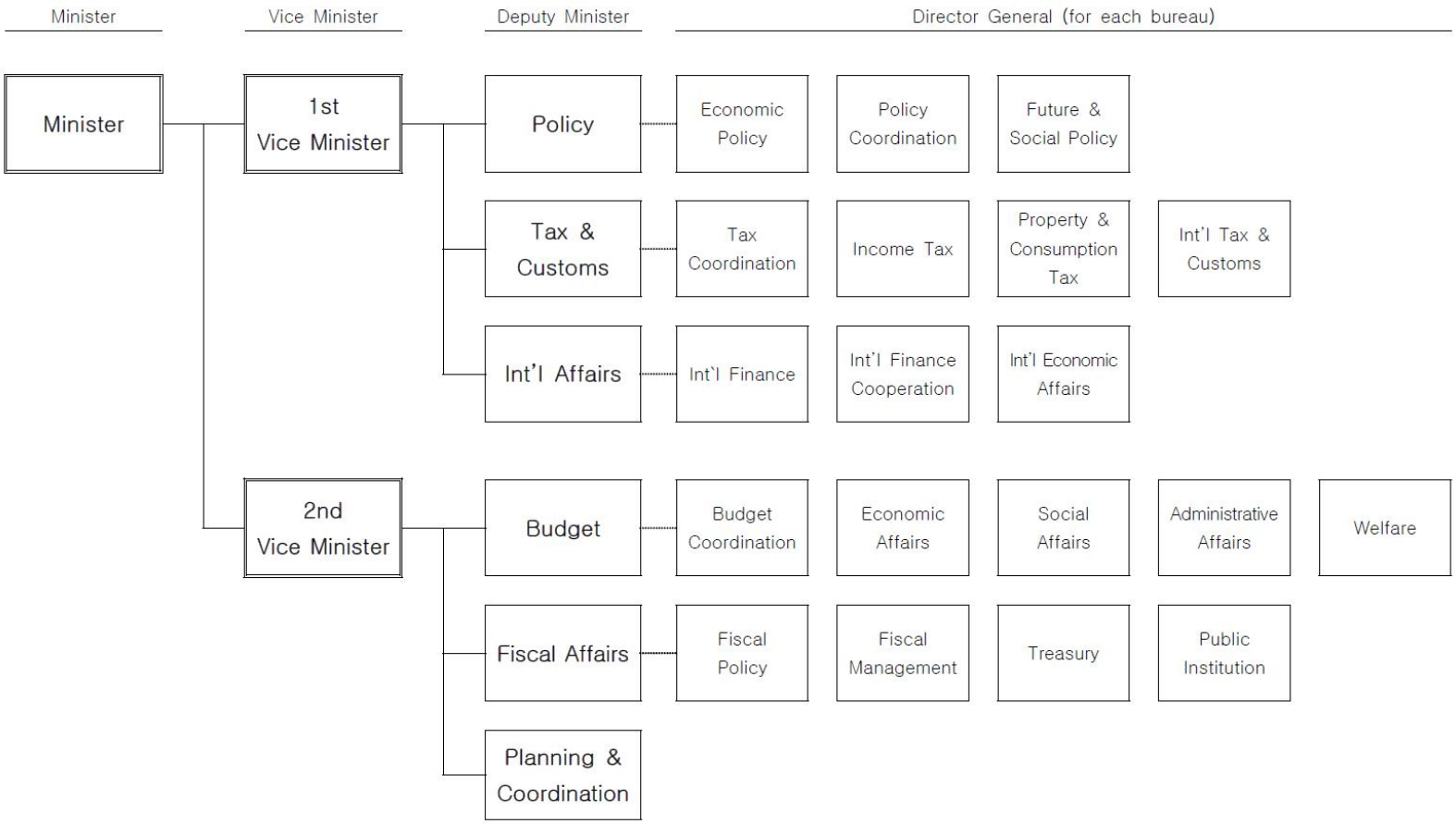
Two institutions play a pivotal role in the budget allocation.

The Ministry of Strategy and Finance[5] plays an essential role in the budgeting procedure. As described in Figure 1.1, there exists one minister, two vice ministers, and six deputy ministers each of whom is responsible for sub-sectors of the economy. The Budget Office is in charge of the whole budgeting procedure, such as formulating a budget draft, executing and managing the budget, and evaluating the budget performance. Moreover, it promotes policy implementation and supports the livelihood of people by allocating limited resources according to the government's priorities. The Budget Office strategically adjusts the size and structure of the budget and effectively aligns it with the needs of the nation. The power of the ministry is mainly originated from the role of budget planning and monitoring of budget implementation.

[4]The budgeting process is primarily dependent on two main agents, *the politician* who is elected by the local public to serve for his electorates, and *the bureaucrat* whose position is independent of the public's vote and acts as an objective technocrat. So it is significant what kinds of the task each agent should assume (Holmstrom, 1982; Dewartripont, Jewitt, and Tirole, 1998). For example, while administrative executives are responsible for making the budget draft in South Korea, this role belongs to congressmen in the United States. Thus, comparing empirical results caused by the different institutional set-up will be an intriguing topic for future research.

[5]Both the Ministry of Strategy and Finance and the National Assembly are depicted based on the system in 2016.

Figure 1.1: Organization of the Ministry of Strategy and Finance



Note: This is the organization chart of the Ministry of Strategy and Finance as of 2016. There are basically two branches under one minister. The Budget Office and the Fiscal Affairs Bureau belong to the 2nd vice minister's branch. Public Officers of the Boxes in the chart are considered as a high-ranked official.

The National Assembly is a unicameral legislature body which represents people by the Constitution. It consists of 300 congressmen, 253 of whom are elected from each local constituency based upon single-member electorate system. A serving term is 4-year. There exist 16 Standing Committees and several Special Committees depending on its jurisdiction and role. Among them, the Special Committee on Budget and Accounts which has 50 committee members is crucial in securing local district's budget. Members of the Special Committee on Budget and Accounts rotates every year.

The administration assumes the authority and initiative in the budgeting process.

The Ministry of Strategy and Finance and the National Assembly are responsible for formulating the budget. Based on the expected amount of national tax revenue, these two governmental bodies construct the annual budget plan on how to allocate and spend tax revenue throughout the year. To be specific, the Budget Office in the Ministry of Strategy and Finance coordinates with other sub-governments to make the annual budget draft, and this process starts from January and ends on September 3rd. After the administration passes over its budget draft to the National Assembly, deliberation process of the budget draft by the National Assembly continues from September 3rd to December 2nd. The deadline is set as such because the National Assembly must come to a resolution on confirming the budget proposal 30 days before the beginning of the new fiscal year. Appendix A.1 describes detailed information of the budgeting procedure.

Overall, high-ranked bureaucrats in the Ministry of Strategy and Finance hold the authority and initiative to allocate funds to central and local governments, and they determine a framework of the budget. This peculiar institutional set-up gives the superiority to the administration over the parliament when it comes to the budgeting procedure.

1.2.2 Hometown as a Social Capital

Before turning to empirical estimation, it is necessary to understand why hometown can play a significant role in the Korean context. A social connection through sharing the same hometown is widespread in South Korea, and it is helpful to cultivate social relations within group members. Hometown tie has been a part of Korean culture that establishes mutual relationships between individuals for a long time, and it is the core of various aspects in dealing with social activities (Mun, et al., 1989; Lim, et al., 1995; Lee and Park, 2000).[6]

Bureaucrats have a reason to present hometown favoritism.

South Korea recruits high-ranked public officials through the Higher Civil Service Qualification Exam, which serves as a stepping stone to becoming a high-ranked public official.[7] The exam is competitive, and passing the test is a glorious event both for him and his hometown. For example, total 13,591 candidates took the exam for 380 slots in 2015. Among them, only 20 to 30 successful candidates whose exam score is high enough are assigned to the Ministry of Strategy and Finance. Selected public officials begin their career in the central government, and they are ordinarily considered to have an opportunity to rise in the society. Hometown communes seek to build an intimate relationship with successful candidates. It is especially the case in a rural area where hometown connection plays a significant role in the community.

Human resource management in the government follows a seniority rule under the roof of Confucianism.[8] After about 20 years of service, members are promoted to the high-ranking

[6]Hometown favoritism is a kind of "*guanxi*" which is also popular in China. Guanxi refers to the broader social network including hometown favoritism, school network, workplace connection. According to Douw, et al. (1999), cultivating hometown ties is "*part and parcel of the Chinese culture of establishing guanxi, or relationships of mutual obligation between individuals, and is therefore also an inherent part of the social structure in which doing business in China is embedded at present.*"

[7]This system is different from other countries such as the United States where spoils system is in root. In South Korea, bureaucrats are exempt from the public's vote, and appointment to major government positions is relatively independent of politician's discretion.

[8]Social norms originated from Confucianism are widespread in social relations, and the seniority rule is one example. For example, irrespective of abilities and other personal characteristics, it is rare for junior colleagues to

position.[9] Rotation term for each position usually lasts for one to two years. Since career prospects become arduous due to the pyramidal hierarchy of government, many of them leave the position and cultivate a new career before reaching statutory retirement age (Bertrand, Burgess, Chawla, and Xu, 2017). One example of an alternative career path is to become a local politician (Choi, 2016). With the help of hometown information, high-ranked bureaucrats have an incentive to exploit their influential power to favor their hometown.

Local governments also have an incentive to exploit hometown connection.

To understand why the local governments seek to secure more budgets using hometown connection with high-ranked bureaucrats, I need to understand the government finance system. Here, I briefly describe the tax revenue and expenditure system of South Korea.

Total tax revenue mainly consists of two bases, *the National Tax* & *the Local Tax*. There are 14 National Tax items and 11 Local Tax items, and each item is defined and regulated by the Act respectively. Figure 1.2 shows detailed components of the National Tax and the Local Tax. The National Tax is collected by two central governments, the National Tax Service and the Korea Customs Service. Collected tax revenue is utilized either by central governments (ministry-level) or local governments (municipality-level). Table 1.1 describes detailed items of tax revenue. According to the Ministry of Strategy and Finance's statistics, about 77% of total tax revenue as of 2015 is financed from the National Tax, which amounts to $215.7 billion. The Local Tax Act describes purposes, resources, and usages of the Local Tax. Each municipality has the authority to collect and use the Local Tax.[10] The Local Tax is unevenly distributed among provinces and counties since geopolitical and socioeconomic environments are different

become a boss of their senior.

[9]The following describes a high-ranked bureaucrat's general career path: Starting as Deputy Director (8-12 years)→Promoting to Director (8-10 years)→Entering into a group of Senior Executive Service, and advance to Director General, Deputy Minister, Vice Minister, and Minister.

[10]There are a few centrally-controlled restrictions by the Ministry of the Interior which imposes basic regulations on tax bases and tax rates.

Table 1.1: Total Tax, National Tax, and Local Tax

($ billion)

	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Tax	205.0	212.8	209.7	226.9	244.7	256.9	255.7	267.2	280.6
(% of GDP)	(21.0)	(20.8)	(19.7)	(19.3)	(19.8)	(20.2)	(17.9)	(18.0)	(18.0)
National Tax	161.5	167.3	164.5	177.7	192.4	203.0	201.9	205.5	215.7
(% of Total Tax)	(78.8)	(78.6)	(78.5)	(78.3)	(78.6)	(79.0)	(79.0)	(76.9)	(76.9)
Local Tax	43.5	45.5	45.2	49.2	52.3	53.9	53.8	61.7	64.9
(% of Total Tax)	(21.2)	(21.4)	(21.7)	(21.7)	(21.4)	(21.0)	(21.0)	(23.1)	(23.1)

[a] Source: Tax Collection Report (National Tax Service, 2015; Korean Customs Service, 2015), Local Tax Annual Report (Ministry of the Interior, 2015).

across local districts and their resources are dependent on local economic circumstances.

Central and local governments operate tax expenditure. One interesting aspect is that there exists a huge discrepancy between the tax revenue and expenditure in South Korea. When it comes to tax revenue, as shown in Table 1.1, about 75-80% of the revenue is collected by the central government whereas only 20-25% is obtained by the local government. However, when it comes to tax expenditure, only 60-65% of the total budget is spent by the central government, and the remaining 35-40% is utilized by the local government. Table 1.2 shows the specific disparity between tax revenue and budget expenditure. It implies that local governments use a substantial portion of the National Tax even if their revenue is mostly financed by central government. The disparity became stronger after the emergence of the local self-autonomy system in the 1990s.[11] Nowadays, a growing number of governmental policies and projects are executed independently at the local government level. However, since tax revenue is still collected and allocated by the central government, politicians in local government pay attention to secure more budgets from it. Hence, it is common for local districts to establish social connections with influential members of government and parliament. By using social

[11] Before the local self-autonomy system was introduced, governor and mayors of local governments were not elected by the public. Instead, they are appointed among public officials in the central government. After introducing the local self-autonomy system (called as administrative decentralization) around mid-1990, head of local governments is now elected by citizens.

Figure 1.2: Korean Tax System in 2015

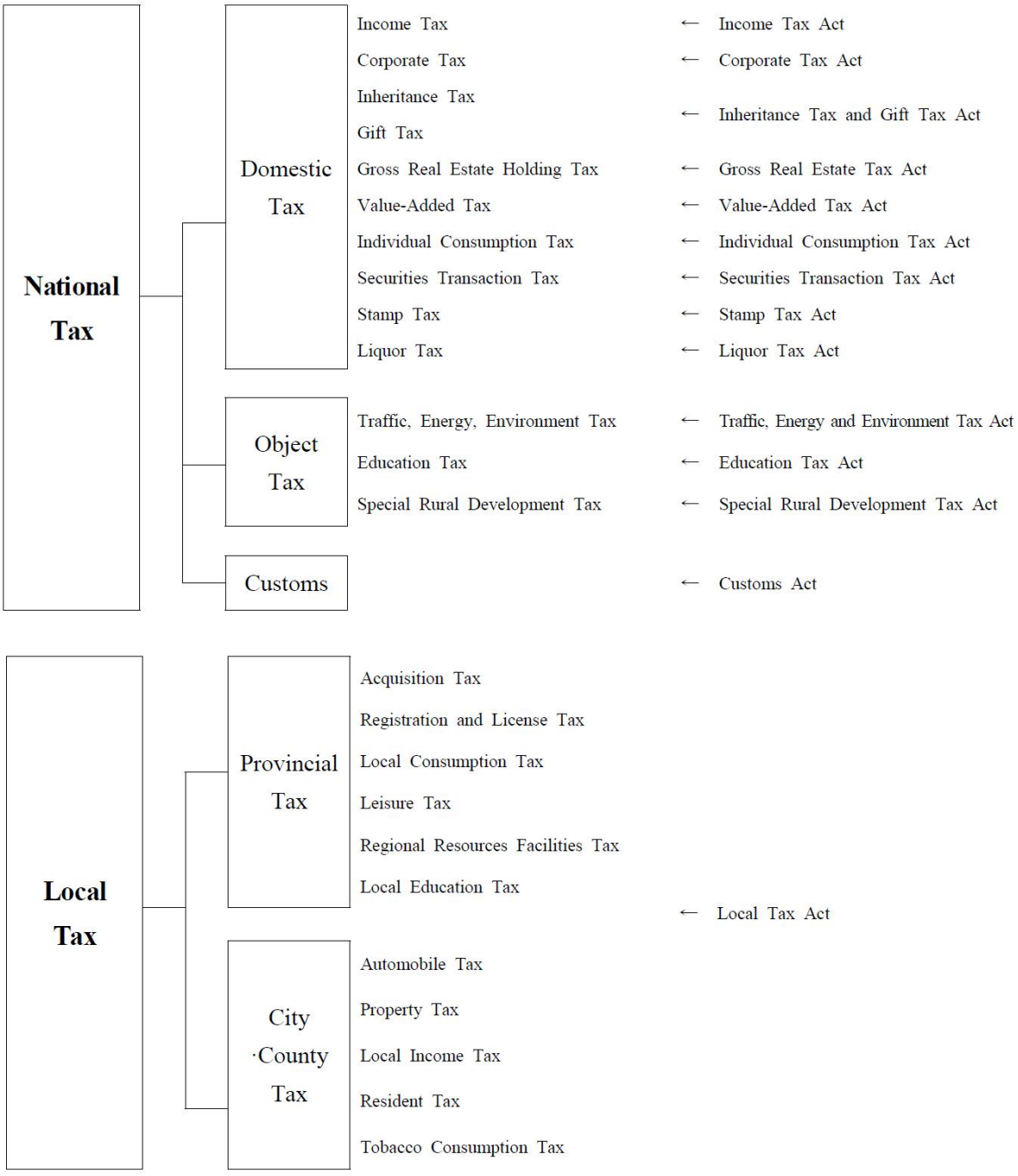


Table 1.2: Total Budget Expenditure by Government Type

($ billion, %)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total	276.8	288.8	320.1	355.0	365.8	376.6	399.7	420.5	438.2	459.6	480.3
Central Government	175.4	176.8	195.1	217.5	225.9	235.6	248.6	263.6	274.7	286.3	295.7
(% of Total)	(63.4)	(61.2)	(60.9)	(61.3)	(61.8)	(62.6)	(62.2)	(62.7)	(62.7)	(62.3)	(61.6)
Local Government	101.4	112.0	125.0	137.5	139.9	141.0	151.1	156.9	163.6	173.3	184.6
(% of Total)	(36.6)	(38.8)	(39.1)	(38.7)	(38.2)	(37.4)	(37.8)	(37.3)	(37.3)	(37.7)	(38.4)

[a] Source: Summary of Local Budget for FY 2016 (Ministry of the Interior, 2016).

capital such as hometown connection or joining the Special Committee on Budget and Accounts in the National Assembly, they seek to attract more financial resources to their constituencies.

The National Subsidy is susceptible to hometown favoritism.

South Korea has an inter-governmental transfer system called *the Local Finance Equalizing Scheme* to resolve the tax revenue-expenditure disparity between central and local governments. Under the Local Finance Equalizing Scheme, revenue from the National Tax is distributed to local governments based on various criterions. The transfer from central to local government redresses fiscal discrepancies between them, and it allows the local governments with weak revenue resource to provide local public goods and services. There are three main components in the Local Finance Equalizing Scheme, *the Local Share Tax*, *the Local Education Subsidy*, and *the National Subsidy*.[12] Table 1.3 shows the total amount of each component.

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- Local Share Tax: The Local Share Tax Act prescribes the amount of the Local Share Tax to each local district. Since the main purpose of the Local Share Tax is to achieve the equity across local regions, the Act precisely predetermines mathematical formula. Based on it, it calculates what amount of budget should be allotted to each district considering excess or deficiency of revenue. Around 20% of internal taxes are allocated to local governments in which fiscal income falls below the standard. It is the component of the budget which is not affected by discretionary behaviors of bureaucrats and politicians.
- Local Education Subsidy: The finance of local education is separately managed by the local education authorities. The Local Education Subsidy is granted to them, which accounts for about 20% of internal taxes.

Table 1.3: Local Finance Equalizing Scheme

($ billion)

	2011	2012	2013	2014	2015	2016
Total Transfer to Local Government	97.8	105.7	114.1	116.6	119.4	123.3
Local Share Tax	29.1	32.0	34.4	34.6	33.2	34.3
Local Education Subsidy	32.3	34.2	37.6	40.0	44.1	43.0
National Subsidy	35.3	38.4	41.1	40.9	39.4	41.2

[a] Source: National Assembly Budget Office website, http://index.go.kr, Summary of Local Budget for FY 2016 (Ministry of the Interior, 2016), The Korea Tax System (Ministry of Strategy and Finance, 2014).
[b] Total Transfer to Local Government = Local Share Tax + National Subsidy + Local Education Subsidy

The National Subsidy plays a crucial role since local development requires financial resources to support various economic and social policies. And it is the grant through which bureaucrats and local politicians can exert their influential power. The National Subsidy is managed by the Subsidy Management Act and the Enforcement Decree of the Subsidy Management Act. In the attached Table 1 of the Enforcement Decree of the Subsidy Management Act, total 122 categories of the National Subsidy and subsidized rate of each category is specified, which looks like to be strictly regulated by the Act. However, the 122nd clause of Table 1 describes an exception rule that "*the National Subsidy can be allocated to other local projects on which the Ministry of Strategy and Finance and local governments mutually agree as necessary, and detailed contents of the project and the subsidized rate are determined based on the governmental budget formation guideline each year*." It implies that bureaucratic powers can affect the National Subsidy allocation via the 122nd clause of Table 1. Therefore, discretionary behaviors of public officials and politicians play a significant role in determining the amount of the National Subsidy to each local district. That is, allocating the National Subsidy each year is contingent on the stakeholder's judgment. In particular, as shown in Table 1.4, while the Local Tax Revenue and the Local Share Tax is relatively at a stalemate, the local government's budget expenditure has increased significantly. It means that National Subsidy is becoming a huge part of financial

Table 1.4: Local Government's Expenditure and Revenue

($ billion)

		2011	2012	2013	2014	2015	2016
Expenditure	Local Budget Expenditure	141,039	151,095	156,889	163,579	173,259	184,583
			(+7%)	(+4%)	(+4%)	(+6%)	(+6%)
Revenue	Local Tax Revenue	52,300	53,938	53,779	61,723	64,903	64,840
			(+3%)	(+0%)	(+13%)	(+5%)	(+0%)
	Local Share Tax	31,938	35,206	35,575	35,921	34,220	31,953
			(+9%)	(+1%)	(+1%)	(-5%)	(-7%)
	National Subsidy	32,295	35,105	36,838	39,195	44,097	43,019
			(+8%)	(+5%)	(+6%)	(+11%)	(-3%)

[a] Source: Local Finance Report for FY 2016 (Ministry of the Interior, 2016).

resources for local government, and it has a higher incentive to gain more subsidies.

1.3 Empirical Strategy

1.3.1 Empirical Design

A testable hypothesis is whether hometown favoritism exists in budget allocation. To be specific, I examine the effect of public officials and politicians on the local budget. I apply a regression on a balanced panel dataset uniquely constructed by the authors. The econometric model is given by:

$$Y_{i,c,t+1} = \beta_1 MOSF_{i,c,t} + \beta_2 BudgetCommittee_{i,c,t} + X_{i,c,t} + \gamma_i + \delta_t + \lambda_{ct} + \epsilon_{i,c,t} \qquad (1.1)$$

where i is a local district, c is a upper-level local (metropolitan) district[13], and t is a year.[14] The period from 2008 to 2015 is analyzed. Two former presidents Myong-bak Lee (2008-2012) and Geun-hye Park (2013-2015), are both from the Saenuri party, which is the majority party in the parliament for both 2008-2011 and 2012-2015 terms. More explanations on analyzing the unit i are provided in Appendix A.2. In all of my analysis, I adjust standard errors for clustering at local district level i to account for any spatial correlation. My main variables of interest are β_1 and β_2.

Outcome variables

The principal outcome variable is the National Subsidy. The National Subsidy is the budgetary sub-part affected by discretionary behaviors, so it is the most suitable candidate in checking for the existence of hometown favoritism. It also has an advantage when it comes to correct measurement to examine the influence of politicians and bureaucrats at time t, since the allocation of the National Subsidy is based on the annual basis.[15] I use per capita value and take a natural log to accommodate population change and ceiling effect caused by budget size. To check the robustness, I substitute the National Subsidy to either the Subsidized Project Budget or the Total Budget.[16]

[13]I control total 17 upper-level local autonomy (Seoul, Busan, Daegu, Incheon, Gwangju, Daejeon, Ulsan, Gyeonggi, Gangwon, Chungbuk, Chungnam, Sejong, Jeonbuk, Jeonnam, Gyeongbuk, Gyeongnam, Jeju).

[14]As explained by Khwaja and Mian (2011), a first step in conducting rent-seeking behavior is to identify a possible rent-seeking actor. However, since a simple difference in outcomes may arise from reasons other than my interest, additional differences are required to remove these concerns. The effective method is to specify certain circumstances in which rent-seeking is more likely to occur. This additional classification provides another difference margin. If identified agents show peculiar behaviors in situations which allow them rent-seeking behavior easier than average participants, it strongly supports the existence of rent-seeking mechanism. In this paper, possible rent-seeking actors are high-ranked bureaucrats or politicians who are suspected of possessing the budgeting manipulation power. So I identify bureaucrats in the Ministry of Strategy and Finance and the local district politicians at first, which gives the first-difference dimension. Second, I use demographic characteristics of bureaucrats and politicians as the second-difference dimension.

[15]If the budget allocation is a multi-year based, dummy variable of *MOSF* and *BudgetCommittee* does not precisely represent hometown favoritism. The annual accounting principle of the National Subsidy excludes this possibility.

[16]The Subsidized Project Budget consists of the National Subsidy plus the corresponding proportional matching fund. Local government is responsible for the matching fund when it operates policies or projects supported by the

Explanatory variables

$MOSF_{i,c,t}$ is a dummy variable indicating whether local district i has a high-ranked bureaucrat in the Ministry of Strategy and Finance at t. Since this public official formulates the budget draft between June and August, I codify 1 into a dummy variable $MOSF_{i,c,t}$ when the high-ranked public official from i is in the government position during this period. I specify high-ranked public officials as follows: one minister, two vice ministers, six deputy ministers, and five director generals in the Budget Office. These are the positions with both the budgetary power and higher social status comparable to the congressman. For more detailed analysis, I separately analyze the impact of bureaucrats by classifying public officials according to rank and relevance to the budget.

$MOSF\,(Core)_{i,c,t}$ includes one minister, two vice ministers, two deputy minister in the Budget Office and the Fiscal Affairs, and five director generals in the Budget Office. I independently apply this variable since these members are more closely related to budget formulation process, which helps to examine the effect of high-level bureaucrats on the budget crafting. Figure 1.3 describes the public official's hometown across years. I also consider public officials of other central governments (ministry-level) since the budget draft is constructed through coordination with multiple government bodies.[17] Thus, $Gov_{i,c,t}$ is equal to 1 when local district

National Subsidy. It is introduced to enhance local governments' financial responsibility and to prevent them from implementing not-credible projects (Choi, 2014). The hierarchy of budget is given by below:

First Level	Second Level	Third Level		Funding Resources
Total Budget	***Subsidized Project Budget***	***National Subsidy***	←	Central Government
		Matching Fund	←	Local Government
	Autonomous Project Budget		←	Local Government

[17] As of 2016, South Korean central government consists of 17 ministries and 6 government commissions.

- I include 11 ministries and 1 commissions. They are directly related to local budget and assume more than 70% of total government budget. (Ministry of Science, ICT and Future Planning, Ministry of Education, Ministry of the Interior, Ministry of Culture, Sports and Tourism, Ministry of Agriculture, Food and Rural Affairs, Ministry of Trade, Industry and Energy, Ministry of Health and Welfare, Ministry of Environment, Ministry of Employment and Labor, Ministry of Land, Infrastructure and Transport, Ministry of Oceans and Fisheries, Financial Service Commission)
- I exclude 5 ministries and 5 commissions. These agencies are not directly related to local budget and mainly

i is a hometown of other ministries' minister or vice-minister at t.

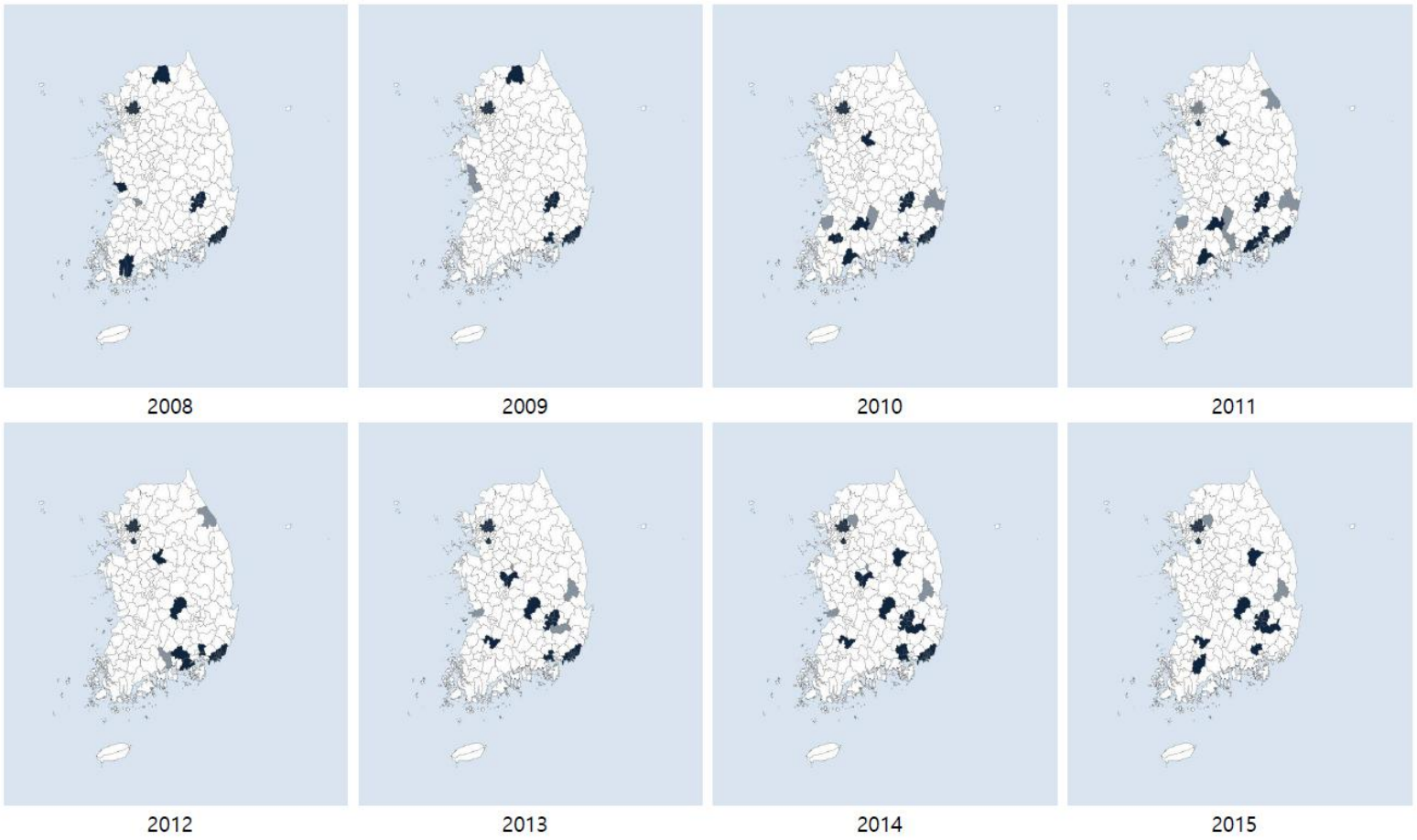
$BudgetCommittee_{i,c,t}$ is a dummy variable which equals to 1 if at least one of congressmen in the region i is a member of the Special Committee for Budget and Accounts at t. Figure 1.4 illustrates a distribution of the variable across years. To examine other possibilities of political influence, I use $FinanceCommittee_{i,c,t}$ which indicates whether one of the congressmen is affiliated to the Standing Committee of Strategy and Finance in the region i at t.

Covariates

I control a number of variables for $X_{i,c,t}$ which can be correlated to my variable of interest. It includes ruling-party existence (whether i is a region of the ruling-party congressmen), fiscal autonomy ratio ($= \{Local\ Tax + Non\ Tax\ Revenue\}/Total\ Budget$), senior population ratio (60 or above), GDP per capita & unemployment rate of upper-level local district c. γ_i is a region fixed effect to capture unobserved characteristics of the local district. Since the budget size tends to increase every year, year dummy variable δ_t is added to control common time fixed effect. Each local district has a specific time trend due to its distinctive socioeconomic circumstances. Hence, I add a term λ_{ct} which is the region-specific linear trend. $\epsilon_{i,c,t}$ is an error term.

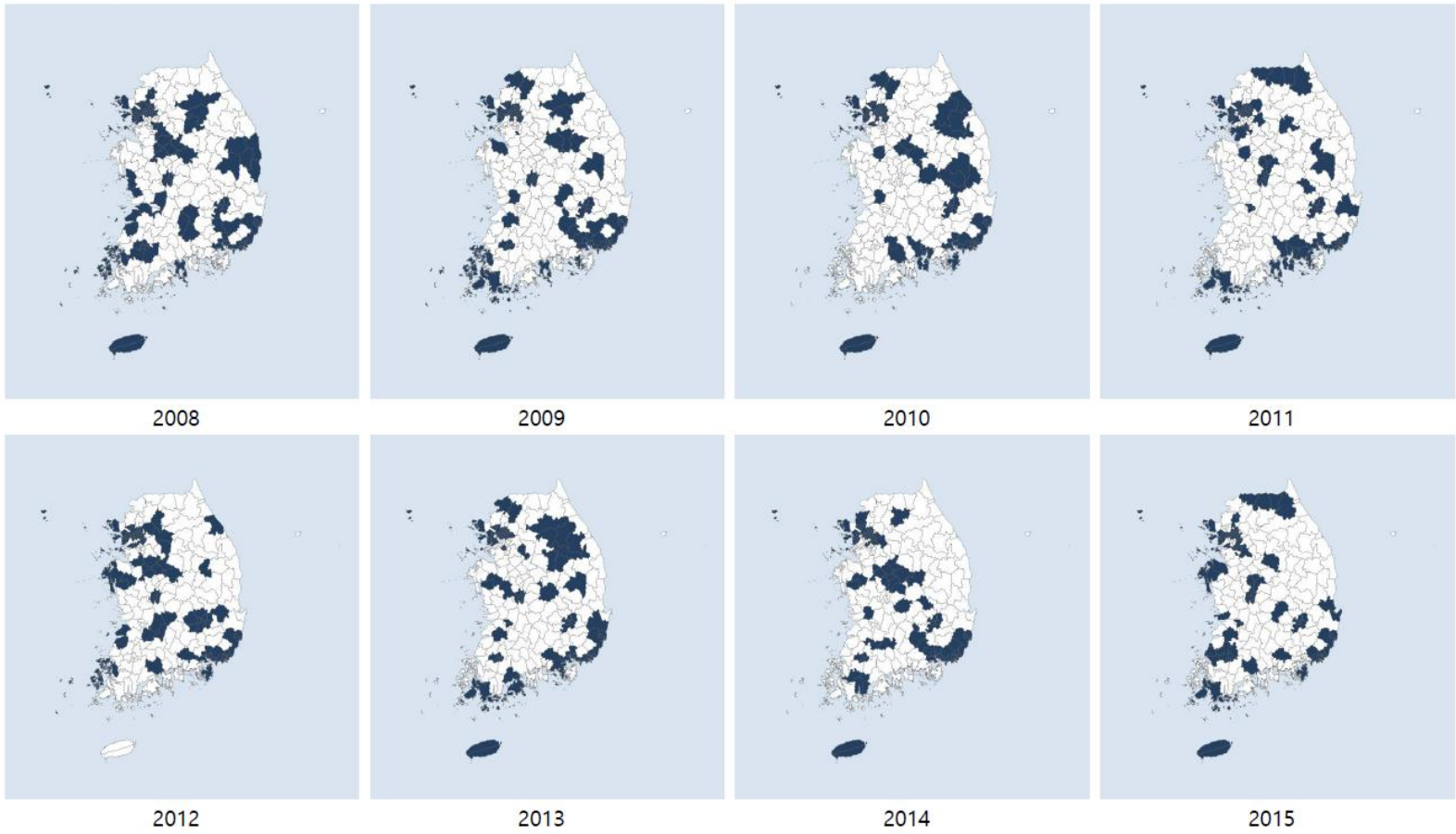
deal with regulatory policy. (Ministry of Foreign Affairs, Ministry of Unification, Ministry of National Defense, Ministry of Justice, Ministry of Gender Equality and Familly, Korea Communications Commission, Korea Fair Trade Commission, Anti-corruption and Civil Rights Commission, Nuclear Safety and Security Commission, National Human Rights Commission)

Figure 1.3: Local Districts of High-ranked Public officials



Note: The dark color represents a region of core member of the MOSF, and the light color shows a region of non-budget member of the MOSF. These regions are depicted based on the administrative unit.

Figure 1.4: Local Districts of Congressman of the Special Committee on Budget and Accounts



Note: The dark color represents a region of congressman of the Special Committee on Budget and Accounts. These regions are depicted based on the electoral constituency unit.

Endogeneity Issue

In estimating the hometown favoritism to the budget allocation, the empirical challenge is a possibility of endogenous attributes to social connections since the assignment of public officials is non-random. Throughout the paper, I carefully interpret the estimation result as evidence of correlations, and my results may show the upper bound of the effect. However, institutional backgrounds give a chance of causal linkage from bureaucrat's hometown to budget allocation. First, public officials are selected solely based on the civil service aptitude test, so the result is random across local districts.[18]

Second, their career path follows a seniority rule that public officials of earlier entering cohort are usually promoted in advance than those of later entering cohort.[19]

Seniors are expected to leave their job automatically when their peers with a shorter career history are promoted to a higher position. This practice reflects the distinctive Korean (and Asian) environment where the length of the experience, rather than competence, play a dominant role in professional relationships. It is a by-product of the Korean culture that if a boss is younger and has a shorter history, then he cannot have a good enough command over the organization. Since this personal management system is orthogonal to regional economic condition, it offers a plausible context to infer the causal relation between the hometown favoritism and budget allocation.

Third, job rotations among high-ranked public officials are an integral part of the Korean government's personnel management. These changes are staggered across periods in different

[18]Skillful applicants are probably not equally-distributed over the country. It implies that regions with a higher education-level have a higher chance to receive a positive treatment in this setting. However, this concern is limited according to the Population Census by Statistics Korea. For example, Population Census of 1985 in which high-ranked officials in the dataset became public officials shows that the ratio of people whose education level is equal and above college is not much variant across the metropolitan regions (9-13%). Also, considering that the test is highly competitive among selected applicants, the exam result is approximate to be random across the local districts.

[19]While ministers and vice ministers are appointed by the president, the appointment and allocation of high-ranked officials in the execution level are in the boundary of the seniority rule.

local districts, which enables the identification sharper than the one-off event.[20]

Fourth, reverse causality linked from the level of local districts' budget to bureaucrat assignment to a certain position is not likely under the above selection and assignment process of bureaucrats.

Fifth, to address endogeneity caused by omitted variables, I control local district's demographic traits $X_{i,c,t}$, region fixed effect γ_i, and region-specific linear trend λ_{ct}. These institutional settings, that selection of public officials is via the civil qualification test and promotion to the high-ranked position is realized based on the seniority rule, have advantages for my empirical approach, since hometown of bureaucrats becomes orthogonal to other confounding individual or regional factors that affect the budget allocation. Thus, it becomes orthogonal to the outcomes of interest.

Similarly, the assignment rule of members of the Special Committee on Budget and Accounts exhibits a high rotation rate (higher than 70% each year) with a short-term tenure (1-year).[21] Hence, it is unlikely to be correlated with any unobserved jurisdiction's characteristics. Considering these facts, the assignment rule can be assumed to be a quasi-random process, which alleviates the endogeneity problem. Therefore, my estimation can give evidence of causal relation of personal characteristics on the budget allocation.

1.3.2 Data Collection and Descriptive Statistics

I collect fiscal data from Local Finance Integrated Open System and Local Finance Yearbook published annually by the Ministry of the Interior. To identify high-ranked bureaucrat's hometown, information is extracted from *Seoul Newspaper* articles which include the detailed profile. I verify it using multiple newspaper resources and private connections. I construct a

[20]Thus, personal relationships via sharing the hometown can have difference effect on provinces across years, serving as a strong identification instrument.

[21]The high rotation rate with short-term period reflects equity concern across local districts. By doing so, the Committee seeks to represent every jurisdiction during the 4-year political session.

dataset for politicians based on the National Assembly website. I also gather demographic-related dataset for each local district from the National Statistical Office website and the National Election Commission website.

Table 1.5 shows summary statistics. Average value of the Total Budget is larger than the Subsidized Project Budget, which in turn is larger than the National Subsidy. The mean of $MOSF_{i,c,t}$ is about 0.332. About 27% and 14% of congressmen are members of the Special Committee of Budget and Accounts and the Standing Committee of Strategy and Finance respectively.

1.4 Estimation Results

The test is constructed to examine whether bureaucrats' hometown attracts intergovernmental transfer more. Figure 1.5 shows the preliminary results. While both per capita National Subsidy and the National Subsidy are on the rising trend, the absolute amount of increase is comparable even though the initial level is smaller in the hometown of public officials in the Ministry of Strategy and Finance. It implies that the growth rate can be different between two regions.

The estimation result in Table 1.6 shows positive effects of high-ranked bureaucrats on the growth rate of per capita National Subsidy. When the local district is hometown high-ranked executive in the Ministry of Strategy and Finance, the National Subsidy increases by 17.2% if I do not control any covariates (column (1)). When I include all vectors of control variables and fixed effects, the growth rate of per capita National Subsidy increases by 6.6% (column (5)). The coefficient of $MOSF_{i,c,t}$ becomes smaller from 0.181 to 0.066 and R^2 increases higher from 0.188 to 0.663 when I control year fixed effect. It demonstrates a tendency of consistent increase of the budget every year. The effect of core bureaucrats is smaller to 5.6%, but it is still significant at 10% level (column (6)).

Table 1.5: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	N
National Subsidy	0.471	0.383	0.036	2.133	1233
Subsidized Project Budget	1.112	0.959	0.132	5.056	1235
Total Budget	2.157	1.745	0.425	9.781	1240
MOSF	0.332	0.471	0	1	1240
MOSF (Core)	0.321	0.467	0	1	1240
MOSF (Nonbudget)	0.157	0.364	0	1	1240
Other Gov.	0.424	0.497	0	1	1240
Budget Committee	0.265	0.441	0	1	1240
Finance Committee	0.143	0.350	0	1	1240
Ruling Party	0.671	0.470	0	1	1240
Fiscal Autonomy	0.315	0.159	0.078	0.86	1234
Senior Pop. Ratio	0.188	0.071	0.073	0.445	1236
GDP per capita	27483	8783	14295	62938	1240
Unemployment Rate	3.28	0.86	1.60	5.10	1240
Year	-	-	2008	2015	1240

[a] National Subsidy, Subsidized Project Budget and Total Budget is per capita value. The hierarchy is as follows: Total Budget $\supset$ Subsidized Project Budget $\supset$ National Subsidy.

[b] MOSF implies high-ranked bureaucrats in the Ministry of Strategy and Finance. MOSF (Core) is a core member of budget-related bureau, and MOSF (Nonbudget) is the rest of all.

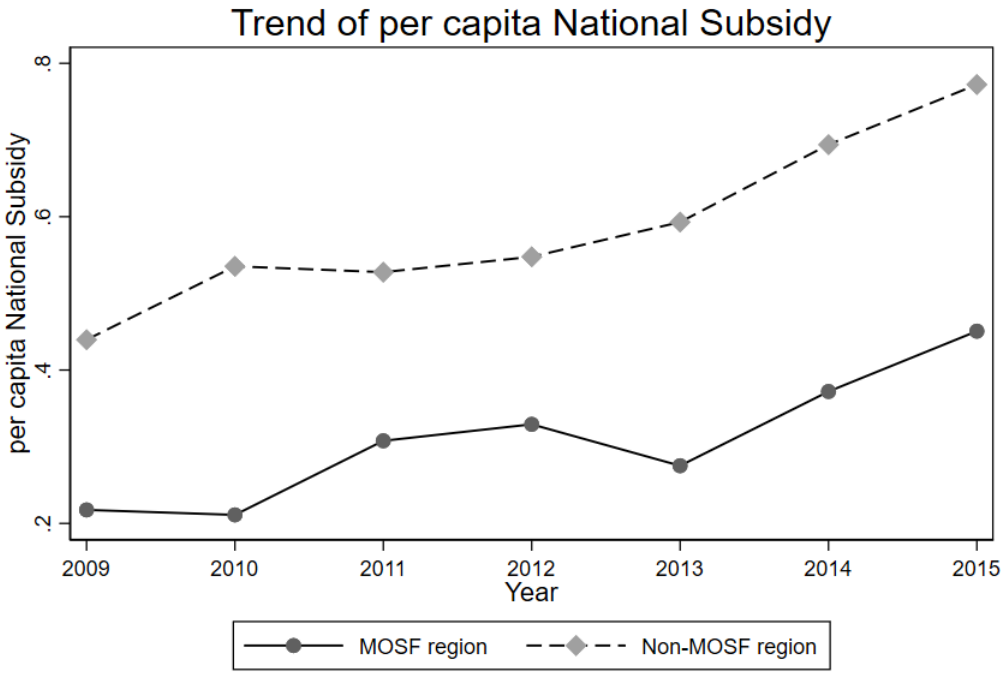
[c] Other Gov. is equal to 1 if the region i is a hometown of either minister or vice-minister of total 11 central governments and 1 government commission.

[d] Budget Committee and Finance Committee is a member of congressmen in each Committee in the National Assembly.

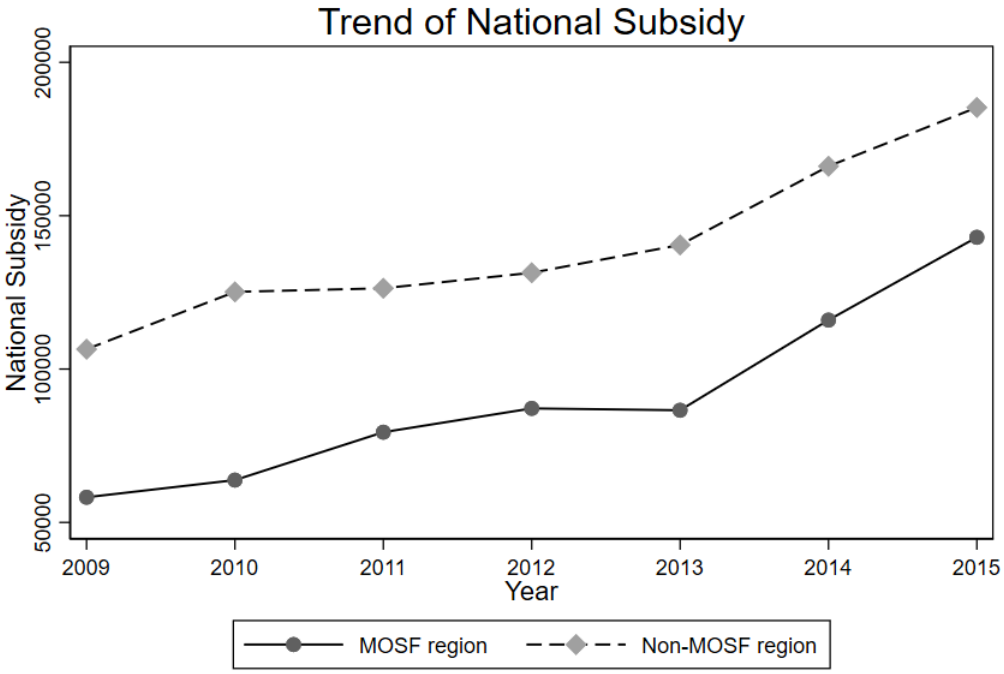
[e] Fiscal Autonomy = (Local Tax Revenue + Non-Tax Revenue)/Total Budget

[f] The unit of GDP per capita is 1000 KRW (1000 KRW is approximately equal to 1 USD).

Figure 1.5: Amount of National Subsidy across Years



Note: The unit is thousand dollar.



Note: The unit is thousand dollar.

Table 1.6: Basic Regression Result

	Dep. Var.: National Subsidy					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
MOSF	0.172***		0.173***	0.181***	0.066*	
	(0.043)		(0.044)	(0.051)	(0.029)	
MOSF (Core)						0.056^{+}
						(0.030)
Budget Committee		-0.020	-0.023	-0.027	-0.015	-0.015
		(0.025)	(0.025)	(0.024)	(0.015)	(0.015)
Ruling Party				-0.109**	-0.088*	-0.088*
				(0.040)	(0.035)	(0.035)
Fiscal Autonomy				0.548	-0.522	-0.534
				(0.371)	(0.295)	(0.296)
Senior Pop. Ratio				-15.153***	-1.117	-1.154
				(2.808)	(2.278)	(2.279)
GDP per capita				-0.000*	-0.000	-0.000
				(0.000)	(0.000)	(0.000)
Unemployment Rate				-0.105***	0.013	0.013
				(0.026)	(0.029)	(0.029)
Region FE	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y
R^2	0.0125	0.0006	0.0132	0.1880	0.6634	0.6630
N	1232	1232	1232	1230	1230	1230

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Interestingly, the effect of politicians on the local budget is not statistically significant in all cases. There are two possible speculations for this result. First, under the current Korean budget system, bureaucrats make a draft of the annual budget plan. After that, politicians only modify and adjust the already-formulated budget by the bureaucrats. Given this environment, there is not much room for the politicians to make a transformation on the annual budget. Second, as observed in Figure 1.3 and 1.4, there are more politicians in the budget committee than the bureaucrats in the Ministry of Strategy and Finance. Therefore, the power concentration is denser among the bureaucrats than the politicians. Third, the null findings for the National Assembly's members may give evidence for the importance of institutions preventing potential nepotism. Over time, many rules and regulations have been introduced to restrict myopic and self-interested budget manipulation by the legislative members. For instance, the annual rotation system for members of the Special Committee on Budget and Accounts makes individual politician's budget manipulation virtually impossible. Also, the budget committee is relatively large and almost equally distributed across regions, which also prevent individual politician's self-interested budget crafting.

The existence of ruling-party politicians shows negative effects on all specifications, which is contradictory to my original prediction. However, it can be possible since the majority party in the National Assembly did not change during my analysis period (2008-2015). Therefore, the fact that local district is occupied by the ruling-party politician may not be beneficial for the local region to secure more budgets. Economic factors such as GDP per capita and unemployment rate do not affect the budget allocation much. It is understandable considering homogeneous characteristics across local regions within a small territory of South Korea.

Overall, Table 1.6 highlights that social capital of region i is related to more subsidies in the following year in the existence of hometown connection through high-ranked bureaucrats. It presents that political representation of the jurisdiction is not constrained by electoral

accountability solely. Bureaucrat's geographical identity as an implicit social capital can play a crucial role in the budget allocation.

1.5 Robustness Checks

Other explanations for the result may exist. Another mechanism other than hometown favoritism can be the main channel. For instance, different types of bureaucrats or politicians can influence the budget allocation. To rule out other explanations, I conduct a battery of sensitivity tests to support that bureaucrats in charge of budgeting affect the resource allocation in real.

1.5.1 Falsification Test

Even though Table 1.6 shows that the growth rate of per capita National Subsidy increases about 6.5% in the hometown of bureaucrats, it remains questionable whether estimated results reflect a causal effect. While I employ various fixed effects γ_i, δ_t, and λ_{ct} to eliminate unobserved factors, the possibility of bias still persists due to the existence of a third factor.

Here, I perform a falsification test. The logic is that the effect of bureaucrats can only appear when he is in power. So it is not possible to influence the local budget allocation before he is in the high-ranking position. Also, bureaucrat's influential power will evaporate after he moves to position irrelevant to the budget allocation. Thus, it can give a necessary condition for my hypothesis. To be specific, I lead the dummy variable $MOSF_{i,c,t}$ from year 1 to 4 and lag it from year 1 to 3, respectively.[22] If my results are robust, it will not yield significant effect on the coefficient β_1 when I lead or lag the $MOSF$ variable.

[22]Considering the hierarchical organization, I cannot exclude a possibility that predecessors in the position may influence following year's budget allocation even after moving to a different position or retiring. Therefore, to be precise, it can be called a "placebo test" in the case of $MOSF_{i,c,t+j}$ for $j \in \{1,2,3,4\}$, and a "persistent effect test" for $j \in \{-3,-2,-1\}$. Below table describes an example how the analysis is interpreted.

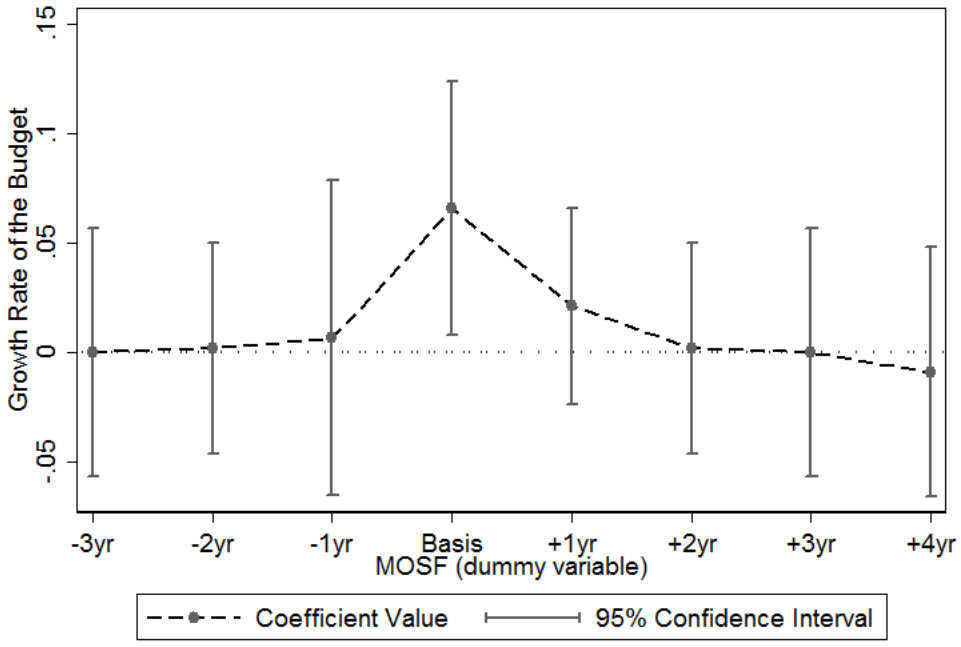
		Budget Year	2008	2009	Explanation
Basic Test		MOSF Year	2007	2008	Basically, bureaucrats of year 2007 affect the budget of year 2008.
Falsification Test	Placebo Test	MOSF (leading 1 year)	2008	2009	Bureaucrats of year 2008 cannot influence the budget of year 2008 since the budget is already determined in year 2007.
	Persistence Test	MOSF (lagging 1 year)	2006	2007	Bureaucrats of year 2006 may influence the budget of year 2008 if their power is persistent.

$$Y_{i,c,t+1} = \beta_1 MOSF_{i,c,t+j} + \beta_2 BudgetCommittee_{i,c,t} + X_{i,c,t} + \gamma_i + \delta_t + \lambda_{ct} + \epsilon_{i,c,t} \tag{1.2}$$

$$j \in \{-3, -2, -1, 0, 1, 2, 3, 4\}$$

As Table 1.7 and Figure 1.6 show, the coefficients β_1 of the dummy variable $MOSF_{i,c,t+j}$ become statistically insignificant, and the sizes become smaller. The coefficient is 0.000-0.005 in case of persistent effect test when $j \in \{-3, -2, -1\}$, and the result is similar in case of placebo test when $j \in \{1, 2, 3, 4\}$. This result shows that the bureaucrat influences his hometown's budget allocation only when he is in the position of power.

Figure 1.6: Falsification Test



Note: The coefficients of falsely leading or lagging years are small and statistically insignificant.

Table 1.7: Falsification Test

	Dep. Var.: National Subsidy							
	Persistence Test			Basis	Placebo Test			
Variable	lagging 3yr.	lagging 2yr.	lagging 1yr.	-	leading 1yr.	leading 2yr.	leading 3yr.	leading 4yr.
MOSF	0.000	0.003	0.005	0.064*	0.020	0.003	0.001	-0.008
	(0.030)	(0.025)	(0.037)	(0.029)	(0.023)	(0.025)	(0.030)	(0.029)
Budget Committee	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015	-0.015
	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Ruling Party	-0.088*	-0.088*	-0.089*	-0.088*	-0.088*	-0.088*	-0.088*	-0.088*
	(0.036)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.036)	(0.036)
Fiscal Autonomy	-0.521	-0.519	-0.522	-0.522	-0.523	-0.519	-0.521	-0.514
	(0.303)	(0.301)	(0.296)	(0.295)	(0.296)	(0.301)	(0.303)	(0.303)
Senior Pop. Ratio	-1.175	-1.175	-1.154	-1.117	-1.173	-1.175	-1.175	-1.149
	(2.307)	(2.307)	(2.303)	(2.278)	(2.297)	(2.307)	(2.307)	(2.307)
GDP per capita	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment Rate	0.011	0.012	0.012	0.013	0.012	0.012	0.011	0.012
	(0.030)	(0.030)	(0.029)	(0.029)	(0.029)	(0.030)	(0.030)	(0.030)
Region FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Region-specific linear trend	Y	Y	Y	Y	Y	Y	Y	Y
R^2	0.6605	0.6608	0.6619	0.6634	0.6614	0.6608	0.6605	0.6603
N	1227	1228	1230	1230	1229	1228	1227	1226

[a] Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Falsification tests are implemented in two parts: persistence test by lagging 1-3 year and placebo test by leading 1-4 year.

1.5.2 Other Bureaucrats Effect

Other governments participate in making the budget draft with the Ministry of Strategy and Finance. Ministers and vice-ministers are the head of departments, and they are regarded to have considerable power and affect the public affairs beyond their jurisdiction via their social capital. It suggests the possibility of favor-trading to the local budget allocation between local regions and bureaucrats in other departments. Thus, I apply a variable $Gov_{i,c,t}$ to examine another substantial channel. Table 1.8 gives the results.

In all specifications, there is no evidence of hometown favoritism by other government bureaucrats. When I consider both public officials of both the Ministry of Strategy and Finance and other governments, the effect appears only in the case of the Ministry of Strategy and Finance (column (6)). There are several possible reasons behind such results. First, possession of hegemony in the budgeting is critical in allocating the local budget. Since other bureaucrats have limited roles and they do not have the initiative in making the budget draft, the effect on the local budget can be restricted. Second, most ministers during the period are appointed-politicians, who do not have a higher incentive to take roots in the local area. Thus, it may lower their association with the favor-trading through hometown preference.

1.5.3 Other Congressman Effect

There is another mechanism that politicians can leverage their power to the budgeting, for example by joining the Standing Committee of Strategy and Finance. This Standing Committee of Strategy and Finance is comprised of 26 congressmen and carries out inspections and audits of governments every year. The term for the Standing Committee of Strategy and Finance is two years. Members of the Standing Committee of Strategy and Finance are more likely to be affiliated with bureaucrats of the Ministry of Strategy and Finance due to frequent meetings and inspections at the National Assembly. Because they can contact bureaucrats more often,

Table 1.8: Regression Result with Other Governments

	Dep. Var.: National Subsidy					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Other Gov.	0.043		0.044	0.021	0.005	0.004
	(0.022)		(0.022)	(0.023)	(0.018)	(0.017)
MOSF						0.064*
						(0.029)
Budget Committee		-0.020	-0.021	-0.026	-0.015	-0.015
		(0.025)	(0.025)	(0.025)	(0.015)	(0.015)
Ruling Party				-0.111**	-0.089*	-0.088*
				(0.040)	(0.035)	(0.035)
Fiscal Autonomy				0.542	-0.524	-0.523
				(0.375)	(0.297)	(0.296)
Senior Pop. Ratio				-15.521***	-1.147	-1.113
				(2.858)	(2.299)	(2.279)
GDP per capita				-0.000*	-0.000	-0.000
				(0.000)	(0.000)	(0.000)
Unemployment Rate				-0.105***	0.011	0.012
				(0.027)	(0.030)	(0.030)
Region FE	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y
R^2	0.0016	0.0006	0.0022	0.1759	0.6619	0.6634
N	1232	1232	1232	1230	1230	1230

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

social connections between them may create a higher possibility of distortive budget allocation.

Table 1.9 reports that the coefficient of $FinanceCommittee_{i,c,t}$ is small and not statistically significant. It suggests that there is no clear evidence of local budget influence through members of the Standing Committee of Strategy and Finance.

1.5.4 Heterogeneous Effect across Regions

It is commonly believed that hometown preference is weaker in the Greater Seoul Metropolitan Area (GSMA). One-third of total populations reside in the GSMA (Seoul, Incheon, and Gyeonggi), and numerous new movers have taken root here after rapid industrialization since 1970. According to Lee and Park (2000), the power of social network becomes stronger in local areas while it becomes weaker in the GSMA. Also, it is difficult to distinguish bureaucrats' impact from other factors since budgets in the GSMA is enormous and complex. Therefore, I separate them into two regions to witness the hometown favoritism more clearly.

Table 1.10 shows that the hometown preference is remarkable in the non-GSMA region. The budget allocation is affected by bureaucrats only in the local regions with strong hometown preference. The effect is stronger by 7.6% for members in the Ministry of Strategy and Finance. In contrast, the effect is small and insignificant in the GSMA region where social capital through sharing the hometown is weak. These findings confirm my argument that high-ranked bureaucrat benefits his hometown through local budget allocation.

1.5.5 Placebo Region Effect

As another robustness check for hometown preference, I perform a placebo test. More specifically, I assess whether hometown favoritism still exists by extending the analyzing unit i to include neighborhoods outside of the hometown. If the budget allocation is affected by bureaucrats via hometown preference, the effect will appear only when the region is well-targeted,

Table 1.9: Regression Result with Finance Committee Members

	Dep. Var.: National Subsidy					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
MOSF	0.172***		0.172***	0.180***	0.063*	
	(0.043)		(0.043)	(0.051)	(0.029)	
MOSF (Core)						0.055^{+}
						(0.030)
Finance Committee		-0.005	-0.009	0.008	0.013	0.013
		(0.038)	(0.037)	(0.025)	(0.022)	(0.022)
Ruling Party				-0.108**	-0.087*	-0.087*
				(0.040)	(0.035)	(0.035)
Fiscal Autonomy				0.542	-0.524	-0.536
				(0.368)	(0.293)	(0.294)
Senior Pop. Ratio				-15.127***	-1.116	-1.154
				(2.794)	(2.275)	(2.275)
GDP per capita				-0.000*	-0.000	-0.000
				(0.000)	(0.000)	(0.000)
Unemployment Rate				-0.106***	0.012	0.012
				(0.026)	(0.029)	(0.029)
Region FE	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y
R^2	0.0125	0.0000	0.0126	0.1871	0.6632	0.6628
N	1232	1232	1232	1230	1230	1230

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

and it will be dissipated when the scope of hometown is arbitrarily expanded. To perform the test, I randomly choose one neighborhood which shares a borderline with the bureaucrat's hometown, and I falsely assume this connected commune as his hometown. Table 1.11 is the result.

The outcome supports my hypothesis. The effect on the budget allocation disappears when the local district is widely defined. As shown in column (5) of Table 1.11, the coefficient becomes insignificant when all covariates and fixed effects are controlled. These results manifest the link between the hometown favoritism and the budget allocation.

Table 1.10: Regression Result with the Two Different Regions

	Dep. Var.: National Subsidy											
	Greater Seoul Metropolitan Area						Non-GSMA					
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
MOSF	0.197		0.197	-0.030	0.034		0.170***		0.172***	0.197***	0.076*	
	(0.149)		(0.152)	(0.107)	(0.118)		(0.045)		(0.046)	(0.054)	(0.030)	
MOSF (Core)						0.034						0.067*
						(0.118)						(0.031)
Budget Committee		-0.015	-0.015	-0.031	-0.005	-0.005		-0.024	-0.028	-0.029	-0.020	-0.019
		(0.048)	(0.048)	(0.045)	(0.029)	(0.029)		(0.029)	(0.028)	(0.029)	(0.017)	(0.017)
Ruling Party				-0.135	-0.047	-0.047				-0.046	-0.112*	-0.112*
				(0.069)	(0.059)	(0.059)				(0.049)	(0.041)	(0.041)
Fiscal Autonomy				0.045	-0.915*	-0.915*				0.767	-0.147	-0.175
				(0.549)	(0.398)	(0.398)				(0.530)	(0.399)	(0.402)
Senior Pop. Ratio				-23.735**	-1.182	-1.182				-12.287***	-1.499	-1.542
				(7.560)	(6.507)	(6.507)				(2.809)	(2.310)	(2.314)
GDP per capita				-0.000***	-0.000**	-0.000**				0.000	-0.000*	-0.000*
				(0.000)	(0.000)	(0.000)				(0.000)	(0.000)	(0.000)
Unemployment Rate				0.019	0.518***	0.518***				-0.071*	-0.021	-0.019
				(0.053)	(0.130)	(0.130)				(0.035)	(0.033)	(0.033)
Region FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y	N	N	N	Y	Y	Y
R^2	0.0020	0.0002	0.0022	0.2765	0.7124	0.7124	0.0216	0.0009	0.0229	0.1653	0.6559	0.6550
N	455	455	455	454	454	454	777	777	777	776	776	776

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1.5.6 Other Dependent Variables

Since my main hypothesis is whether bureaucrats and politicians influence the budget allocation, I use the Subsidized Project Budget and the Total Budget as dependent variables.[23] If my result is robust enough, similar results should occur in these changed variables. Table 1.12 and Table 1.13 report the results. In both cases, the dummy variable $MOSF_{i,c,t}$ still shows positive effects. One noticeable point is that the magnitude of effect becomes larger. It may hint at the existence of other budget components which are engineered via the bureaucrat's discretionary judgment.

I also use the revenue-related component as a dependent variable to corroborate the existence of hometown favoritism. Autonomous financial resource, which is a sum of the Local Tax and the Non-Tax Revenue, is mechanically determined by regional economic situations, and it is not affected by bureaucrats' discretionary power. Thus, the regression on autonomous financial revenue should not be influenced by hometown favoritism if my estimations are robust. To be specific, I estimate the equation by changing $Y_{i,c,t}$ to the sum of the Local Tax and the Non-Tax Revenue divided by total population and taking a natural log.

The result in Table 1.14 is as expected. There is no evidence that high-ranked bureaucrats influence autonomous financial revenue. It reinforces my hypothesis of hometown favoritism prevalence on the budget allocation.

1.5.7 Indirect Influence Possibility

There is a possibility that local politicians indirectly seek to secure more funds to their constituency through affiliated bureaucrats to avoid criticisms of pork barrel. Based on this speculation, I add an interaction term between the bureaucrats and politicians to check the possibility of indirect influence. However, the result in Table 1.15 shows that the interaction

[23] These measures go beyond the scope of bureaucrats' discretion, so they are a less precise component that I wish to capture.

Table 1.11: Regression Result with the Expanded Region

	Dep. Var.: National Subsidy				
Variable	(1)	(2)	(3)	(4)	(5)
MOSF	0.111**		0.112**	0.100*	0.016
	(0.034)		(0.035)	(0.040)	(0.026)
Budget Committee		-0.020	-0.022	-0.027	-0.015
		(0.025)	(0.025)	(0.025)	(0.015)
Ruling Party				-0.108**	-0.088*
				(0.040)	(0.035)
Fiscal Autonomy				0.585	-0.517
				(0.371)	(0.295)
Senior Pop. Ratio				-15.133***	-1.116
				(2.859)	(2.300)
GDP per capita				-0.000*	-0.000
				(0.000)	(0.000)
Unemployment Rate				-0.108***	0.011
				(0.026)	(0.029)
Region FE	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y
Region-specific linear trend	N	N	N	Y	Y
R^2	0.0081	0.0006	0.0087	0.1813	0.6620
N	1232	1232	1232	1230	1230

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.12: Regression Result with the Subsidized Project Budget

	Dep. Var.: Subsidized Project Budget					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
MOSF	0.150***		0.150***	0.175***	0.093***	
	(0.037)		(0.037)	(0.045)	(0.027)	
MOSF (Core)						0.095***
						(0.027)
Budget Committee		-0.008	-0.010	-0.013	-0.006	-0.006
		(0.021)	(0.021)	(0.021)	(0.015)	(0.015)
Ruling Party				-0.090**	-0.073**	-0.074**
				(0.032)	(0.027)	(0.027)
Fiscal Autonomy				0.454	-0.501	-0.522
				(0.444)	(0.411)	(0.410)
Senior Pop. Ratio				-11.276***	-0.076	-0.132
				(2.531)	(2.224)	(2.225)
GDP per capita				-0.000	-0.000	-0.000
				(0.000)	(0.000)	(0.000)
Unemployment Rate				-0.100***	0.040	0.040
				(0.023)	(0.027)	(0.027)
Region FE	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y
R^2	0.0138	0.0001	0.0140	0.1639	0.5618	0.5620
N	1234	1234	1234	1232	1232	1232

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.13: Regression Result with the Total Budget

	Dep. Var.: Total Budget					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
MOSF	0.112***		0.112***	0.142***	0.089***	
	(0.031)		(0.031)	(0.038)	(0.026)	
MOSF (Core)						0.091***
						(0.026)
Budget Committee		-0.003	-0.005	-0.006	-0.001	-0.001
		(0.017)	(0.017)	(0.017)	(0.014)	(0.014)
Ruling Party				-0.043	-0.032	-0.032
				(0.022)	(0.019)	(0.019)
Fiscal Autonomy				0.190	-0.377	-0.397
				(0.385)	(0.385)	(0.384)
Senior Pop. Ratio				-6.487**	0.372	0.318
				(2.042)	(2.026)	(2.025)
GDP per capita				-0.000	-0.000	-0.000
				(0.000)	(0.000)	(0.000)
Unemployment Rate				-0.080***	0.026	0.026
				(0.019)	(0.025)	(0.025)
Region FE	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y
R^2	0.0131	0.0000	0.0132	0.1347	0.4120	0.4123
N	1234	1234	1234	1232	1232	1232

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1.14: Regression Result with Autonomous Financial Revenue

	Dep. Var.: Autonomous Financial Revenue					
Variable	(1)	(2)	(3)	(4)	(5)	(6)
MOSF	-0.052		-0.051	0.017	0.017	
	(0.030)		(0.030)	(0.019)	(0.016)	
MOSF (Core)						0.028
						(0.016)
Budget Committee		-0.005	-0.004	-0.002	-0.002	-0.002
		(0.011)	(0.011)	(0.007)	(0.007)	(0.007)
Ruling Party				0.001	0.003	0.003
				(0.015)	(0.015)	(0.015)
Senior Pop. Ratio				3.209*	4.065*	4.054*
				(1.532)	(1.838)	(1.831)
GDP per capita				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Unemployment Rate				0.045***	0.032*	0.032*
				(0.010)	(0.015)	(0.015)
Region FE	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y
R^2	0.0052	0.0001	0.0053	0.6041	0.6186	0.6194
N	1234	1234	1234	1234	1234	1234

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

term is small and insignificant. There is no evidence that politicians indirectly exert their power on the budget allocation through bureaucrats. It further supports one of my results that local politicians have limited power to the budgeting in South Korea.

Table 1.15: Indirect Influence Possibility

	Dep. Var.					
Variable	National Subsidy	Subsidized Project Budget	Total Budget	National Subsidy	Subsidized Project Budget	Total Budget
MOSF x Budget Committee	0.009	0.019	0.026			
	(0.031)	(0.027)	(0.025)			
MOSF x Finance Committee				-0.003	0.028	0.065
				(0.041)	(0.041)	(0.039)
MOSF	0.062*	0.088**	0.082**	0.064*	0.088**	0.078**
	(0.030)	(0.028)	(0.026)	(0.030)	(0.027)	(0.026)
Budget Committee	-0.018	-0.012	-0.009			
	(0.018)	(0.019)	(0.018)			
Finance Committee				0.014	-0.015	-0.017
				(0.030)	(0.020)	(0.017)
Ruling Party	-0.088*	-0.074**	-0.033	-0.087*	-0.074**	-0.033
	(0.035)	(0.027)	(0.020)	(0.036)	(0.027)	(0.019)
Fiscal Autonomy	-0.520	-0.497	-0.372	-0.523	-0.505	-0.383
	(0.295)	(0.411)	(0.386)	(0.293)	(0.408)	(0.375)
Senior Pop. Ratio	-1.121	-0.086	0.358	-1.115	-0.070	0.331
	(2.278)	(2.226)	(2.029)	(2.275)	(2.209)	(1.999)
GDP per capita	-0.000	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Unemployment Rate	0.013	0.041	0.026	0.012	0.039	0.023
	(0.029)	(0.027)	(0.025)	(0.029)	(0.027)	(0.025)
Region FE	Y	Y	Y	Y	Y	Y
Year FE	N	N	N	N	Y	Y
Region-specific linear trend	N	N	N	Y	Y	Y
R^2	0.6634	0.5620	0.4124	0.6632	0.5619	0.4139
N	1230	1232	1232	1230	1232	1232

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1.6 Discussion

1.6.1 The Effect of Transparency on Budget Allocation

Goverment Subsidies Integration Management System

To reduce fraud and enhance work efficiency, the Korean government launches a portal website called the Government Subsidies Integration Management System. This system is established based on the Act on the Budgeting and Management of Subsidies and the Act on Disclosure of Information by Public Agency. One of the divisions in the Ministry of Strategy and Finance is responsible for operating the system. It was partially introduced in January 2017 and became fully available to the public in July 2017. The newly introduced system provides detailed information about the government subsidy programs to the public. Hence, it gives an opportunity to monitor and evaluate the implementation of the National Subsidy by third-party like civic groups. Improved transparency on the allocation and execution of the National Subsidy can decrease an incentive for the bureaucrats and the local governments to exploit social connections to get more budgets.[24] If this is the case, it can further confirm the existence of hometown favoritism in budget allocation. I explore whether such mechanisms hold effective.[25]

Empirical Evidence

As the Government Subsidies Integration Management System was discussed in the Ministry of Strategy and Finance since 2015, I expect that the budget allocation can be influenced by the newly adopted system beginning in 2016. Thus I restrict the analyzing period to 2015-2017 and seek to examine whether the introduction of the system affects the budget allocation. Table

[24] According to Ferraz and Finan (2008) and Avis, Ferraz, and Finan (forthcoming), publicly released audit reports in Brazil successfully improve political accountability and reduce corruption.

[25] Appendix A.3 gives a simple framework of the transparency mechanism.

Table 1.16: The Effect of Transparent System on Budget Allocation

	Period: 2015-2017		
Dep. Var.:	National Subsidy	Subsidized Project Budget	Total Budget
Panel A: All districts			
MOSF	-0.264*	-0.235**	-0.229**
	(0.103)	(0.081)	(0.080)
Budget Committee	0.004	-0.021	-0.013
	(0.059)	(0.045)	(0.041)
R^2	0.7173	0.6490	0.5505
N	463	463	463
Panel B: Excluding the Greater Seoul Metropolitan Area			
MOSF	-0.293*	-0.237*	-0.222*
	(0.119)	(0.092)	(0.089)
Budget Committee	-0.014	-0.052	-0.038
	(0.080)	(0.059)	(0.054)
R^2	0.6790	0.6188	0.5386
N	292	292	292
Covariates	Y	Y	Y
Regional FE	Y	Y	Y
Year FE	Y	Y	Y
Region-specific linear trend	Y	Y	Y

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$ * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1.16 shows the result.

Surprisingly, the effect has changed significantly. After the introduction of the transparent system, the growth rate of per capita National Subsidy decreases about 26%, and 24% for the Subsidized Project Budget and 23% for the Total Budget, respectively (Panel A). The results are similar when I limit the samples to the non-Greater Seoul Metropolitan Area (Panel B). Considering that the growth rate of per capita National Subsidy increases about 6.5% in the hometown of high-ranked bureaucrats during 2008-2015, this is a huge difference.

The analysis should be cautiously interpreted since it includes several limitations. The electoral constituency changed in 2016, so the analyzing unit should have been altered to reflect this fact, which I cannot introduce here. The data such as GDP per capita and unemployment rate are also missing. However, stark differences that hometown favoritism is dissipated after the adoption of the Government Subsidies Integration Management System suggests crucial implications. Bureaucrats from the same hometown have better information about the local circumstances, and it leads to allocating more funds to the communities in an efficient manner. Or more allocation of resources may represent opportunistic behaviors such as career concern or corruption by using regional networks to fulfill personal interests. Among these two hypotheses, my results of the effectiveness of transparent system on curbing the increase of budget shed lights on indirect evidence that budget officers are susceptible to be captured by rent-seeking intentions. Thus, making the budget allocation system transparent and sharing information to the public can be an effective way to prevent this channel.

1.6.2 Why Bureaucrats and Not Politicians?

In the previous section, I present the results with various evidence that local budget allocation is affected by high-ranked bureaucrats of the Ministry of Strategy and Finance via hometown preference, while there is no such effect in case of the politicians. It is beyond my study to find an exact channel, but specific institutional set-up can be one main reason under this peculiar budget allocation. That is, the authority and initiative of budget allocation are coming from the central government rather than the parliament. Using a simple theoretical framework that reflects the specific institutional set-up in South Korea, I attempt to explore the underlying mechanism how bureaucrats can affect the budget allocation while politicians have no such effect.

The Korean budget allocation is a sort of sequential Nash bargaining game reflecting the

fact bureaucrats formulate the budget draft at the first stage and politicians finalize it at the second stage. First, considering that the Korean budgetary system prevents negotiations from the breakdown, it is not unrealistic to interpret the budget allocation as a Nash bargaining game, as it seeks to achieve a Pareto-optimal solution. Second, it is well established that the outcome of the cooperative game solution is the same as that of the noncooperative game in certain circumstances, which alleviate the analytical cumbersome. Hence, I can assume that the budget allocation is a sequential Nash bargaining game and solve it by backward induction.

Suppose there are two regions, $D = \{x, y\}$. Here, x and y represent the total amount of final budget that each district obtains. For simplicity, I assume that their utility is linearly dependent on the amount of budget, so $U(x) = x$ and $U(y) = y$. Also, I assume that each region has one bureaucrat and one politician. Bargaining power of region x's bureaucrat is β and $(1 - \beta)$ for region y. Similarly, bargaining power of region x's politician is α and $(1 - \alpha)$ for region y. This set-up is followed by an asymmetric bargaining game.

1. In the second stage where politicians play with each other, they are bargaining for (x, y) given $(\bar{x}, \bar{y})$, which is obtained from the first stage.[26] It yields

$$\{x, y\} = \arg\max_{x,y} (x - \bar{x})^{\alpha} (y - \bar{y})^{(1-\alpha)} \; s.t. \; x + y = R + \epsilon$$

   where R is the total amount of budget draft set by bureaucrats at the first-stage, and ϵ is the amount of budget adjustment during the process of the Special Committee of Budget and Accounts, which reflects the Korean budget-making system. The Constitution Article 54 endows bureaucrats with the capacity to formulate the annual budget, while the National Assembly's power is strictly restricted only to modify the original

[26] In theory, $(\bar{x}, \bar{y})$ represents allocation when no agreement is reached. To be real, $(\bar{x}, \bar{y})$ can be interpreted as a quasi-budget schedule (called *jun-yesan* in Korean). If the National Assembly fails to formulate a next-year fiscal plan, the Constitution requires implementing a quasi-budget schedule as a contingency plan for governmental services.

draft. Furthermore, time for budget review is limited, which makes it difficult for the legislatures to pay full attention to the budget-making process. As a result, net changes ϵ by the congressmen rarely exceed 1% of the original proposal (Kang, 2015). If I solve the second stage problem, I get

$$x = \bar{x} + \alpha(R + \epsilon - \bar{x} - \bar{y})$$
$$y = \bar{y} + (1 - \alpha)(R + \epsilon - \bar{x} - \bar{y})$$

, which implies that each politician obtains additional resources proportional to his bargaining power.

2. In the first stage where two bureaucrats play with each other,

$$\{\bar{x}, \bar{y}\} = \arg\max_{\bar{x},\bar{y}} (\bar{x} - x_0)^{\beta} (\bar{y} - y_0)^{(1-\beta)} s.t.\ x = \bar{x} + \alpha(R + \epsilon - \bar{x} - \bar{y})$$
$$y = \bar{y} + (1 - \alpha)(R + \epsilon - \bar{x} - \bar{y})$$
$$R = \bar{x} + \bar{y}$$

where (x_0, y_0) is a default level of the budget if bureaucrats fail to establish the next year budget.[27] If I solve the first stage optimization problem, I get

$$x = x_0 + \beta(R - x_0 - y_0) + \alpha\epsilon$$
$$y = y_0 + (1 - \beta)(R - x_0 - y_0) + (1 - \alpha)\epsilon$$

, which means that each executive gets the local budget proportional to his bargaining power, as is the case of the second stage.

3. Finally, it leads to comparativie statistics that $\frac{\partial x}{\partial \beta} = R - x_0 - y_0 (> 0)$ and $\frac{\partial x}{\partial \alpha} = \epsilon (> 0)$.

Choi and Yang (2015) survey public officials in charge of budget affairs as of 2013, and they find

[27] (x_0, y_0) can be interpreted as a budget level in the previous year.

that fine-tuning controls by the Ministry of Strategy and Finance are widespread. Also, Park (2011) shows that adjustment figure of the budget by members in the Special Committee for Budget and Accounts is relatively small around $\pm 2\%$ of the first draft, which can be interpreted as a small ϵ. Considering these facts, it is possible that the impact of the bureaucrat on his hometown's budget is much larger than that of the politician. Hence, it yields

$$\underbrace{R - x_0 - y_0(= \frac{\partial x}{\partial \beta})}_{Bureaucrat} > \underbrace{\epsilon(= \frac{\partial x}{\partial \alpha})}_{Politician}$$

, which shows that bureaucrat's bargaining power to the local budget is far greater than politician's influence.

Theoretical prediction is compatible with my estimation in that the coefficient of $MOSF_{i,c,t}$ is significantly positive and large whereas that of $BudgetCommittee_{i,c,t}$ is both insignificant and small. While the parliament has the authority and initiative to make the budget draft from the beginning and the Office of Management and Budget in the Executive Office of the President only plays as a subsidiary agency in the US, the role is reversed in South Korea. Thus, it can cause the difference that Korean bureaucrats have significantly higher influential power in the budgeting process.

1.7 Concluding Remarks with Policy Implication

In this paper, I seek to examine whether the hometown favoritism exists in the budget allocation using South Korea's example. While existing literature concentrates on politician's influence on the budget allocation, I complementarily examine the role of bureaucrats by exploiting their demographic identity. I find that the hometown of high-ranked executive experience a higher

growth rate of governmental subsidies, whereas there is no evidence that politicians affect the budget allocation. Many sensitivity checks support my argument. The local budget allocation should be based on integrity, efficiency, and fairness. However, my findings indicate the presence of significant biases in the Korean budget allocation system due to the bureaucrat's hometown favoritism.[28]

Two interesting aspects of South Korea's environment may attribute to the result. First, demographic identity combined with future career concern can affect the bureaucrat's decision making in the public area. Second, the process that the administration formulates the budget draft in advance and the legislative merely finalizes it afterward has a significant impact on the budget allocation.

My analysis manifests the possibility of distortive budget allocation by high-ranked bureaucrats. The finding of demographic linkage between bureaucrats and local governments on the local budget has serious policy implications in governmental budgeting. If there exists a misallocation of the National Subsidy across local regions due to bureaucrat's hometown favoritism, what is the solution? One possible solution is to improve the transparency of the National Subsidy execution process. By allowing people to monitor allocation and implementation of the National Subsidy through easy access to the data, the government may enhance the efficiency of the budgeting process. Fundamentally, more academic debates are necessary for designing the institutional setting, which is capable of achieving efficiency and fairness to the budget allocation. Organizational performance can be enhanced by assigning high-ranked public officials in budgeting away from the position which is vulnerable to the hometown tie.

[28]My study still has limitations. It is beyond the scope of this paper to directly quantify the impact of pork barrel on social welfare outcomes since it is difficult to exercise the counterfactual estimates as I only exploit a single channel of favoritism. Also, the outcomes of resource allocation can be more constructive and efficient since the high-ranked bureaucrats have accumulated a lot of knowledge and experiences on the budgeting front.

Chapter 2

The Effect of School Choice on Student and Public Education

2.1 Introduction

Economists have been interested in the relationship between educational set-up and quality of public education, such as the effect of school type on pupil's performance (Evans and Schwab, 1995; Neal, 1997; Altonji, Elder, and Taber, 2005a). Among them, one of the most long-time controversial topics is whether school choice policy is beneficial to improve the quality of education by enhancing students' academic attainments and transforming their class attitudes.

Although many studies have tried to resolve the question, conclusions are still ambiguous. Proponents argue that the quality of education can improve by making academic institutions more responsive to students, and competitions among schools to attract better students can help to enhance general level of education (Friedman, 1962; Hoxby, 2000; Hanushek and Rivkin, 2003; Hoxby, 2003; Abdulkadiroğlu, Angrist, Dynarski, Kane, and Pathak, 2011). Also, aligning the pupil's revealed preference to his attending school may enhance a self-image and help to achieve better outcomes (Akerlof and Kranton, 2002). However, opponents emphasize that school choice is not advantageous to improve student's academic performance. It only ranks schools and segregates student groups by socioeconomic position. There is also a risk of regressive educational outcome by benefiting high ability students more (Bettinger, 2005;

Cullen, Jacob, and Levitt, 2006; Abdulkadiroğlu, Pathak, and Walters, 2018).

When analyzing educational policy effect on students, we need to consider following things more seriously: (1) "What are the specific characteristics of policy environment?", and (2) "Is the self-selection issue properly resolved?" Educational policy is layered on top of each region's historical and socioeconomic contexts, and many policy questions are peculiar to this path-dependent experience. Therefore, it is significant to examine specific environment beforehand and analyze the policy effect afterward to obtain a valid conclusion (Angrist and Pischke, 2010). In addition, resolving the self-selection problem is critical because students may expect policy implementation and adjust their behaviors in advance (Ashenfelter, 1978). The estimated result would be biased without considering this self-selection issue. Since we cannot observe the counterfactual, evaluating the policy impact is difficult and consequently finding a proper comparison group is crucial. We should compare the treatment and control group, among which the only difference should be its variable of interest.

Seoul, the capital of South Korea, provides an attractive environment to analyze the effect of school choice policy on students' outcomes. South Korea is well known for its highest enthusiasm for education, often represented as *"a country of the tiger mom."* Competition for entering into a better school is high at all levels, private tutoring is widespread, and more than 80% of high school students advance to tertiary-level education. Thus, examining the effect of school choice program can help to improve the education system. Also, Seoul has an advantageous aspect from an analysis perspective in that (1) student applies to high school which he wishes to attend, and (2) the assignment is implemented via lottery. Since pupils are randomly assigned, it enables to precisely analyze the effect by limiting self-selection problem and minimizing any ethical issue.[1] The application-based random assignment system makes

[1]It is impossible to execute a controlled experiment on students since implementing an educational policy considered to be beneficial to some pupils while forbidding it to others would be unethical. While many educational experiments can be both unethical and unfeasible, Seoul's quasi-natural experimental circumstances from the random assignment system give a close approximation to such experiment.

the treatment and control group share similar observed and unobserved traits in various aspects. In this environment, any statistical difference between the treatment and control group is attributed to the policy intervention, not to pupil's initial abilities or family backgrounds. Moreover, what makes Seoul distinguished from other regions is that all students are subject to the same random assignment system irrespective of personal backgrounds, and no attrition issue exists because most students accept the lottery result. The comparability of a lottery winner and loser should be compromised if the non-random attrition problem exists (Cullen, Jacob, and Levitt, 2006). There is no such risk in Seoul.

In this paper, I distinguish the pupils into two groups, ones who attend their preferred school (win the lottery) and the others who do not enroll in their preferred option (lose the lottery) by exploiting the unique application-based random assignment system via lottery in Seoul. And I analyze the effect of school choice system on these two groups' cognitive and non-cognitive outcomes. I find that school choice does not have a statistically significant effect on academic attainments. There is little evidence that students who win the lottery perform better in Korean, math, and English test. Also, school choice policy is not causally related to various aspects of student's class attitudes and overall manners. This is a similar result which refutes the argument that school choice positively influences student's academic performance (Bettinger, 2005; Cullen, Jacob, and Levitt, 2006). However, student's school satisfaction is different between two groups that lottery winners are more likely to satisfy with their attending school (Peterson, Howell, Wolf, and Campbell, 2003; Hastings, Neilson, and Zimmerman, 2012). Interestingly, I find that behavioral characteristics of principals and teacher do not change over time after introducing school choice policy. Considering that advocators have claimed normalization of public education through competition among schools as one of their primary goals of school choice program, these contradictory results require more productive discussions about the effect of school choice policy on the educational front.

The value-added feature of my study is as follows. To my knowledge, it is the first attempt to empirically analyze the effect of school choice on students' outcome using a South Korea example. Under the environment where students are randomly assigned based on their revealed preference and the quality of high school is standardized, I can study the effect of school choice policy on students' outcomes more rigorously. This paper is also different from existing literature in various aspects. Firstly, it focuses on students who became a high school freshman in 2013 so they were under the new school choice system (Kang, 2007; Kang, Park, and Lee, 2007; Kim, Lee, and Lee, 2008; Park, Behrman, and Choi, 2013; Kim and Kim, 2015; Dustmann, Ku, and Kwak, 2017; Hahn, Liang, and Yang, 2018). Secondly, it alleviates the self-selection problem which previous research did not directly deal with (Park, 2016). Thirdly, it uses a rich panel dataset constructed by the Seoul Metropolitan Office of Education contrary to existing research which used cross-sectional data (Choi and Hwang, 2017). Finally, it evaluates the effect of school choice on not only cognitive outcomes but also non-cognitive attitudes since both of them are important determinants of adult outcomes.

The paper is organized as follows. Section 2.2 reviews related literature. Section 2.3 introduces basic knowledge of education system in Seoul, South Korea. Section 2.4 explains a dataset and how samples are constructed. Section 2.5 describes an empirical strategy and Section 2.6 reports estimation results. Section 2.7 gives a further discussion topic. Section 2.8 is a conclusion.

2.2 Literature Review

My study is similar to prior literature which utilizes the school lottery to examine the effects on students' outcome. The effect of school choice program in the United States begets mixed results. To name a few, proponents argue that school choice programs can effectively raise test scores (Rouse, 1998; Hanushek and Rivkin, 2003; Hoxby, 2003; Abdulkadiroğlu, Angrist,

Dynarski, Kane, and Pathak, 2011; Hastings, Neilson, and Zimmerman, 2012). However, some studies find that there is no evidence of academic improvement, and only non-traditional measures are positively affected. The effect even turns out to be negative due to the selection of low-quality schools into the lottery (Bettinger, 2005; Cullen, Jacob, and Levitt, 2006; Wiswall, Stiefel, Schwartz, and Boccardo, 2014; Abdulkadiroğlu, Pathak, and Walters, 2018).

A number of studies have used South Korean case to analyze various education-related questions since the random assignment system of South Korea gives a chance to exploit the quasi-experimental situation. Kang, Park, and Lee (2007) and Kim, Lee, and Lee (2008) investigate the impact of equalization policy on students' outcomes such as test scores and adulthood earnings. Kang (2007) finds that the quality of student's peers improves the student's performance by employing instrumental variable methods. Park, Behrman, and Choi (2013) assess a casual effect of single-sex school on STEM outcome using a national college entrance mathematics exam and a longitudinal survey of high school seniors. Dustmann, Ku, and Kwak (2017) find that coed classroom teaching has positive effects for boys. Hahn, Liang, and Yang (2018) analyze that private high school have better student outcomes than public high school and attribute their findings to autonomous personnel decisions in private school. These studies are based on the assumption of complete randomization. However, Kim and Kim (2015) argue that this is not the case since actual student assignment is implemented by the rule considering student's residential address and commuting time, which implies that the student assignment process is not entirely random. Thus, a possibility of endogenous sorting in the assignment may emerge, which is likely to yield a biased result when we estimate the effect of school on students.

The new application-based random assignment system was introduced in 2010. This newly adopted policy provides a chance to investigate several interesting topics. For example, Park (2016) examines whether the autonomous private high schools enhance students' academic

performance by applying a value-added model.[2] The closest research to mine is by Choi and Hwang (2017), which also attempt to examine the effect of school choice on students' test score. Similar to my analysis, it exploits the new assignment environment in Seoul, which changed from the complete randomization within the school district into the application-based randomization system. By applying a difference-in-difference methodology on high school students' National Assessment of Educational Achievement test score, they find no statistical evidence of academic improvement. However, it does not specify individual's school choice. They also use cross-sectional data ranged from 2009 to 2011. Thus, they cannot check the self-selection issue directly.

2.3 Background of the Study

2.3.1 General Picture of Korean High School

Korean elementary and secondary education follows the three-stage system, elementary school (6-year), middle school (3-year), and high school (3-year). The former two stages are mandatory but more than 99% of middle school students advance to high school.[3] In 2016, high schools in Seoul mainly consist of 4 types, special purpose, vocational, autonomous (private/public), and regular high school. As of 2015, there were total 318 high schools and 308,306 students.

Special purpose high schools are specialized in science, foreign languages, and arts for talented students. Vocational high schools focus on educating students to learn practical skills to find a job after graduation. These two types of school use their own criterion to select students. Regular and autonomous high school are under the same application-based random

[2] In 2009, the government introduced a new type of school called "autonomous private high school." This type of school has a bigger autonomy in school management at the expense of financial support from the government. The introduction of autonomous private high school gives an opportunity to investigate whether the autonomy and financial incentive may improve the quality of education (Park, 2016).

[3] According to the Statistics Korea, percentage of students advancing to a high school is 99.6% (2009), 99.7% (2010) 99.7% (2011), 99.7% (2012), 99.7% (2013), 99.7% (2014), and 99.7% (2015).

Table 2.1: Number of Schools and Student as of 2015

		Number of Schools	Number of Students
Regular HS	Public	73	73,477
	Private	110	129,454
Special Purpose HS	Public	8	3,324
	Private	12	9,580
Vocational HS	Public	18	14,595
	Private	53	34,515
Autonomous HS	Public	19	15,177
	Private	25	26,184
Total		318	308,306

[a] Source: http://statistics.sen.ge.kr/

assignment system, and students of them prepare for college entrance. Both schools are similar, but the latter has a higher autonomy when it comes to operating its curricula at the expense of little financial subsidies from the government (Park, 2016). The unique feature of the South Korean high school system is that both public and private regular high school are managed and regulated similarly by the Ministry of Education. The central government controls both financial resources, budget-management rules, academic curricula, teachers' salaries and their qualifications (Hahn, Liang and Yang, 2018).

2.3.2 Student Assignment System

The Korean education system has traditionally valued the equality of educational opportunity. Over a growing concern of intensified competition and increased educational inequality among students, the government has sought to adopt educational policies which support the idea of equal educational opportunity. Under this circumstance, the Seoul Metropolitan Office of Education had introduced the randomized allocation system since 1974. It implies that pupils

were randomly allocated to high school irrespective of any preference they had for schools.

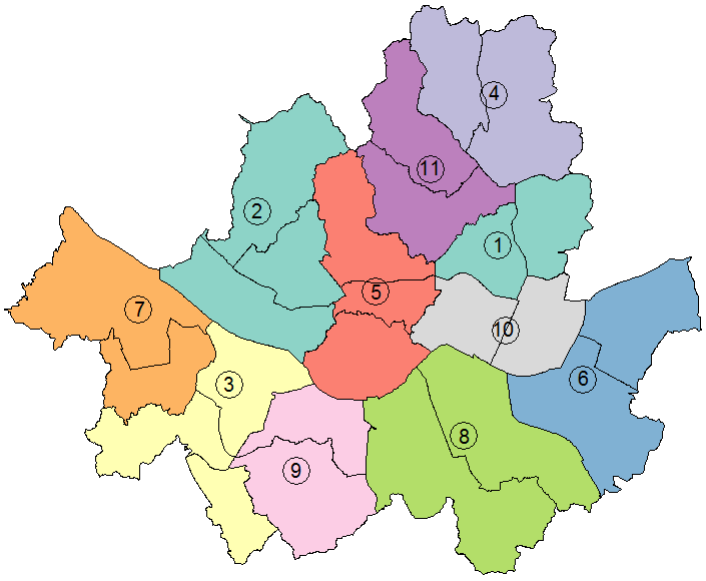
However, in 2010, the student assignment system changed to accommodate public's criticism that students have a right to choose their high school. Advocators of school choice policy argued that it would help to normalize the public education through competition among schools. Following this criticism, the newly adopted system allows middle school students to select high school before moving onto the lottery. It implies that the system is transformed from the complete random assignment into the application-based random assignment. Still, the assignment is implemented based on the randomization allocation principle. For instance, it does not use any academic index such as exam scores to fulfill the philosophy of equalization policy.[4] However, one difference emerges that the government tries to reflect students' preference when assigning them to high school.

Currently, the Seoul Metropolitan Office of Education and the Seoul Local Office of Education are responsible for educational policies, including the student assignment process. The scope of Seoul Metropolitan Office of Education is referred as the *single-school-district*, which covers entire regions of Seoul. The range of Seoul Local Office of Education Office is defined as the *general-school-district*, and total 11 *general-school-district* exist. Finally, the *combined-school-district* comprises of several adjacent *general-school-district*, and total 19 *combined-school-district* exists. To illustrate how these school districts work, a student is regarded as a member of the 8*th general-school-district* when his/her residential address is in the 8*th general-school-district* as of August in 3*rd* grade at middle school. And this information is a central part of the assignment procedure. Figure 2.1 describes the school district in Seoul.

Table 2.2 introduces current student assignment process. It undergoes two stages. In the

[4]The exact assignment mechanism is strictly confidential, but one crucial point is that academic performances and family backgrounds are not used to allocate students to high schools. Dustmann, Ku, and Kwak (2017) provide administrative details about the assignment procedures through an in-depth interview with an official who is responsible for the process. According to them, the Seoul Metropolitan Office of Education firstly determines the total quota for high school entrance which varies year by year. Secondly, students participate in the assignment procedure, and the computer program randomly matches them to high school.

Figure 2.1: School District in Seoul



1. Dongbu
2. Seobu
3. Nambu
4. Bukbu
5. Jungbu
6. Gangdong-Songpa
7. Gangseo-Yangcheon
8. Gangnam-Seocho
9. Dongjak-Gwanak
10. Seongdong-Gwangjin
11. Seongbuk-Gangbuk

Map of Seoul | Scope of each 11 SLOE

School-District	Criterion	Area	
		Total Number	Specific Area
Single	Scope of SMOE	1	{1,2,3,4,5,6,7,8,9,10,11}
General	Scope of SLOE	11	{1} {2} {3} {4} {5} {6} {7} {8} {9} {10} {11}
Combined	Combining adjacent General-School-District	19	{1,4} {1,5} {1,10} {1,11} {2,3} {2,5} {2,7} {3,5} {3,7} {3,9} {4,7} {5,8} {5,9} {5,10} {5,11} {6,8} {6,10} {8,9} {8,10}

[a] SMOE: Seoul Metropolitan Office of Education
[b] SLOE: Seoul Local Office of Education
[c] Seoul consists of total 25 administrative districts called "Gu". There exists total 11 general-school-district, and each general-school-district covers 2 to 3 Gu in its scope.

first stage, special purpose, autonomous private, and vocational high schools select middle school graduates based on their own criteria. Students can opt for whether they apply to these types of high school or not. All remaining students (those who do not apply or who fail to be selected in the first stage) move onto the second stage. In the first round of the second stage, students select two regular high schools within the *single-school-district*, and they apply to them. About 20% of all slots are filled in the first round. In the second round, students apply to two regular high schools again. However, their choice is limited to high schools within the *general-school-district*. For example, a student from the 8*th general-school-district* can apply only to two regular high schools which are located in the 8*th general-school-district*. They can stick to their original choice or change to school which they wish to apply from the earlier round. About 40% of all vacancies are filled. In the final round, the government randomly allocates all remaining students to schools within the *combined-school-district*.

Table 2.2: Student Assignment System as of 2015

	First Stage	Second Stage		
		1st Round	2nd Round	3rd Round
School Type	Special Purpose HS Autonomous Private HS Vocational HS	Regular HS Autonomous Public HS	Regular HS Autonomous Public HS	Regular HS Autonomous Public HS
School-District Restriction	single-school-district	single-school-district	general-school-district	combined-school-district
Student Assignment Method	self-selective	application-based lottery	application-based lottery	lottery

[a] Source: http://hinfo.se.go.kr/index.do
[b] School Types: Special Purpose HS, Vocation HS, Autonomous HS, Regular HS.
[c] School-District Restriction: In each stage and round, student's school application is limited to schools within specific school-district (single-school-district, general-school-district, combined-school-district).

2.4 Data and Balance Test

2.4.1 Data and Sample Construction

In this paper, I use the Seoul Education Longitudinal Study of 2010 (SELS). The panel data were constructed by the Seoul Metropolitan Office of Education to collect students' various information of different stage and utilize them to improve educational practice and policy. The SELS includes a substantial list of observable information such as personal backgrounds, family traits, and school characteristics. The dataset includes three different cohorts, 4th grade at elementary school in 2010, 1st grade at middle school in 2010, and 1st grade at high school in 2010.

To correctly estimate the effect of school choice on student outcome, I need to create samples which are homogeneous in various aspects except for my interest variable, whether or not they attend their preferred school. To minimize the risk of self-selection problem, I select the sample as follows.

1. First, I focus on the student cohort who was 1st grade at middle school in 2010. They were examined for 6 years from 2010 (1st grade at middle school) to 2015 (3rd grade at high school). This cohort allows me to examine the self-selection issue when students are sorted into high school since it contains academic records and various subjective evaluation indexes before advancing to high school.

2. Second, I work on students of regular and autonomous public high school only, since they are subject to the same application-based random assignment system.

3. Third, I distinguish these pupils into two groups, one who attends his/her preferred choice (winning the lottery) and the other who does not (losing the lottery). To do so, I exploit the survey's question "*My high school is where I want to attend before the lottery.*"

The interpretation of "*My high school is where I want to attend before the lottery.*" requires several cautions. It may be the case that attending the preferred school is not directly translated into winning the lottery. Since my dataset is not a designed experiment, I cannot directly observe the preference of the samples, and I only infer the students' preference from the survey's question. Also, winners in the lottery include students who are placed in their preferred high school in any round of the assignment process. Thus, winners in the lottery include those who are rejected in the earlier round.

However, these concerns can be alleviated for the following reasons. First, the question in the survey measures students' preference explicitly by asking whether students attend their preferred school. Since the goal of my paper is to examine the effect of school choice on students, and the student's attending school is aligned with the result of the lottery, it is not a strong assumption that attending the preferred school is interpreted as winning the lottery. Second, the inquiry in the survey can help to observe students' final decision by accommodating both original and later-developed preferences. It is a reasonable measure considering the institutional background that students can still have an option to which school they wish to apply in the next round, and they are able to stick to their original choice even after the rejection from the first round.

From the above classification, I select total 328 students, and 258 of them are reported to win the lottery. It implies that about 79% of students succeed to attend their preferred high school. Since the difference between these two groups comes from the lottery result only, I expect that their overall characteristics would be qualitatively homogenized. In the next section, I prove this matter more rigorously by checking their balance across various traits.

2.4.2 Balance Test

Table 2.3 presents summary statistics as of 2012 when students are 3*rd* grade at middle school. My main interest variable is "School Choice," which is equal to 1 if a student succeeds to enroll in his preferred high school. About 78.7% of students attend their preferred choice. The number of siblings is about 2. More than 75% of students are using a private tutoring service, and its average cost amounts to 142 dollars per month. Family income is around 5,350 dollars per month. Father's schooling level is higher than mother's. Table 2.3 shows that characteristics of sample students in the dataset are the representative of Korean middle school student in general.

Next, I conduct the balance test whether two groups are systematically different before advancing to high school. Table 2.4 shows that there exists little difference between two groups in academic performances, individual characteristics, and family backgrounds. In Figure 2.2, I plot the distribution of academic performance during the pre-treatment period. Although the distribution patterns are not exactly identical, they are similar in general and any systematic pre-trend is hardly expected across years by the group. Overall, the characteristics of two groups are qualitatively the same throughout many aspects during their middle school period. There is not much disparity between two groups, and they are balanced across various observable characteristics. It shows that the random assignment is successful, and the existence of self-selection problem is unlikely to occur. Therefore, it gives an internal validity of examining the causal effect, whether the school choice affects the student's outcome.

Table 2.3: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max.	Obs.
School Choice	0.787	0.41	0	1	328
Sex	0.606	0.489	0	1	327
Siblings	1.894	0.738	1	4	321
Birth Order	0.467	0.5	0	1	321
Food Program	0.088	0.284	0	1	328
Private Tutoring	0.752	0.432	0	1	323
Average Cost of Tutoring	14.241	11.551	0	133.667	254
Family Income	535.320	816.91	35	9599	309
Books in Household	3.559	1.808	1	7	322
Familiy Type	0.87	0.337	0	1	323
Father Schooling	0.5	0.501	0	1	310
Mother Schooling	0.326	0.469	0	1	313
Father Age	0.835	0.372	0	1	309
Mother Age	0.707	0.456	0	1	314
School Type (Sex Composition)	0.866	0.341	0	1	328
School Type (Foundation)	0.506	0.501	0	1	328
Class Size	34.522	3.487	25.8	42	328

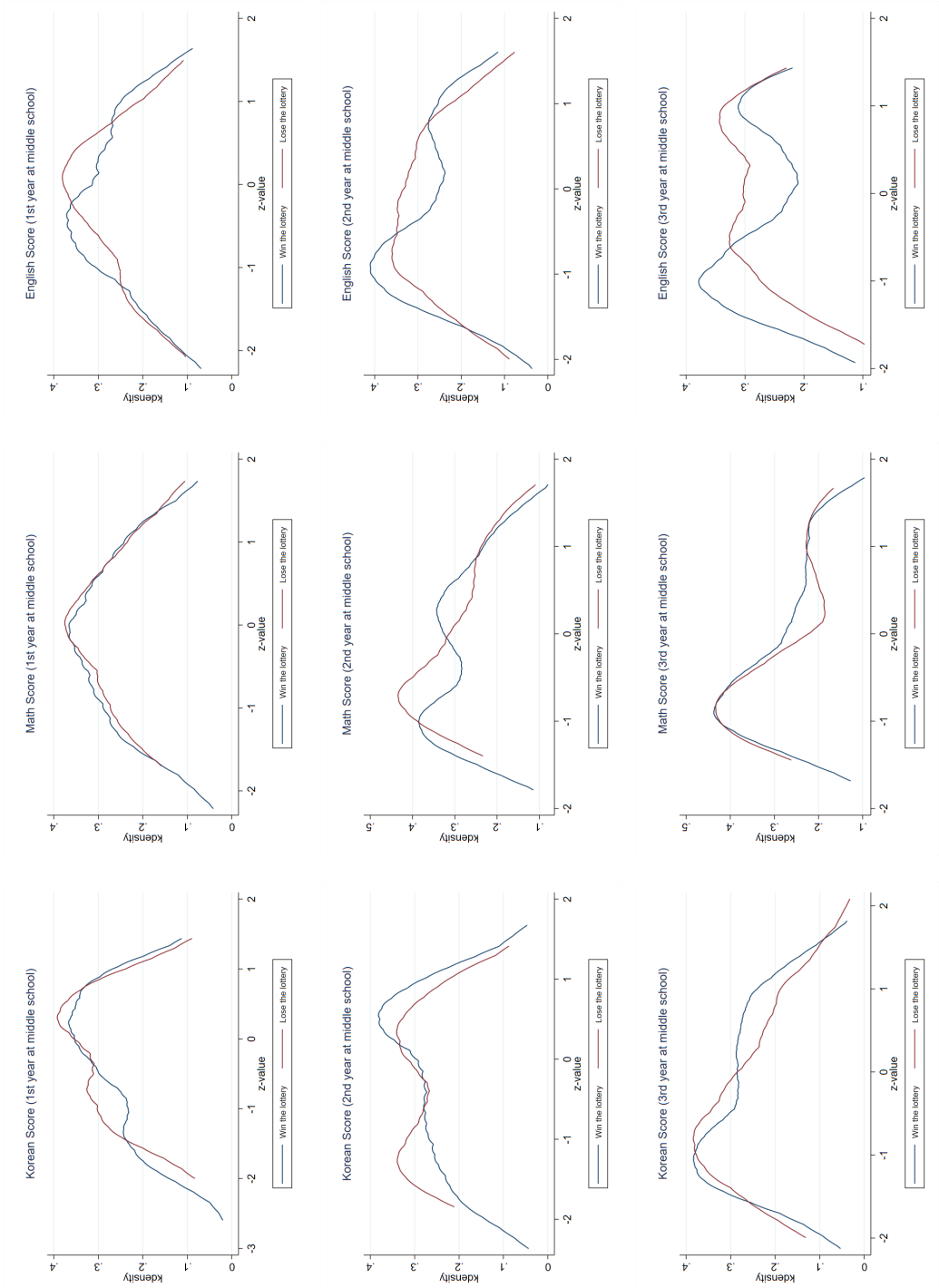
[a] Table shows a summary statistics of sample students when they are 3rd grade at middle school in 2012.
[b] Variable explanation is given in Appendix B.

Table 2.4: Balance Test

	2010 (1*st* at MS)			2011 (2*nd* at MS)			2012 (3*rd* at MS)		
Variable	Treatment	Control	Diff. (p-value)	Treatment	Control	Diff. (p-value)	Treatment	Control	Diff. (p-value)
Academic Performance									
Korean	-0.0893	0.0747	0.3954	-0.1455	-0.3492	0.2044	-0.1772	-0.3549	0.2618
Math	0.1388	0.2133	0.6880	0.0090	-0.0425	0.7441	-0.0160	0.0449	0.6984
English	0.0782	-0.0307	0.5430	-0.0466	-0.1664	0.4500	-0.1194	0.1996	0.0521^{+}
School Satisfaction									
Satisfaction	3.6117	3.3714	0.2090	3.2593	3.2609	0.9914	3.3596	3.2128	0.3442
Individual Characteristics									
Private Tutoring	0.9223	0.9429	0.6883	0.9259	0.9348	0.8386	0.8876	0.8085	0.1512
Self-studying (Korean)	1.9029	1.5429	0.5723	2.3704	2.3696	0.9976	1.9831	2.2553	0.2707
Self-studying (Math)	3.1456	1.8286	0.1310	3.2469	2.8478	0.2269	2.9270	2.9574	0.9232
Self-studying (English)	2.5825	1.8571	0.3343	2.9383	2.8913	0.8744	2.6910	2.6809	0.9735
Watching TV (weekday)	2.0000	1.7429	0.4802	2.0123	2.1087	0.6917	1.9157	1.7872	0.5367
Watching TV (weekend)	3.3883	3.2000	0.7157	3.4321	3.3043	0.6700	3.0281	2.8511	0.5021
Playing Computer Game (weekday)	1.2427	1.1714	0.7992	1.6420	1.6304	0.9616	1.3315	1.6809	0.1392
Playing Computer Game (weekend)	2.3786	3.0857	0.1475	2.7840	2.8261	0.8985	2.3090	2.7872	0.1311
Reading Book	3.2427	2.2286	0.3089	1.6543	1.8478	0.5074	1.7360	1.6596	0.8250
Number of Reading Book	6.0680	6.6571	0.7148	1.2901	1.4348	0.5580	2.2809	2.0426	0.4983
Family Backgrounds									
Siblings	1.8447	1.9714	0.3484	1.8951	2.0000	0.3759	1.8596	1.9362	0.5072
Birth Order	0.5049	0.4857	0.8463	0.4877	0.4783	0.9110	0.5112	0.5106	0.9942
Family Type	0.9417	1.0000	0.1464	-	-	-	0.9101	0.9362	0.5697
Father Age	0.8738	0.8571	0.8023	0.8395	0.8696	0.6200	0.8146	0.8298	0.8115
Mother Age	0.7087	0.7143	0.9506	0.6975	0.7609	0.4051	0.7191	0.7447	0.7284
Father Schooling	0.5825	0.6857	0.2832	0.5556	0.6304	0.3674	0.5449	0.7021	0.0526
Mother Schooling	0.4272	0.3714	0.5661	0.3889	0.4130	0.7687	0.3820	0.4043	0.7819
Family Income	494.27	460.00	0.6337	559.01	640.43	0.4985	554.49	821.91	0.0831^{+}
Books in Household	-	-	-	3.9877	4.0652	0.7951	3.8708	4.0000	0.6532
Average Cost of Tutoring	20.332	18.267	0.3090	27.443	21.370	0.3448	14.452	14.004	0.7597
Food Program	0.0291	0.0000	0.3108	0.0062	0.0000	0.5953	0.0449	0.0426	0.9439

[a] $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$
[b] The information of 'Books in Household in 2010' and 'Family Type in 2011' is not available at the dataset.

Figure 2.2: Distribution and Pre-trend of Academic Performance by Student Type



2.5 Empirical Strategy

To understand the effect of school choice on student's outcomes, I apply a basic regression equation to the longitudinal data at the student level. The basic empirical strategy in this paper is as follows:

$$Y_{i,t} = \beta T_{i,t} + \epsilon_{i,t}$$

where i is a student and t is a time. Throughout my analysis, standard errors are clustered by the student level. $T_{i,t}$ is a dummy variable which is equal to 1 if a student attends his preferred school choice at time t. For a dependent variable $Y_{i,t}$, I standardize Korean, math and English test score by subtracting the means and dividing by the standard deviation. I also use various student's subjective evaluation indexes which range from 1 (strongly disagree) to 5 (strongly agree).[5] Based on this model, I can estimate the consistent coefficient β since the treatment $T_{i,t}$ is randomly assigned via lottery.

Although the treatment $T_{i,t}$ is random, it is still possible that the assumption $\mathbb{E}(\epsilon_{i,t}|T_{i,t}) = 0$ does not hold for following reasons. First, $Y_{i,t}$ is measured in June whereas $T_{i,t}$ is pre-determined in February, which leaves me with a 4-month gap. Although this period is rather short, I cannot dismiss any possibility that the coefficient β is biased due to omitted variables since pupils undergo different environments which may affect $Y_{i,t}$. Second, the educational environment can affect the students. In Seoul, almost every student graduating from an elementary school are assigned to a neighborhood middle school which is within the same *general-school-district* (Park, 2016). This implies that students from the same middle school share similar demographic environments during their schooling which can affect the outcome variable over time. To alleviate these problems, I extend the basic model for a robustness check

[5]Criticisms exist about the validity and comparability of subjective measures. However, these measures have advantages in that they give a chance to focus on more subjective determinants of student's well-being, so they can directly reflect student's welfare (Kahneman and Krueger, 2006).

as follows:

$$Y_{i,t} = \beta T_{i,t} + \gamma_1 X_{i,t} + \gamma_2 Z_{i,t} + \gamma_3 R_{i,t} + \epsilon_{i,t}$$

where i is a student t is a time. $X_{i,t}$ is covariates of i's personal characteristics and family backgrounds[6], $Z_{i,t}$ is a vector of school characteristics of i's high school[7][8], and $R_{i,t}$ is the *general-school-district* of i's middle school. By including covariates $X_{i,t}$, $Z_{i,t}$, and $R_{i,t}$, I can control confounding effects caused by various individual/school/environment heterogeneities. Under the assumption of $(T_{i,t} \perp \epsilon_{i,t})|X_{i,t}, Z_{i,t}, R_{i,t}$, I can consistently estimate the coefficient β.[9]

2.6 Estimation Result

2.6.1 Effect on Academic-related Index

First, I estimate the causal effect of school choice on student's academic attainments. Table 2.5 reports that there is no clear evidence that the school choice positively affects student's academic performance. The column (1) shows that the effect of school choice on exam score is even slightly worse in English by -0.2481 standard deviations at 10% significance level. Extending the analysis by controlling for covariates does not change my result qualitatively (column (2)-(5)). First, I estimate the causal effect of school choice on student's academic attainments. Table 2.5 reports that there is no clear evidence that the school choice positively

[6] I control sex, number of siblings, birth order, free food program, private tutoring, family income, parents' age, and parents' schooling level.

[7] I control school gender type (single-sex or co-ed), school foundation type (public or private), and average class size.

[8] However, concerns of different effect by school characteristics are rare since regular high schools are equalized and homogenized. First, teachers in public school are rotating to school every few years. Hence, little selection of teacher quality exists among high schools. Second, the Ministry of Education centrally regulates regular high school curriculum and tuition. Consequently, class numbers, lesson hours, and academic materials are similar across teachers and schools. Teachers and schools need to follow this course of study, so there is little possibility of self-selection about coursework. Third, school facilities are equalized since central government allocates resources across schools based on equity and fairness. These equalized and homogenized public education environments enable to distinguish the policy effect from other confounding factors such as school/teacher/peer effect.

[9] If the effect is similar with and without control variables suggests that selection based on observable characteristics is not a big problem in my model specification (Altonji, Elder, and Taber, 2005b).

affects student's academic performance. The column (1) shows that the effect of school choice on exam score is even slightly worse in English by -0.2481 standard deviations at 10% significance level. Extending the analysis by controlling for covariates does not change my result qualitatively (column (2)-(5)). I check whether any heterogeneous effect exists by sub-group. To do so, I divide students by sex, income level, and exam score[10], and estimate the effect using the basic regression without covariates. Table 2.6 indicates no discernible heterogeneous effects by school choice policy. I even find that English exam scores of male adolescents are *negatively* affected by -0.5512 standard deviations. My result suggests that the advocator's argument that allowing school choice can improve students' academic performance does not have a strong empirical background.

It is still possible that other academic-related indexes are positively affected. I test this possibility by exploiting the survey's questions rigorously. One hypothesis is whether the student has better attitudes in a classroom when he wins the lottery. Since the student can match his preference to school, it can enable him to behave more affirmatively in school activities. To examine this channel, I test various school life-related categories. First, I use the survey's questions "Interesting," "Helpful," "Concentration," "Participation," and "Diligence" in each subject to measure student's class attitudes.[11] Second, I utilize the survey's variables "Understanding," "Fun," "Purpose," "Self-preference," and "Self-advantage" to examine student's general manners and his class evaluations.[12] Each variable is evaluated by a 5-point

[10] I calculate exam score by averaging three-subject (Korean, math, and English) test result of 3*rd* grade at middle school.

[11] Followings are an explanation for each category.
(1) Interesting: a level of student's interest in the lecture.
(2) Helpful: a level of class helpfulness to student's learning.
(3) Concentration: a level of student's concentration in the lecture.
(4) Participation: a level of student's participation in the classroom.
(5) Diligence: a level of student's preparation for the class in advance.

[12] Followings are an explanation for each category.
(1) Understanding: a level of student's lecture understanding via class materials and teacher's teaching skill.
(2) Fun: a level of student's fun to studying.
(3) Purpose: a level of student's proclivity on setting a specific purpose for studying and engaging in the class actively.

Table 2.5: Regression Result on Exam Scores

	OLS (Basic)	OLS (Extention)			
Variable	(1)	(2)	(3)	(4)	(5)
Dep. Var.: Korean Score					
School Choice	0.0846	0.1378	0.0384	0.1088	0.1647
	(0.1206)	(0.1279)	(0.1184)	(0.1234)	(0.1297)
R^2	0.0015	0.1504	0.0747	0.0652	0.2683
Dep.Var.: Math Score					
School Choice	-0.0884	-0.0755	-0.1213	-0.0587	-0.0915
	(0.1470)	(0.1700)	(0.1464)	(0.1451)	(0.1783)
R^2	0.0012	0.0335	0.0201	0.0770	0.1102
Dep. Var.: English Score					
School Choice	-0.2481^{+}	-0.3114*	-0.2619^{+}	-0.2092	-0.2775^{+}
	(0.1343)	(0.1463)	(0.1367)	(0.1376)	(0.1533)
R^2	0.0116	0.0674	0.0181	0.0596	0.0971
Personal (X)	N	Y	N	N	Y
School (Z)	N	N	Y	N	Y
Region (R)	N	N	N	Y	Y

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 2.6: Regression Result on Exam Scores by Sub-category

	Gender		Income		Exam Score	
Variable	Male	Female	>50%	<50%	>Median	<Median
Dep. Var.: Korean Score						
School Choice	0.2343	-0.0365	-0.1205	0.3355^{+}	0.1803	0.0633
	(0.1487)	(0.1651)	(0.1582)	(0.1856)	(0.1783)	(0.1378)
R^2	0.0122	0.0003	0.0037	0.0199	0.0068	0.0011
Dep.Var.: Math Score						
School Choice	-0.1926	-0.0194	-0.0113	-0.2515	0.0127	-0.1391
	(0.2418)	(0.1865)	(0.1700)	(0.2631)	(0.1975)	(0.2177)
R^2	0.0058	0.0001	0.0000	0.0072	0.0000	0.0031
Dep. Var.: English Score						
School Choice	-0.5512*	-0.0718	-0.2754	-0.2120	-0.2316	-0.2264
	(0.2124)	(0.1708)	(0.1725)	(0.2234)	(0.1859)	(0.1933)
R^2	0.0578	0.0010	0.0150	0.0077	0.0098	0.0103

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

Table 2.7: Regression Result on Class Attitudes

	Dep. Var.: Class Attitudes				
Variable	(1) Interesting	(2) Helpful	(3) Concentration	(4) Participation	(5) Diligence
Korean Class					
School Choice	0.1806	0.3314**	0.2124	0.1040	0.2316^{+}
	(0.1325)	(0.1200)	(0.1324)	(0.1429)	(0.1329)
R^2	0.0053	0.0227	0.0086	0.0018	0.0085
Math Class					
School Choice	0.2171	0.1915	0.1281	0.0590	0.0519
	(0.1388)	(0.1290)	(0.1584)	(0.1574)	(0.1521)
R^2	0.0068	0.0053	0.0021	0.0004	0.0003
English Class					
School Choice	0.0647	0.1345	0.1591	0.0580	0.0092
	(0.1365)	(0.1388)	(0.1469)	(0.1459)	(0.1400)
R^2	0.0007	0.0029	0.0037	0.0005	0.0000

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

scale from 1 (strongly disagree) to 5 (strongly agree).

Table 2.7 and Table 2.8 give the outcomes of the basic model.[13] In Table 2.7, a few of categories such as "Helpful" and "Diligence" in Korean class are positively related by 0.3314 and 0.2316 points respectively. However, other variables have no significant effect. There is no clear evidence that students who win the lottery have better class attitudes. In Table 2.8, I investigate whether pupils are more likely to show better manners and give good evaluations to school lecture when they are accepted to their preferred choice. However, I find no such effect. The coefficient is small and insignificant across all categories.

Overall, there does not appear to be any linkage between the school choice and student's class attitudes or general manners in school life. My result casts doubt on the effectiveness of school choice policy from an academic perspective. Not only student's academic achievements

(4) Self-preference: a level of student's self-perception on his preference due to school attendance.
(5) Self-advantage: a level of student's self-perception on his comparative advantage due to school attendance.
[13]The result does not change when I extend the model to include covariates.

Table 2.8: Regression Result on General Manners

	Dep. Var.: General Manners				
Variable	(1) Understanding	(2) Fun	(3) Purpose	(4) Self-preference	(5) Self-advantage
School Choice	0.0270	-0.0770	-0.0183	0.0200	0.0585
	(0.1159)	(0.1300)	(0.1377)	(0.1173)	(0.1134)
R^2	0.0002	0.0010	0.0001	0.0001	0.0007

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

but behavioral changes which the government tries to induce to normalize the public education turn out to be much harder to achieve.

2.6.2 Effect on School Satisfaction

Although school choice does not lead to academic gains, it can yield a better outcome to student's subjective perception via improved matching. Allowing more options can sort people into the choice which matches to their preference, and the application-based random assignment system is one example. A possible consideration is student's school satisfaction. Better sorting and matching can increase a sense of belonging to his school, and it leads to the increment of school satisfaction.[14] To estimate the hypothesis, I use the survey's question "*I am satisfied with my high school*."

Table 2.9 reports that school choice policy influences on student's non-cognitive index. Contrary to the academic-related indexes, a level of school satisfaction significantly increases when the student wins the lottery. Regardless of the model specifications, the coefficient of school choice variable is 0.2418-0.3954 points higher (10.8-17.3% higher). Interestingly, the value-added effect on school satisfaction is not persistent in following years. When I lag the dependent variable by 1 to 2 year, no significant outcome comes out. It suggests that students become satisfied with the school when they are accepted to the preferred choice, but their

[14] In a similar context, Hastings, Neilson, and Zimmerman (2012) argue that attending a first choice school can improve students' intrinsic motivation by helping them to put more effort into school activities.

Table 2.9: Regression Result on Student's Satisfaction

	OLS (Basic)	OLS (Extention)			
Variable	(1)	(2)	(3)	(4)	(5)
Dep. Var.: Satisfaction at t					
School Choice	0.2418*	0.3197*	0.2490*	0.2703*	0.3954**
	(0.1137)	(0.1310)	(0.1151)	(0.1153)	(0.1272)
R^2	0.0160	0.0766	0.0173	0.0437	0.1476
Dep.Var.: Satisfaction at t+1					
School Choice	0.1700	0.1947	0.1586	0.1690	0.1636
	(0.1242)	(0.1349)	(0.1270)	(0.1263)	(0.1420)
R^2	0.0072	0.0439	0.0089	0.0507	0.0930
Dep. Var.: Satisfaction at t+2					
School Choice	0.0564	-0.0102	0.0387	0.0341	-0.0311
	(0.1155)	(0.1343)	(0.1147)	(0.1166)	(0.1310)
R^2	0.0007	0.0434	0.0152	0.0317	0.0878
Personal (X)	N	Y	N	N	Y
School (Z)	N	N	Y	N	Y
Region (R)	N	N	N	Y	Y

[a] Standard errors in parentheses, $^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$

satisfaction disappears over time during the schooling period.

2.7 Discussion

Policymakers have thought that school choice policy can normalize the public education by aligning the student's preference for his choice. They have argued that the policy would help students to behave better in the classroom. However, my results do not support this argument. Their academic achievements, class attitudes, and overall manners are not positively affected by school choice program. Although winning the lottery helps students satisfied

with their high school, the effect is not lasting over periods. In general, the newly-adopted application-based random assignment system does not alleviate the concerns of crumbling public education.

Proponents of school choice policy have addressed that the quality of public education can improve via market competition to attract better students. They claim that this competition effect can enhance instructor's teaching skills and attitudes. [15] However, little empirical evidence supports the argument. Figure 2.3 illustrates that there is little behavioral change among teachers and principals after the application-based random assignment system was introduced.

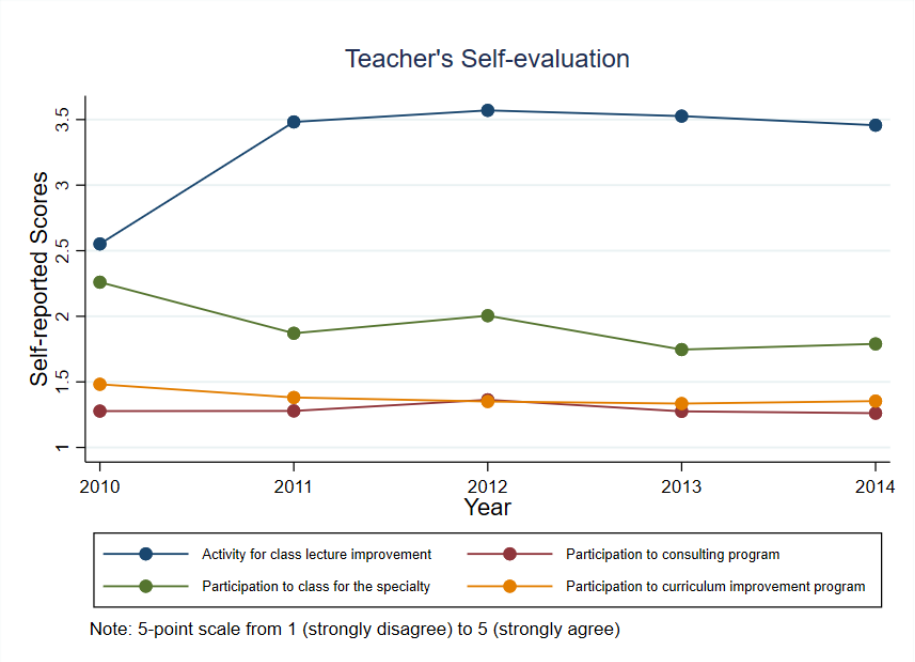
These results suggest that school choice policy does not translate into the improvement of public education quality on average. In this respect, school choice system is not an effective way to prop up the public education. It appears that students and parents abuse this chance to fulfill another purpose, which is not related to the goal of government. A natural question arises: What is an underlying reason for student's school choice?

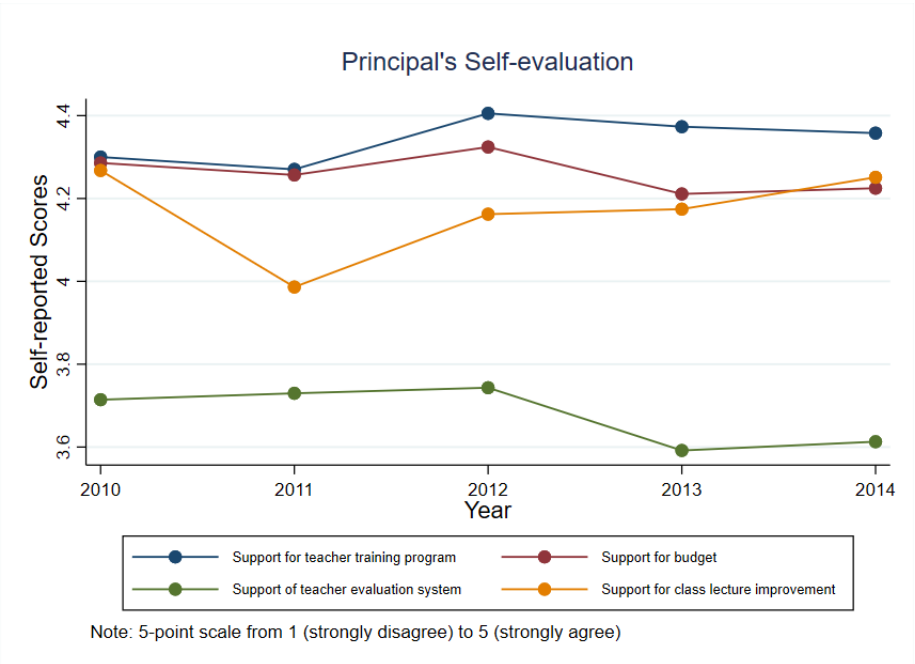
It is beyond my study to pin down the mechanism why school choice policy does not influence pupil's academic attainment and attitudes but positively affect school satisfaction. However, I can infer that factors other than the quality of high school may be the main reason when students select a high school. Exploiting the survey's question "*What is your priority when you apply to high school?*", I find that sizable students want to enroll in high school which is located at close distance from their residence, and school quality considerations are rather small.[16] Table 2.10 shows that more than 30% of students choose "regional proximity from

[15] My paper cannot examine how the school choice affects the quality of school directly since each school accommodates both winners and loser in the lottery. However, advocators of the school choice program claim that overall quality of public education will be positively influenced by the policy via competition effect. Thus, I can indirectly check whether the argument is valid by investigating the trend of the quality-related index of public education such as attitudes of teachers before and after the school choice program.

[16] Total 256 students (78%) students answer the question out of 328 samples. Attrition from the survey may cause a bias. However, it is unlikely considering that percentages of each category in the survey are balanced between the winner and loser in the lottery.

Figure 2.3: Teacher's & Principal's Self-evaluation





home" as their priority when applying to high school. Given this fact, I speculate that middle school graduates are selecting a high school based on the reason which does not match to the government's intention of improving the public education system.

Table 2.10: Priority when Choosing a High School

Priority	All	(%)	Winner in the Lottery	(%)	Loser in the Lottery	(%)
Regional Proximity from Home	78	30.47	66	31.28	12	26.67
Educational Program Contents	56	21.88	45	21.33	11	24.44
High School's History & Reputation	43	16.80	33	15.64	10	22.22
Teacher Quality	27	10.55	24	11.37	3	6.67
Graduating Performance (college, job, etc.)	26	10.16	21	9.95	5	11.11
Easiness to obtain Good GPAs	24	9.38	21	9.95	3	6.67
Etc. (facilities, friends, scholarships)	2	0.78	1	0.47	1	2.22
Total	256	100	211	100	45	100

[a] Total 256 students of regular and autonomous public high school are surveyed. They are subject to the same application-based lottery system.

While the government adopts school choice policy to improve the quality of public education, students may appropriate the chance based on the reason which is not aligned with the government's purpose. In real, regular high schools have been mostly standardized after the equalization policy since 1974. And it has been a long concern that students do not care about school lectures, as most of them rely on private tutoring to learn academic materials and prepare for a college entrance exam. They even tend to think that lectures in public education are not useful. Students think of private tutorings as a substitute for classroom education. In this environment, given the possibility of school choice, students may select the nearest school from the residence to minimize commuting time and focus on private tutorings. If this is the case, attending preferred school is not aligned to factors which can help to improve exam scores or build positive attitudes and mindsets in the classroom.

As Hanushek (1981) points out, students and parents can focus on school characteristics such as facilities or peers which are not directly linked to educational impact. From this perspective, it is reasonable to think that school choice does not necessarily improve either student's academic achievement or quality of public education if students choose their school based on other reasons. Although I cannot examine a real motivation of student's school choice and the above explanation is more of speculation, my result suggests one possible explanation why school choice policy does not transform into the improvement of student's outcomes and public education.

2.8 Conclusion

Throughout the paper, I examine how the school choice policy affects student's outcomes. The paper shows that the expansion of school choice is not directly related to student's academic performance. Students who win the lottery do not necessarily perform better on academic attainment in all three subjects. In this sense, the mechanism that allowing students to choose

their school is not effective to improve exam scores. I seek to find whether student's class attitudes, general manners, or class evaluations are positively affected. In many considered variables, there is no clear evidence that school choice policy is related to student's good class behaviors as well as his positive class evaluations. Contrary to cognitive outcomes, student's school satisfaction is positively affected by school choice program. The average effect of school choice on school satisfaction is about 10-17% higher. However, the effect disappears when students advance to upper grade. Finally, I find no positive effect of school choice policy on attitudes of principals and teachers, which are one aspect of the quality of public education. I suspect that my result is associated with the fact that students appropriate the chance of school choice for another purpose, which is not related to the government's goal of public education normalization.[17]

A controversial policy implication emerges in my study. There is no statistical evidence that allowing students to have a school choice option does improve student's cognitive performance, and only non-cognitive index of school satisfaction is shown to be positively affected. In addition, school choice policy does not lead to student's positive attitudes, good class evaluations, and behavioral changes of principal and teacher. These are debatable outcomes since proponents have argued that one main benefit of school choice policy is to normalize the public education system via competition among schools. We need to be risk-averse about altering the public education system. Radical reforms with insufficient evidence or impetuous presumption can put the youth at risk. Therefore, more analysis and discussions about the effect of school choice should be followed.

[17]To be fair, I need to point out two limitations. First, the sample size is relatively small, about 300 students. Second, we should be careful that the findings would not be generalized to a larger world or another place. The external validity is not guaranteed, and either minor or unobservable conditions specific to Seoul may be the core characteristics that lead to a large difference.

Chapter 3

A late bird or a good bird? The Effect of 9 o'clock Attendance Policy on Student's Achievement

3.1 Introduction

In 2014, South Korea swirled into a debate about whether schools ought to adopt the 9 o'clock attendance policy. It is the policy that staggers a school starting time from 8:00-8:20 to 9:00. The Gyeonggi Provincial Office of Education recommended schools in Gyeonggi province to introduce the 9 o'clock attendance policy beginning from the fall semester in 2014, and about 90% of elementary and middle schools adopted the proposal.[1] The policy became popular and reached to neighboring regions. The Seoul Metropolitan Office of Education also suggested schools in the area to follow suit starting from the spring semester in 2015. With the support of other superintendents of the Office of Education, the 9 o'clock attendance policy is expected to expand to other provinces.[2]

The effort of delaying the school starting time is not exclusive to South Korea. For example,

[1] Korean elementary and secondary education follows the three-stage system, elementary school (6-year, age 8-13), middle school (3-year, age 14-16), and high school (3-year, age 17-19). The former two stages are mandatory, but more than 99% of middle school students advance to high school, according to the Statistics Korea.

[2] South Korea consists of 17 provincial/metropolitan regions, and residents in each province elect their head of the Office of Education. The head is called as an education superintendent, and the term is 4-year. The most recent election was held in June 2014. Total 13 heads, including Seoul and Gyeonggi, were elected from a liberal party which supports the 9 o'clock attendance policy.

the "Zzz's to A's Act" was firstly introduced by the US Representative Zoe Lofgren in 1998, and it was submitted to the US House of Representatives in 2017 to request the US Secretary of Education to make policy suggestions related to the school starting time. The major press such as New York Times has consistently addressed the necessity of staggering the school starting time for student's health and development.[3]

These proposals are based on scientific evidence that sleep is a significant factor to develop adolescent's cognitive and non-cognitive abilities.[4] According to numerous medical research, a circadian rhythm which controls sleep-wake cycle undergoes major changes during the onset of puberty, and the youth's lifestyle becomes more "owl-like." That is, the biological timing of sleep pattern changes significantly, and they sleep more in the morning and less at night. However, relative to this transformed circadian rhythm, the adolescent's life environment does not alter, and it becomes asynchronized with the youth's biological rhythm. School schedules are still fixated to require students to attend school early in the morning, and social conventions of studying hard at a younger age make them stay awake until late night. This situation deprives of both quantity and quality of sound sleep from young students, which can hamper their physical and mental growth. Since students who start a school later can typically sleep longer and it is regarded to be positively related to student's health, well-being, and performance, policymakers begin to acknowledge the importance of changing the school starting time and implement related policies in the field.[5]

[3]The following articles are a few of examples: The Early Bird Gets the Bad Grade (Jan. 14, 2008), To Keep Teenagers Alert, Schools Let Them Sleep In (Mar. 13, 2014), Schools Are Slow to Learn That Sleep Deprivation Hits Teenagers Hardest (Mar. 28, 2016), The Economic Case for Letting Teenagers Sleep a Little Later (Sep. 13, 2017).

[4]The school starting time is also controversial for social reasons, such as harmonizing the school starting time with public transportation schedules (Edwards, 2012; Hafner, Stepanek, and Troxel, 2017). Still, the primary reason for postponing the school attendance time is from an educational consideration.

[5]It is beyond my study to introduce all related papers which examine how the circadian rhythm changes in the adolescent period, and how it influences on students. For more information, refer to the following articles and website: Laberge, Petit, Simard, Vitaro, Tremblay, and Montplaisir (2001), Dexter, Bijwadia, Schilling, and Applebaugh (2003), Sadeh, Gruber, and Raviv (2003), Wolfson and Carskadon (2003), Carskadon, Acebo, and Jenni (2004), Fredriksen, Rhodes, Reddy, and Way (2004), Curcio, Ferrara, and Gennaro (2006), Crowley, Acebo, and Carskadon (2007), Owens, Belon, and Moss (2010), Lufi, Tzischinsky, and Hadar (2011), https://www.cdc.gov/features/school-start-times/index.html.

In this paper, I use the Gyeonggi Education Panel Study and examine whether the delaying the school starting time to 9:00 a.m. affects student's academic achievement. I find no discernible effect on academic performance by students who start the school later. Interestingly, a large difference of outcomes emerges either when I control for in-depth individual traits which are commonly supposed to be related to learning behaviors or when I include an individual-level fixed effect term. It implies that individual's omitted heterogeneities may conflate the result. Hence, my paper suggests that returns to delaying the school starting time can be smaller than those reported in previous studies, which have supported "a late bird" effect that students' performance can be enhanced through putting off the school starting time. Rather, the result can be confounded by self-selection of "a good bird" effect that academically capable students exploit the policy. My result requires cautions in rescheduling the school starting time, and more analysis and discussion are necessary on the education front to find an optimal school schedule.

The paper is organized as follows. Section 3.2 is a literature review. Section 3.3 describes a background of the study. Section 3.4 introduces a dataset. Section 3.5 explains an empirical strategy and its basic result. Section 3.6 extends the basic result and examines any difference. Section 3.7 discusses a possible channel of the changed result. Section 3.8 is a conclusion.

3.2 Literature Review

After recognizing the significance of the school starting time on student's development, educational economics literature is also seeking to examine the effect of the school starting time on student's academic attainment. They try to infer a causal relation directly linking the school starting time to student's academic performance, and the results are mixed.

Carrell, Maghakian, and West (2011) exploit the randomized placement of freshman to courses and instructors at the US Air Force Academy to identify a causal effect of the school

starting time on pupil's academic performance, and they find that the late starting time has a positive effect. Edwards (2012) observes the staggered daily start time for middle schools of Wake County in North Carolina, and he finds that postponing a daily start time increases both reading and math test score. He argues that the increased sleep time is a mechanism for improving the academic achievement. Heissel and Norris (2017) instrument for sunlight hours with the time zone boundary in Florida and find that moving the school starting time later increases exam scores. Groen and Pabilonia (2017) postulate that female students attending schools with later time get higher scores on reading tests, using longitudinal data from the Panel Study of Income Dynamics. In Korean context, using the Korean Time Use Survey and the Korean Education & Research Information Service, Shin (2017) finds that delaying the school starting time helps teenagers to have an additional 33 minutes sleep, and increase math/reading test scores by 0.034/0.022 standard deviations. Kim (2018) shows that the 9 o'clock attendance policy increases sleep time, the math score of 11th-graders, English score of female students in 9th-grade, and emotional well-being and self-evaluated health of middle school students by applying the difference-in-difference method.

While these papers show positive effects, Hinrichs (2011) finds no such evidence using samples from Minneapolis, Kansas, and Virginia under a variety of estimation specifications. Luong, Lusher, and Yasenov (2017) also report a smaller gain to the delayed school starting time in case of Vietnam college freshman. In a similar context, Pope (2016) identifies that students learn more in the morning using nearly two-million sixth to eleventh-grade students in Los Angeles. Lusher and Yasenov (2016) find that student's performance drops during afternoon blocks in Eastern Europe.

My paper can complement the existing studies in following ways. First, South Korea provides a favorable environment to examine the effect of the school starting time on student's academic performance. Elementary school students are randomly assigned to their middle

school, and the quality of public education is commonly equalized across schools under the same academic curriculum, similar teacher characteristics, and homogenized school facilities. It also gives a chance to analyze the policy effect more clearly since the 9 o'clock attendance policy was introduced to middle schools in the affected region as an exogenous shock. Second, I use a comprehensive and representative panel dataset, which enables to analyze the policy effect and its mechanism rigorously. It tracks two different cohorts of thousands of students for a few years during the adolescent period, and it includes substantial information such as student's personal traits, family backgrounds, and school-related characteristics. Thus, it fills the blank of previous research in various perspectives. For example, I conduct the individual-level fixed effect estimation to the general student body, which clarifies the effect of the 9 o'clock attendance policy by controlling for unobserved individual heterogeneities.[6] Moreover, my paper explores a possible channel of the outcome, through which the policy effect is realized by exploiting survey questions such as student's time allocation and lifestyle habit.[7]

3.3 Background

My paper focuses on South Korea which offers attractive settings to address my research question. In this section, I explain how the 9 o'clock attendance policy has been adopted and introduce specific characteristics of South Korea's educational environment.

[6]There are a few papers considering the individual fixed effect, but they are themselves restrictive in regard to samples and data coverages. Carrell, Maghakian, and West (2011) study high-achievers who attend the military service academy, thus their samples are old-aged above the puberty and not representative of the majority. Luong, Lusher, and Yasenov (2017) examine old-aged students (incoming college freshman in Vietnam) as well, and they focus on sleep regularity rather than sleep duration.

[7]For instance, the 9 o'clock attendance policy assumes that students are benefited from the policy by more sleep and regular breakfast. Since the dataset includes specific information of student's time allocation and lifestyle habit, which was not available to the existing studies, I can examine whether such mechanism holds effective.

3.3.1 Introduction of the 9 o'clock attendance policy

South Korea consists of 17 provincial/metropolitan regions, and a 4-year term elective head of the Office of Education is responsible for making and implementing educational policies to his district. A nationwide election was held in June 2014, and a liberal candidate Jae-Jung Lee was elected as an education superintendent of Gyeonggi province. Right after his inauguration, he encouraged schools in the district to adopt the 9 o'clock attendance policy beginning from the fall semester in 2014. In fact, students of the Uijeongbu girl's middle school firstly proposed the policy. They posted the idea on a free bulletin on the website of the Gyeonggi Provincial Office of Education, and the newly elected superintendent Jae-Jung Lee accepted their suggestion. He sent an official document to all schools to introduce the school starting time, although principals of school commonly determine the class starting schedules under their autonomy.

Since the policy was applied to about 90% of schools within a short period in dictatorial manners by the Office of Education, a lot of controversies arose in the public. Proponents supported the policy with scientific evidence that sleep is significant to the adolescent's growth (Baek, Cho, and Woo, 2015). They also indicated harsh environment which students are facing with to emphasize the necessity of the 9 o'clock attendance policy. According to reports by the National Youth Policy Institute (Lim, 2012; Kim and Kim, 2013), average sleeping time is 8.3 hours, 7.2 hours, and 5.6 hours respectively for elementary, middle, and high school students, and 52.8% of surveyed students complain a lack of sleep. They also show that many students answer to falling asleep in class and they sometimes feel like not going to school due to a lack of sleep in the morning. Based on these facts, policy initiatives of delaying the school starting time gained a momentum. Proponents expect that the 9 o'clock attendance policy can normalize the public education in the long run by improving the adolescent's cognitive and non-cognitive abilities due to their increasing sleep time.

However, opponents argued that disadvantages outweigh advantages (Baek, Cho, and

Woo, 2015). They emphasized that the 9 o'clock attendance policy does not reflect the reality. For example, parents of double-income families, which are a common family type in South Korea, need to commute early in the morning irrespective of the school starting time. Hence, it can cause another problem by leaving young students unattended. The policy also cannot secure enough sleep for students if schools finish later due to the staggered starting time or students begin to attend private academy's morning classes. To support their argument, conservative organizations such as the Korean Federation of Teachers' Associations rejected the 9 o'clock attendance policy based on their own survey results that around 80% of teachers and parents are against the policy.[8]

After severe debates between two groups, the 9 o'clock attendance policy was firstly substantiated to the Gyeonggi province in fall 2014. According to press release by the Gyeonggi Provincial Office of Education, 1,123 out of 1,195 elementary schools (94.0%), 550 out of 604 middle schools (91.1%), and 328 out of 451 high schools (72.7%) adopted the 9 o'clock attendance policy right after the initiation in fall 2014 (Gyeonggi Provincial Office of Education, 2014). And it rapidly spread to schools in the Gyeonggi province. Table 3.1 shows that 100% of elementary schools and higher than 90% of middle and high schools introduce the 9 o'clock attendance policy since spring 2016. The 9 o'clock attendance policy is expected to stretch out to the whole country since 13 out of total 17 education superintendent of the Office of Education are associated with a liberal party which is more likely to favor delaying the school time to reduce student's burden of study. Seoul joined the trend in spring 2015, and Gangwon province has a plan to follow suit.[9]

[8] I refer to the following article:
http://news.chosun.com/site/data/html_dir/2014/09/01/2014090100184.html?Dep0=twitter&d=2014090100184 (in Korean)

[9] I refer to the interview by the Yonhap News Agency:
https://www.huffingtonpost.kr/2014/10/06/story_n_5936884.html (in Korean)

Table 3.1: Implementation Status of the 9 o'clock Attendance Policy in the Gyeonggi Province

	Fall, 2015	Spring, 2016	Fall, 2016	Spring, 2017	Fall, 2017
Elementary School	1213/1213 (100%)	1223/1223 (100%)	1263/1263 (100%)	1239/1239 (100%)	1248/1248 (100%)
Middle School	610/613 (99.5%)	617/619 (99.7%)	622/624 (99.5%)	626/628 (99.7%)	623/625 (99.7%)
High School	409/460 (88.9%)	433/470 (92.1%)	432/470 (91.9%)	440/472 (93.0%)	445/472 (94.2%)
Total	2232/2286 (97.6%)	2312/2273 (97.6%)	2232/2286 (97.6%)	2305/2339 (97.6%)	2316/2345 (98.8%)

[a] To calculate the specific number, I request the dataset via the governmental website (https://www.open.go.kr/), and I modify the obtained file.

3.3.2 South Korea's Educational Environment

The following features of South Korea's education help to alleviate a school-level self-selection concern when I examine the policy treatment effect.

Student Random Assignment

South Korea students advance to a 3-year middle school after a 6-year elementary school, and age of graduating elementary school student is twelve, which is at the point when circadian rhythm is changing. The middle school follows a semester system, under which school starts in the spring semester (March to July) and continues to the fall semester (August to December, and a few days in February). Graduating elementary school students are randomly assigned to a middle school within their residential district. This random assignment system is founded on several laws. For example, the Enforcement Decree of the Elementary and Secondary Education Act explains admission, timing, and method for entering middle schools. Based on the Act, the Gyeonggi Provincial Office of Education annually notifies specific principles and procedures of student assignment system. Student's residential address is the only consideration in the assignment. All other factors, such as family background and student's grades are ignored, ruling out any possible confounding. In addition, commuting time across students become similar as they are assigned to a school within their district. Due to the random assignment, it helps to avoid confounding factors which can affect a variable of interest.

Equalized and Homogenized Public Education Environment

Not only students are randomly assigned to a school, but the quality of public education is equalized and homogenized across schools. First, public school's teachers rotate their attending school every few years. Hence, little selection exists when it comes to teacher quality among middle schools.[10] Second, the Ministry of Education centrally regulates middle school curriculum and tuitions. Consequently, class numbers, lesson hours, and academic materials are uniform without any variation irrespective of teachers and schools. Teachers are obliged to follow this course of study, so there is little possibility of self-selection about coursework. Third, school facilities are equalized since central government allocates resources across schools considering equity and fairness. These equalized and homogenized public education environments enable to distinguish the policy effect from other confounding factors such as school/teacher/peer effect.

Policy as a Quasi-Experiment

The 9 o'clock attendance policy was proposed in June 2014, and the Gyeonggi Provincial Office of Education decided to delay the school start time in August 2014. Since the policy was introduced in a short period to almost all middle schools in Gyeonggi province, schools did not have much time to prepare for this change in advance. This sudden and unexpected adoption of the 9 o'clock attendance policy acts as an exogenous shock on the education front. Thus, it helps to avoid the school-level self-selection (Ashenfelter, 1978). Moreover, no huge policy experiments occurred after the initiation of the 9 o'clock attendance policy during the period of analysis.[11] It helps to observe the policy effect more clearly.

[10] Although private middle school's teachers stay in the same school, the qualification is almost the same regardless of school type. Thus, the quality of teachers is commonly equalized and homogenized.

[11] The 9 o'clock attendance policy was executed from the fall semester in 2014. I use test results of the spring semester in 2015 to examine the effect on student's academic performance.

Table 3.2: Sample Description in the Gyeonggi Education Panel Study

Cohort	2012	2013	2014	2015	2016	2017
Cohort A (2,782 students)	4th	5th	6th	7th	8th	9th
	elementary school			middle school		
Cohort B (4,026 students)	7th	8th	9th			
	middle school					

[a] The 9 o'clock policy starts from August 2014.
[b] In the analysis, I construct two different samples. Group I is all 2,782 students of Cohort A, and Group II is 2,562 students from the 7th-grade of Cohort A in 2015 and 4,062 students from the 7th-grade of Cohort B in 2012.

3.4 Data

3.4.1 Data Source

I use the Gyeonggi Education Panel Study by the Gyeonggi Institute of Education. It tracks 3,541 4th-grade students in 85 elementary schools and 4,051 7th-grade students in 63 middle schools in Gyeonggi province since 2012. Each student and his/her parent are linked and rigorously surveyed for various observable information, ranging from personal cognitive and non-cognitive traits to family backgrounds and school characteristics. Therefore, I can control substantial lists of observable features which can be related to a variable of interest.[12] Another unique advantage of the dataset is that it collects rich information about student's lifestyle habit and time allocation during a day. Hence it gives a chance to examine the effect not only on student's academic attainment but also on their behaviors via the policy change.

3.4.2 Sample Construction

I create two samples to examine the policy effect and apply a different model specification respectively. Table 3.2 describes the sample construction.

[12]These covariates include categorical (sex, number of children, birth order, parent's schooling level, etc.) or continuous (family income, private tutoring fee, etc.) variables.

First, I mainly use *Cohort A* from 2012 to 2015. Students in *Cohort A* are affected by the 9 o'clock attendance policy since 2015. Starting with 3,541 students, I drop students who have incomplete information or are heterogeneous relative to the majority. To be specific, I remove students 1) who have no information of attending middle school (559 students removed), 2) who are from multicultural families (40 students removed), 3) who transfer to school during the period of analysis (6 students removed), 4) who do not answer the question whether they follow the 9'clock attendance policy (99 students removed), and 5) who are not surveyed either in 2013, 2014 and 2015 (75 students removed). The final dataset includes 2,782 students, of which 1,421 (51.08%) are male. The sample construction procedures from 1) to 5) are common and reasonable, and there exist no systemic correlations between the sample attrition and other teacher/school characteristics. It reports that 2,562 students follow the 9 o'clock attendance policy while 220 students do not. I call it as *Group I* in this paper.

Second, for a robustness check, I alternatively use the samples from both *Cohort A* and *Cohort B* shown in Table 3.2. I consider *Cohort A* in 2015 as the treatment and *Cohort B* in 2012 as the control group, and I compare test result of *Cohort A* in 2015 to that of *Cohort B* in 2012. It is a cross-sectional and not longitudinal dataset, so I cannot control unobservable individual characteristics via the fixed effect estimation. However, *Cohort B* is a useful comparison group for *Cohort A* because two cohorts are quite similar. They are the same 7th-grade students in middle school, and educational environment within the districts is stable for three years, including general characteristics of teacher, school, and neighborhood. Therefore, students in *Cohort B* can be a valid control group which is compared to the treated students in *Cohort A*. Similar to the first case, I only keep samples with complete information and sharing uniform characteristics. From the process, I have 2,562 students who follow the 9 o'clock attendance policy (*Cohort A* in 2015), and 4,026 students who are outside of the program (*Cohort B* in 2012). I refer to it as *Group II*. Since the size of the treatment and control group are relatively

comparable, I expect that the robustness check can help to complement the analysis of *Group I* which contains an asymmetric number of samples between two groups.

3.5 Basic Result

3.5.1 Empirical Model

For *Group I*, I mainly apply a difference-in-difference estimation (Angrist and Pischke, 2008). The empirical design is as follow:

$$Y_{i,j,t} = \beta T_{i,t} + \gamma X_{i,j,t} + \delta_t + \epsilon_{i,j,t}$$

where i is a student, j is a school, and t is a year.

$Y_{i,j,t}$ is a test score of Korean, English, and math. I normalize the test score to a mean of zero and a variance of one (z-score) to account for differences in exam difficulty across years. $T_{i,t}$ is a dummy variable that equals to 1 if student i keep the 9 o'clock attendance policy in 2015 and 0 otherwise. β is the coefficient of interest which measures the average effect of the 9 o'clock attendance policy. $X_{i,j,t}$ is composite covariates including student, parent, and family characteristics.[13] It is also necessary to control for common time trend which all students from the same cohort uniformly experience. Thus, I include a year fixed effect δ_t. It can pick up any influence of time-series trends in the outcome which is not captured by other explanatory variables. Standard errors are clustered by school-level to accommodate any heteroskedasticity among students within the same school.

[13]For control variables, I contain sex, number of children, birth order, income, father school, mother school, private tutoring fee, family type, and housing type. Appendix C provides a detailed explanation of variables.

3.5.2 Balance Test

In Section 3.3, I explain that the institutional settings make students randomly assigned across schools. This specific environment helps general characteristics for both the treatment and the control group to become similar. Here, I confirm my explanation through the balance test. If the assignment of students to schools is truly random, observable pre-characteristics and pre-trends of two groups should have no statistical differences. I present differences in mean characteristics as of 2014 (which is before the treatment) in Table 3.3 and show pre-trends from 2012 to 2015 in Figure 3.1.

Table 3.3 shows that except for sex, two groups are similar across observable characteristics, which are considered to be correlated to student's academic attainments. In particular, sleep time, wake-up time, and breakfast, which have been suggested as the principal mechanism to affect student's academic performance, have little difference before the 9 o'clock attendance policy. The graphical examination also confirms parallel trends. Figure 3.1 shows little evidence of any systematic difference of pre-trends between two groups. Thus, time-invariant differences can be ruled out.[14]

3.5.3 Main Result

Table 3.4 is the main result for *Group I*. Throughout the columns, I extend the specifications and compare the coefficients of main treatment variable.

In the general OLS estimation, math and English test score are shown to be positively affected by the 9 o'clock attendance policy, and the magnitude is about 0.27-0.29 standard deviations without any covariates (column (1)). The coefficient becomes smaller when I control for observable personal covariates, but the reduction is only slight to 0.03-0.05 (column (2)).

The effect of the 9 o'clock attendance policy can be heterogeneous by student's household

[14]Private tutoring cost of the control group appears to increase faster than that of the treatment group. However, the direction is the same, and the size is negligible.

Figure 3.1: Pre-trend of Observable Variables

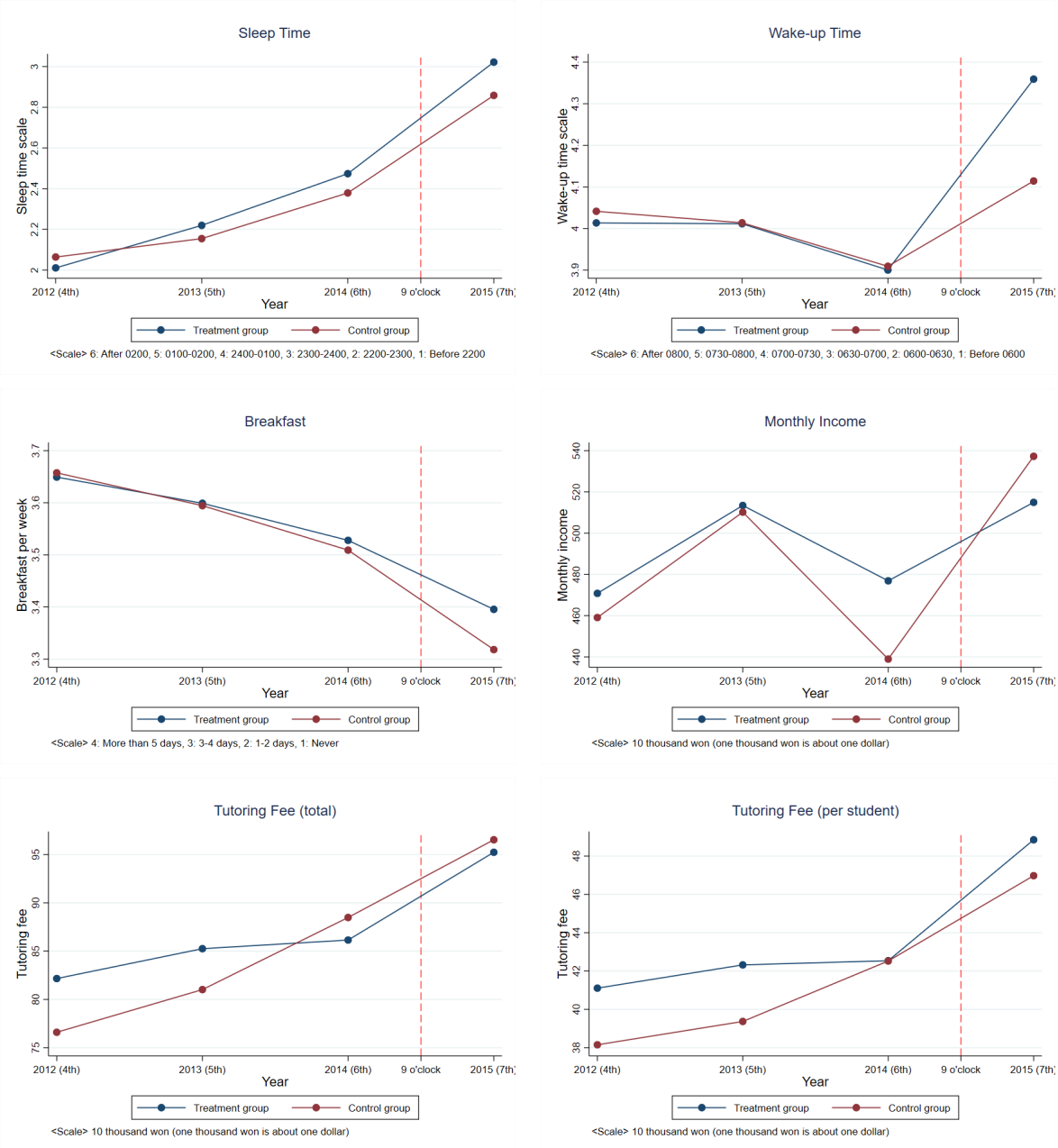


Table 3.3: Balance Test for Group I

Variable	Treatment	Control	Diff. (p-value)
sex	0.5051	0.5773	0.0398*
sleep time	2.4736	2.3790	0.1262
	(22:58)	(22:52)	
wake-up time	3.9001	3.9091	0.9000
	(07:12)	(07:12)	
breakfast	3.5278	3.5091	0.7612
family type	0.9239	0.9234	0.9797
number of children	2.0886	2.1227	0.4770
birth order	1.5909	1.6136	0.6319
monthly income	476.89	438.94	0.1826
father schooling	3.1198	3.0909	0.7357
mother schooling	2.8228	2.8273	0.9510
private tutoring fee	86.15	88.48	0.5644
private tutoring fee (per student)	42.54	42.52	0.9936
housing type	0.6237	0.6227	0.9765
N	2,562	220	

[a] * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.
[c] Differences in mean characteristics are measured in 2014 which is before the treatment. The treatment group is students who follow the 9 o'clock attendance policy in 2015.

Table 3.4: Regression Result, for Group I

	(1)	(2)	(3)	(4)	(5)
Dep. Var.: Korean (z-score)					
9 o'clock policy	0.1340	0.1097	0.1164	0.0481	-0.2933**
	(0.0935)	(0.1214)	(0.1297)	(0.0871)	(0.0960)
R^2	0.0008	0.1065	0.1155	0.2681	0.0066
N	5,507	4,064	3,937	3,951	5,507
Dep. Var.: Math (z-score)					
9 o'clock policy	0.2683**	0.2327*	0.2150*	0.1587	-0.1690
	(0.0962)	(0.0966)	(0.1002)	(0.0833)	(0.1106)
R^2	0.0027	0.1479	0.1556	0.3915	0.0029
N	5,560	4,104	3,976	3,991	5,560
Dep. Var.: English (z-score)					
9 o'clock policy	0.2881**	0.2364**	0.2578**	0.1764**	-0.1447
	(0.0873)	(0.0853)	(0.0879)	(0.0656)	(0.0972)
R^2	0.0032	0.1808	0.1918	0.4200	0.0024
N	5,558	4,101	3,973	3,988	5,558
Year FE	Y	Y	Y	Y	Y
Personal covariates	N	Y	Y	Y	N
Extended personal covariates	N	N	N	Y	N
Extended other covariates	N	N	Y	N	N
Individual FE	N	N	N	N	Y

[a] Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[b] Appendix C provides a detailed explanation of variables.

[c] Personal covariates: sex, number of children, birth order, income, father schooling, mother schooling, private tutoring fee per student, family type, housing type.

[d] Extended personal covariates: delinquency, mental health, class understanding, class attention, reading activity, class attitude, stress, teacher evaluation, self-esteem, self-effectiveness, belief in self-growth, career maturity, civic mind, social relation, friend relation, teacher relation, learning motivation 1-5.

[e] Extended other covariates: activity together with parents, parent's nurturing attitude, parent's affection, teacher effectiveness, teacher morale.

background. To be fair, a family can be one main factor which leads to different effect, considering that the policy affects both student's daily schedule and parent's lifecycle. For instance, relative to two-parent family, a single family's child is more likely to be alone in the morning when his/her parent goes to work, and it would be less beneficial to student's academic performance due to a lack of attention by parents. Another possible channel is family's wealth. A student from affluent family has a higher chance of securing more benefits from the policy, through using private tutoring service in the morning for example. To check these heterogeneous effects, I interact the 9 o'clock attendance policy $T_{i,t}$ with either family type or family wealth $D_{i,t}$ as follow:

$$Y_{i,j,t} = \beta T_{i,t} \cdot D_{i,t} + \gamma X_{i,j,t} + \delta_t + \epsilon_{i,j,t}$$

In case of family type, $D_{i,t}$ is equal to 1 if a student i at time t is from two-parent family and 0 otherwise. In case of family income, $D_{i,t}$ is a continuous variable, and the unit is one-hundred dollar (about 100-thousand KRW) per month. The result is given in Table 3.5 and Table 3.6.

The interaction term between the policy and the family type is statistically insignificant to all Korean, math, and English test score (column (1) and (2) in Table 3.5). However, when it comes to family income, positive outcomes exist in math and English test score. The coefficient of z-score of math and English is around 0.001-0.002 standard deviations, which implies that test scores increase about 0.1-0.2 when family income increases by one-hundred dollar per month (column (2) in Table 3.6). Although an underlying mechanism is uncertain, it confirms the common belief that students from higher income family are more likely to be benefited from the 9 o'clock attendance policy.

Table 3.5: Heteregeneous Effect by Family Type, for Group I

	(1)	(2)	(3)	(4)	(5)
Dep. Var.: Korean (z-score)					
9 o'clock attendance	-0.0206	0.0719	0.1171	0.0298	-0.3840**
	(0.1193)	(0.1407)	(0.1499)	(0.1139)	(0.1279)
family type	0.1546*	0.1271	0.1191	-0.0077	-0.1360
	(0.0670)	(0.0788)	(0.0792)	(0.0680)	(0.0961)
9 o'clock attendance × family type	0.1605	0.0424	-0.0008	0.0205	0.0930
	(0.0857)	(0.0915)	(0.0964)	(0.0859)	(0.0824)
R^2	0.0057	0.1066	0.1155	0.2681	0.0080
N	5,214	4,064	3,937	3,951	5,214
Dep. Var.: Math (z-score)					
9 o'clock attendance	0.1784	0.2286	0.2255	0.1973	-0.1779
	(0.1041)	(0.1183)	(0.1217)	(0.1031)	(0.1385)
family type	0.3992***	0.2055**	0.2138**	0.0835	0.0245
	(0.0662)	(0.0738)	(0.0746)	(0.0592)	(0.0730)
9 o'clock attendance × family type	0.0792	0.0045	-0.0118	-0.0433	0.0281
	(0.0737)	(0.0835)	(0.0839)	(0.0692)	(0.0722)
R^2	0.0191	0.1479	0.1556	0.3915	0.0023
N	5,267	4,104	3,976	3,991	5,267
Dep. Var.: English (z-score)					
9 o'clock attendance	0.1404	0.1909	0.2187	0.2046*	-0.2746*
	(0.0987)	(0.1095)	(0.1167)	(0.1028)	(0.1230)
family type	0.3528***	0.2295*	0.2215*	0.0761	-0.0105
	(0.0715)	(0.0895)	(0.0881)	(0.0674)	(0.0747)
9 o'clock attendance × family type	0.1491	0.0511	0.0438	-0.0317	0.1405
	(0.0852)	(0.0997)	(0.1059)	(0.0869)	(0.0716)
R^2	0.0192	0.1808	0.1919	0.4200	0.0041
N	5,265	4,101	3,973	3,988	5,265
Year FE	Y	Y	Y	Y	Y
Personal covariates	N	Y	Y	Y	N
Extended personal covariates	N	N	N	Y	N
Extended other covariates	N	N	Y	N	N
Individual FE	N	N	N	N	Y

[a] Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.
[c] Personal covariates: sex, number of children, birth order, income, father schooling, mother schooling, private tutoring fee per student, family type, housing type.
[d] Extended personal covariates: delinquency, mental health, class understanding, class attention, reading activity, class attitude, stress, teacher evaluation, self-esteem, self-effectiveness, belief in self-growth, career maturity, civic mind, social relation, friend relation, teacher relation, learning motivation 1-5.
[e] Extended other covariates: activity together with parents, parent's nurturing attitude, parent's affection, teacher effectiveness, teacher morale.

Table 3.6: Heteregeneous Effect by Family Income, for Group I

	(1)	(2)	(3)	(4)	(5)
Dep. Var.: Korean (z-score)					
9 o'clock attendance	0.1768	0.1115	0.1228	0.0753	-0.3404**
	(0.1013)	(0.1282)	(0.1351)	(0.1001)	(0.1113)
9 o'clock attendance × income	-0.0002	-0.0000	-0.0001	-0.0005	0.0004
	(0.0007)	(0.0006)	(0.0006)	(0.0006)	(0.0007)
R^2	0.0032	0.1065	0.1155	0.2682	0.0082
N	5,304	4,064	3,937	3,951	5,304
Dep. Var.: Math (z-score)					
9 o'clock attendance	0.2612*	0.1540	0.1311	0.1081	-0.2597
	(0.1142)	(0.1086)	(0.1091)	(0.1036)	(0.1385)
9 o'clock attendance × income	0.0005	0.0015*	0.0016**	0.0010	0.0017*
	(0.0012)	(0.0006)	(0.0006)	(0.0007)	(0.0007)
R^2	0.0142	0.1489	0.1568	0.3919	0.0067
N	5,356	4,104	3,976	3,991	5,356
Dep. Var.: English (z-score)					
9 o'clock attendance	0.2796*	0.1638	0.1791	0.1351	-0.2488*
	(0.1126)	(0.0944)	(0.0957)	(0.0801)	(0.1158)
9 o'clock attendance × income	0.0006	0.0014*	0.0015*	0.0008	0.0018**
	(0.0014)	(0.0006)	(0.0006)	(0.0006)	(0.0006)
R^2	0.0211	0.1816	0.1929	0.4203	0.0073
N	5,354	4,101	3,973	3,988	5,354
Year FE	Y	Y	Y	Y	Y
Personal covariates	N	Y	Y	Y	N
Extended personal covariates	N	N	N	Y	N
Extended other covariates	N	N	Y	N	N
Individual FE	N	N	N	N	Y

[a] Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.
[c] Personal covariates: sex, number of children, birth order, income, father schooling, mother schooling, private tutoring fee per student, family type, housing type.
[d] Extended personal covariates: delinquency, mental health, class understanding, class attention, reading activity, class attitude, stress, teacher evaluation, self-esteem, self-effectiveness, belief in self-growth, career maturity, civic mind, social relation, friend relation, teacher relation, learning motivation 1-5.
[e] Extended other covariates: activity together with parents, parent's nurturing attitude, parent's affection, teacher effectiveness, teacher morale.

3.6 Extension

According to Section 3.5, it appears that math and English test score are positively affected by the 9 o'clock attendance policy. Here, I exploit the advantages of the Gyeonggi Education Panel Study to check whether the result holds in extended model specifications.

First, the Gyeonggi Education Panel Study contains various information including student's cognitive and non-cognitive traits, which are unavailable to the administration during the assignment process but observable to the researchers. Thus, I control for these additional characteristics in the general OLS estimation.[15] In this regard, the analysis can provide a useful glimpse how individual's specific characteristics affect the result. Second, I apply the student fixed effect estimation. In the existing literature, the standard approach has been restricted to either the general OLS or school-level fixed effect estimation due to data limitations (Hinrichs, 2011; Edwards, 2012; Heissel and Norris, 2017; Shin, 2017; Kim, 2018). With the advantage of the Gyeonggi Education Panel Study, I additionally include the student fixed effect in the model. The result will be biased if I do not control for student's unobserved characteristics which are related to the treatment. For instance, suppose that students with outstanding academic aptitudes are more likely to follow the 9 o'clock attendance policy to improve their test score. In this case, positive sorting between the student's cognitive abilities and the policy treatment can conflate the result. In this respect, examining the effect using the individual fixed effect and comparing the result with that of other specifications is one of the main contributions to existing literature.

[15] I control covariates of delinquency, mental health, class understanding, class attention, reading activity, class attitude, stress, teacher evaluation, self-esteem, self-effectiveness, belief in self-growth, career maturity, civic mind, social relation, friend relation, teacher relation, learning motivation 1-5. Appendix C provides a detailed explanation of variables.

3.6.1 Extended Estimation Result

Column (3)-(5) in Table 3.4 reports the extended estimation result. In column (3), I include parent's and teacher's traits which can affect student's academic achievement.[16] However, the changes are negligible in magnitude, and math and English score are still shown to be positively influenced by the 9 o'clock attendance policy by 0.22 and 0.26 standard deviations. It implies that parent's and teacher's characteristics are orthogonal to the policy treatment and they do not affect the outcomes. This result makes sense considering the random assignment of students irrespective of family backgrounds and homogenized teacher characteristics across schools.

However, I witness noticeable changes in column (4) and (5). In column (4), I extend the general OLS estimation to include additional personal covariates which are related to student's attitudes and lifestyles. Then, the effect becomes smaller in all subjects. It changes from 0.11 to 0.05 in Korean, from 0.23 to 0.16 in math, and from 0.24 to 0.18 in English. A similar change occurs in the student fixed effect estimation.[17] Column (5) shows that the change of coefficient's sign and magnitude is remarkable. Its sign even becomes negative, and the size is about -0.29 in Korean, -0.17 in math, and -0.14 in English. Of course, I am cautious when it comes to interpretations since the results are statistically insignificant except for Korean. However, The result is juxtaposed to that of Hinrichs (2011), Pope (2016), Lusher and Yasenov (2016), and Luong, Lusher, and Yasenov (2017), which show that no significant or even negative effects emerge when the school starting time is delayed. My result contradicts with previous claims which support positive causal effects of the delaying the school starting time on student's performance.

[16] I control covariates of activity together with parents, parent's nurturing attitude, par- ent's aection, teacher eectiveness, teacher morale. Appendix C provides a detailed explanation of variables.

[17] The empirical design is as follow:

$$Y_{i,j,t} = \beta T_{i,t} + \gamma X_{i,j,t} + \delta_t + \omega_i + \epsilon_{i,j,t}$$

where i is a student, j is a school, and t is a year. ω_i is a student fixed effect.

Whereas inclusion of parent's and teacher's characteristics does not influence the result much (column (3)), controlling for student's cognitive and non-cognitive features changes the result substantially (column (4)). And this is similar to the case of the student fixed effect estimation (column (5)). In general, I find no evidence in support of a causal linkage between the 9 o'clock attendance and student achievement when I control substantial lists of personal covariates or unobserved individual heterogeneities. There is no clear evidence of outperformance by students who start the school later, which is widely supported on the educational front. The stark difference observed in column (4) and (5) requires a new perspective when we evaluate the effect of the school starting time on student's academic performance. I will discuss it more in detail in Section 3.7.

3.6.2 Robustness Check

I use *Group II* as a robustness check to support the extended estimation result in the previous section. Here, I apply the general OLS estimation as follow:

$$Y_{i,j,k} = \beta T_{i,k} + \gamma X_{i,j,k} + \epsilon_{i,j,k}$$

where i is a student, j is a school, and k is a cohort. The treatment group is the 7th-grade students in 2015, and the control group is the 7th-grade students in 2012.

Two concerns exist to this empirical model. First, the treatment and control group are from a different cohort, so there may exist systemical differences between them. But I expect that their observable characteristics would be balanced considering that two cohorts are under the same random assignment system, and living environments are stable during this period since the cohort gap is only 3-year. To check this, I compare means in characteristics of students and schools.[18]

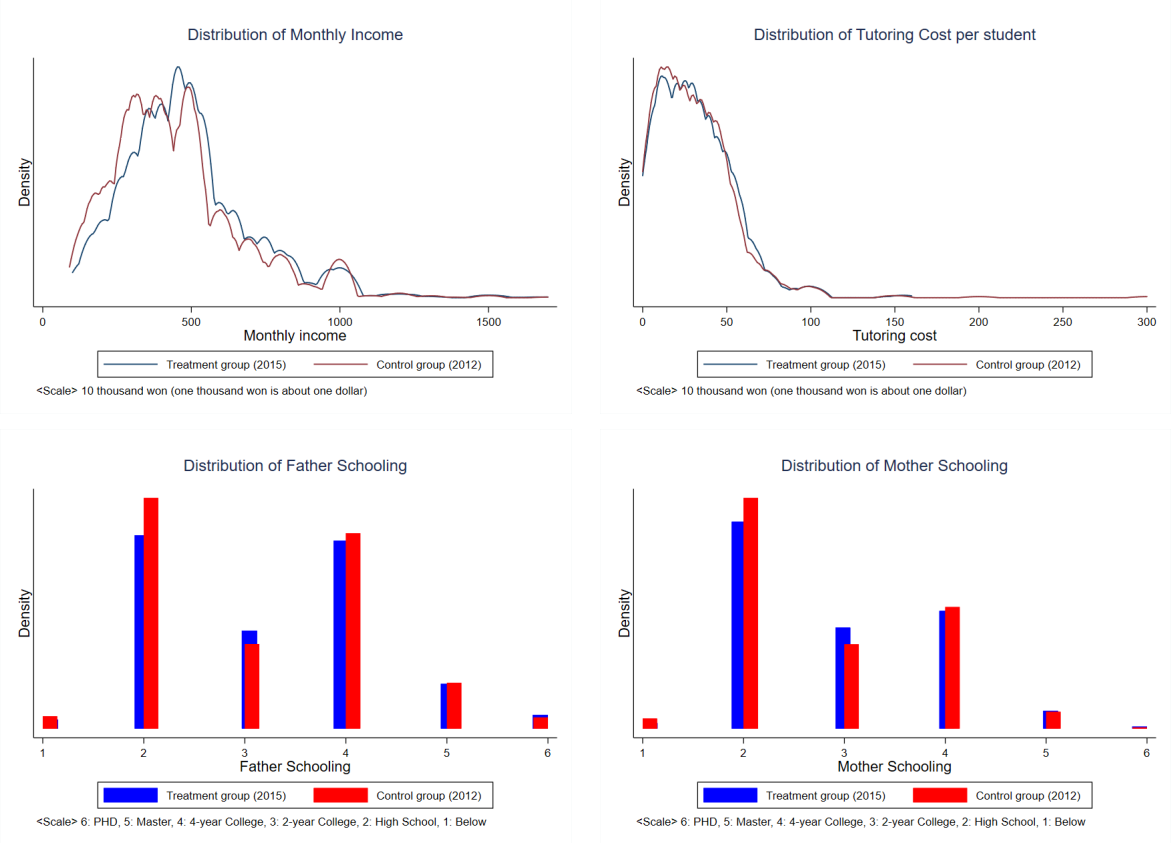
[18]To compare monetary value of student/family characteristics, I modify nominal into real values using the

Table 3.7: Balance Test for Group II

Variable	Treatment	Control	Diff. (p-value)
student/family characteristics			
sex	0.5051	0.5147	0.4483
family type	0.9098	0.8991	0.1650
number of children	2.0886	1.7847	0.0000***
birth order	1.5909	1.5805	0.5473
monthly income (CPI modified)	520.12	499.16	0.1092
father schooling	3.1198	3.0216	0.0016**
mother schooling	2.8228	2.7019	0.0000***
tutoring fee (CPI modified)	96.19	98.47	0.2602
tutoring fee per student (CPI modified)	49.34	48.50	0.3642
housing type	0.6237	0.6190	0.6982
N	2,562	4,026	
school characteristics			
student number	268.31	306.62	0.1002
teacher's average year	15.15	14.49	0.2845
pupil to teacher ratio	8.2764	7.1046	0.1856
time allocation for class by teacher	42.37	42.08	0.8267
N	47	47	

[a] * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.
[c] The treatment group is students who follow the 9 o'clock attendance policy in 2015, and the control group is students without the 9 o'clock attendance policy in 2012.
[d] I select 47 schools which are observed both in 2012 and 2015, and which are affiliated with the surveyed students.

Figure 3.2: Distribution of Observable Variables



Relative to the balance test for *Group I*, Table 3.7 shows several differences in variables such as parents' education. However, as Figure 3.2 illustrates, there exists little evidence of systemical difference to the distribution across periods.[19] The spread and pattern of monthly income, tutoring cost per student, and parents' schooling are stable over time. I also check school characteristics in Table 3.7, and the results are balanced between two periods. All in all, the balance test results confirm that there is little disparity of observable traits between the treatment and control group.

A second concern is a measurement. The test score $Y_{i,j,k}$ can be a problem when I compare test score of two different cohorts since students took different exams. In my study, this concern is limited. Firstly, the coverage, style, and level of exam in each period are similar.[20] Secondly, the achievement gap between two cohorts is negligible considering a short period gap (3-year). These facts alleviate a mismeasurement issue (Reardon and Portilla, 2016). For evidence, Figure 3.3 shows that score distribution, mean, and standard errors by absolute point-scale are similar between two periods.

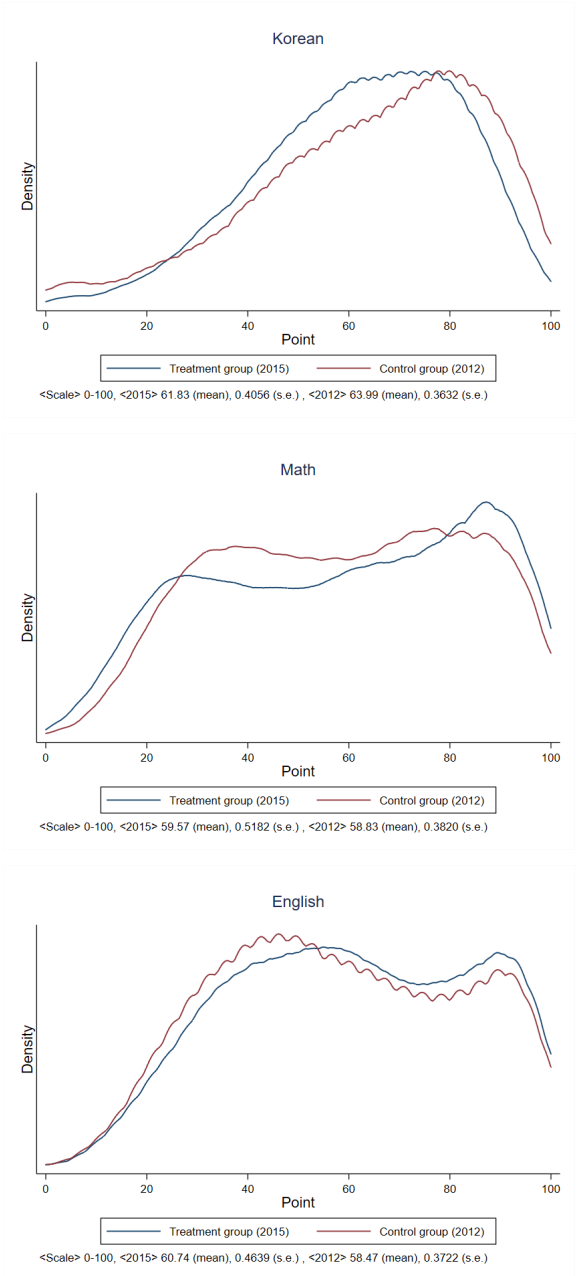
All in all, estimating the effect using *Group II* gives a chance to check robustness. Under this background, I conduct the estimation, and Table 3.8 shows the result. Here, I obtain similar results with those of *Group I*. Column (1) is the result when I do not control any covariates. The effect is small and insignificant. It is -0.004 for Korean, 0.009 in math, and 0.005 in English. The outcome confirms my observation that there is little evidence that the 9 o'clock attendance policy leads to better academic performance. Also, similar changes are realized when I control

CPI since the absolute size of average value can be different considering 3-year time elapses. To measure school characteristics, I select schools which are observed both in 2012 and 2015, and which are affiliated with the surveyed students. By doing so, I discern total 47 schools. The reason for this selection is due to limitations of the dataset. Unfortunately, only rudimentary information about schools is available, such as type and location (private/public, single-sex/co-ed, urban/rural).

[19] To precisely examine the distribution, I winsorize at the top and bottom 1% samples of monthly income and tutoring cost per student.

[20] The exam is conducted for 45 minutes for each subject at the end of spring semester. It covers spring semester's class materials. Korean test is 5-writing questions, math test is 20 multiple choice questions, and English test is 28 multiple choice questions. A full score for each subject is 100 points.

Figure 3.3: Score Distribution (by absolute point-scale) between Two Periods



extended personal characteristics. Including substantial lists of individual vectors affects the outcome negatively, and the magnitude is large and statistically significant. It is -0.15 for Korean, -0.28 for math, and -0.22 for English (column (4)). These coefficients are comparable to those of the student fixed effect model from *Group I* (column (5) in Table 3.4).

3.7 Discussion

Including student's extended traits changes the result significantly, and the effect becomes closer to that of student-level fixed effect model. However, controlling for parent and school-related covariates have no such effect. My findings suggest that the link between the delayed school starting time and student's academic performance is likely to be confounded by student-level heterogeneities. Since student's extended characteristics are the principal part of omitted heterogeneities in the student-level fixed effect estimation, it implies that there exists another channel, which has been neglected in the conventional approach but affects the outcomes significantly.

What causes the divergence? One essential factor which makes my paper different from previous studies is that I exploit the actual policy participation by student-level, not by school-level. To be real, the actual participation of the 9 o'clock attendance policy by student-level even diverges within the same school and class, according to the Gyeonggi Education Panel Study.[21] Thus, even though schools as a whole are surveyed to delay the school starting time to 9 o'clock, the actual participation by student-level can vary within the school. Many of previous literature assume that student's participation to the policy is uniform within the school (Hinrichs, 2011; Edwards, 2012; Heissel and Norris, 2017, Shin, 2017; Kim, 2018). However, this is not a realistic assumption on the educational front. For instance, think of how

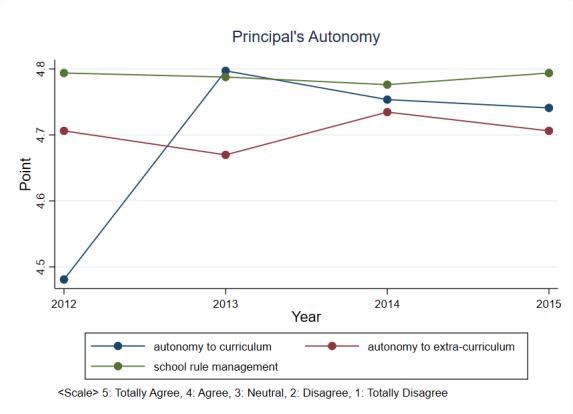
[21] While about 90% of schools are reported to adopt the 9 o'clock attendance policy according to the press release (Gyeonggi Provincial Office of Education, 2014), the panel study investigates the actual participation of the policy by student-level. In the survey, students are asked to answer whether they take part in the 9 o'clock attendance policy.

Table 3.8: Robustness Check

	(1)	(2)	(3)	(4)
Dep. Var.: Korean (z-score)				
9 o'clock policy	-0.0036	-0.0360	-0.0797	-0.1521*
	(0.0593)	(0.0573)	(0.0582)	(0.0733)
R^2	0.0000	0.1245	0.1341	0.3061
N	6,529	3,717	3,593	3,488
Dep. Var.: Math (z-score)				
9 o'clock policy	0.0086	-0.0805*	-0.1178*	-0.2802***
	(0.0588)	(0.0406)	(0.0459)	(0.0520)
R^2	0.0000	0.1939	0.2028	0.4608
N	6,584	3,759	3,634	3,530
Dep. Var.: English (z-score)				
9 o'clock policy	0.0051	-0.0573	-0.0941	-0.2193***
	(0.0706)	(0.0454)	(0.0488)	(0.0605)
R^2	0.0000	0.2597	0.2732	0.5067
N	6,581	3,756	3,631	3,527
Year FE	Y	Y	Y	Y
Personal covariates	N	Y	Y	Y
Extended personal covariates	N	N	N	Y
Extended other covariates	N	N	Y	N

[a] Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.
[c] Personal covariates: sex, number of children, birth order, income, father schooling, mother schooling, private tutoring fee per student, family type, housing type.
[d] Extended personal covariates:delinquency, mental health, class understanding, class attention, reading activity, class attitude, stress, teacher evaluation, self-esteem, self-effectiveness, belief in self-growth, career maturity, civic mind, social relation, friend relation, teacher relation.
[e] Extended other covariates: activity together with parents, parent's nurturing attitude, parent's affection, teacher effectiveness, teacher morale.

Figure 3.4: Principal's Autonomy in School Policy Practice



the 9 o'clock attendance policy was initiated and implemented in Gyeonggi province. The Uijeongbu girl's middle school students firstly proposed the 9 o'clock attendance policy, and it spread all over provinces. It implies that students, who are more positively self-motivated when it comes to learning behaviors and class attitudes, were more likely to be self-selected into the 9 o'clock attendance policy. So it can yield biased results unless these individual's characteristics are properly considered.[22] Moreover, I confirm that the actual compliance to the 9 o'clock attendance policy is different across students even within the same class through interviews with several middle school teachers in the field, which gives credences to the panel dataset. For example, the actual 9 o'clock attendance policy execution can be affected by other factors such as principals who are responsible for the field practice. As circumstantial evidence, Figure 3.4 shows that principals of middle school have higher levels of autonomy with respect to school regulation. It suggests that schools and students may discretionally implement and follow the policy.

In the environment where the decision of school attendance time is dependent on student's choice, the effect of 9 o'clock attendance policy is likely to be influenced by the individual

[22]For example, through field experiments in physical education classes at secondary school, Kiessling, Radbruch, and Schuabe (2018) show that the self-selection results in different peers, and it improves individual performance.

heterogeneities. This fact has been dismissed in the previous literature. Thus, I suspect that existing studies contain a student-level self-selection risk. Based on these observations, I think that the self-selection by students via their heterogeneity is one main reason to draw my result, which previous researchers have not investigated in detail. In particular, students with outstanding academic aptitudes are more likely to exploit the 9 o'clock attendance policy. And the interpretation of results without considering these facts can be misleading.[23]

Using the dataset of *Group I*, I examine whether my argument can be upheld with empirical evidence. First, Table 3.9 and Figure 3.5 show differences to several academic-related indexes before the policy implementation (2012-2014). Table 3.9 presents that the treatment students are more likely to have better academic aptitudes in school. Like Edwards (2012), I also plot the cumulative distribution for Korean, math, and English test results in 2012-2014, which are before the 9 o'clock attendance policy. The cumulative distributions for the treatment group first-order stochastically dominate those of the control. While Edwards (2012) argues that these figures suggest positive impacts of delaying school starting time on student's performance, I emphasize that this can be circumstantial evidence of student-level self-selection effect.

[23] A simple framework illustrates this logic. Suppose an econometric model is given by

$$y = \beta T + u + \epsilon$$

where T is a treatment and u is an individual heterogeneity, with a common assumption of $T \perp \epsilon$. Then, $\hat{\beta} = \beta + \mathbb{E}[(T'T)^{-1}(T'u)] + \mathbb{E}[(T'T)^{-1}(T'\epsilon)] = \beta + \mathbb{E}[(T'T)^{-1}(T'u)]$ by the assumption. If the fixed effect yields a smaller coefficient than the OLS ($\hat{\beta} > \beta$), it means $cov(T, u) > 0$. This shows that there exist positive correlations between the policy treatment and individual's heterogeneities. While Hinrichs (2011) speculates total 10 possible reasons why there might be no effect of the school starting time on student's academic performance, I seek to specify another possible reason, which is the student-level self-selection effect, based on empirical evidence.

Table 3.9: Comparison of Academic Attitudes

	2012 ($4th$)			2013 ($5th$)			2014 ($6th$)		
Variable	Treatment	Control	Diff. (p-value)	Treatment	Control	Diff. (p-value)	Treatment	Control	Diff. (p-value)
Korean (z-score)	0.0228	-0.2391	0.0002***	0.0299	-0.2575	0.0000***	0.0432	-0.3907	0.0000***
math (z-score)	0.0353	-0.1224	0.0226**	0.0425	-0.2534	0.0000***	0.0424	-0.4013	0.0000***
English (z-score)	0.0457	-0.3955	0.0000***	0.0461	-0.4044	0.0000***	0.0395	-0.3992	0.0000***
class understanding (Korean)	4.4426	4.2110	0.0001***	4.4541	4.2091	0.0000***	4.3490	4.1818	0.0067**
class understanding (math)	4.2415	4.1142	0.0611	4.2750	4.1872	0.1993	4.0642	4.2276	0.0249*
class understanding (English)	4.1707	3.7202	0.0000***	4.1571	3.8945	0.0014**	4.1537	3.7936	0.0000***
class attention (Korean)	3.3823	3.2922	0.0828	3.3826	3.2500	0.0095**	3.2985	3.2864	0.8119
class attention (math)	3.3994	3.3136	0.1121	3.3792	3.3045	0.1815	3.3036	3.3165	0.8217
class attention (English)	3.2610	3.1273	0.0303*	3.2194	3.1091	0.0754	3.1746	3.0548	0.0523
class attitude	3.4363	3.3602	0.1871	3.4452	3.3091	0.0185*	3.3638	3.2909	0.2055
reading activity	2.8062	2.6892	0.0445*	2.6360	2.5307	0.0717	2.6114	2.5042	0.0742
learning motivation (1)							2.0174	1.9955	0.7433
learning motivation (2)							2.2588	2.1682	0.1945
learning motivation (3)							3.5435	3.4303	0.1013
learning motivation (4)							3.0330	2.9045	0.0759
learning motivation (5)							1.8988	1.9817	0.1820
self-esteem	3.8973	3.7266	0.0053**	4.0259	3.8991	0.0214*	4.0545	3.9984	0.3226
self-effectiveness	3.5972	3.5443	0.3995	3.5554	3.4734	0.1915	3.6138	3.4295	0.0033**
N	2,562	220		2,562	220		2,562	220	

[a] * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.

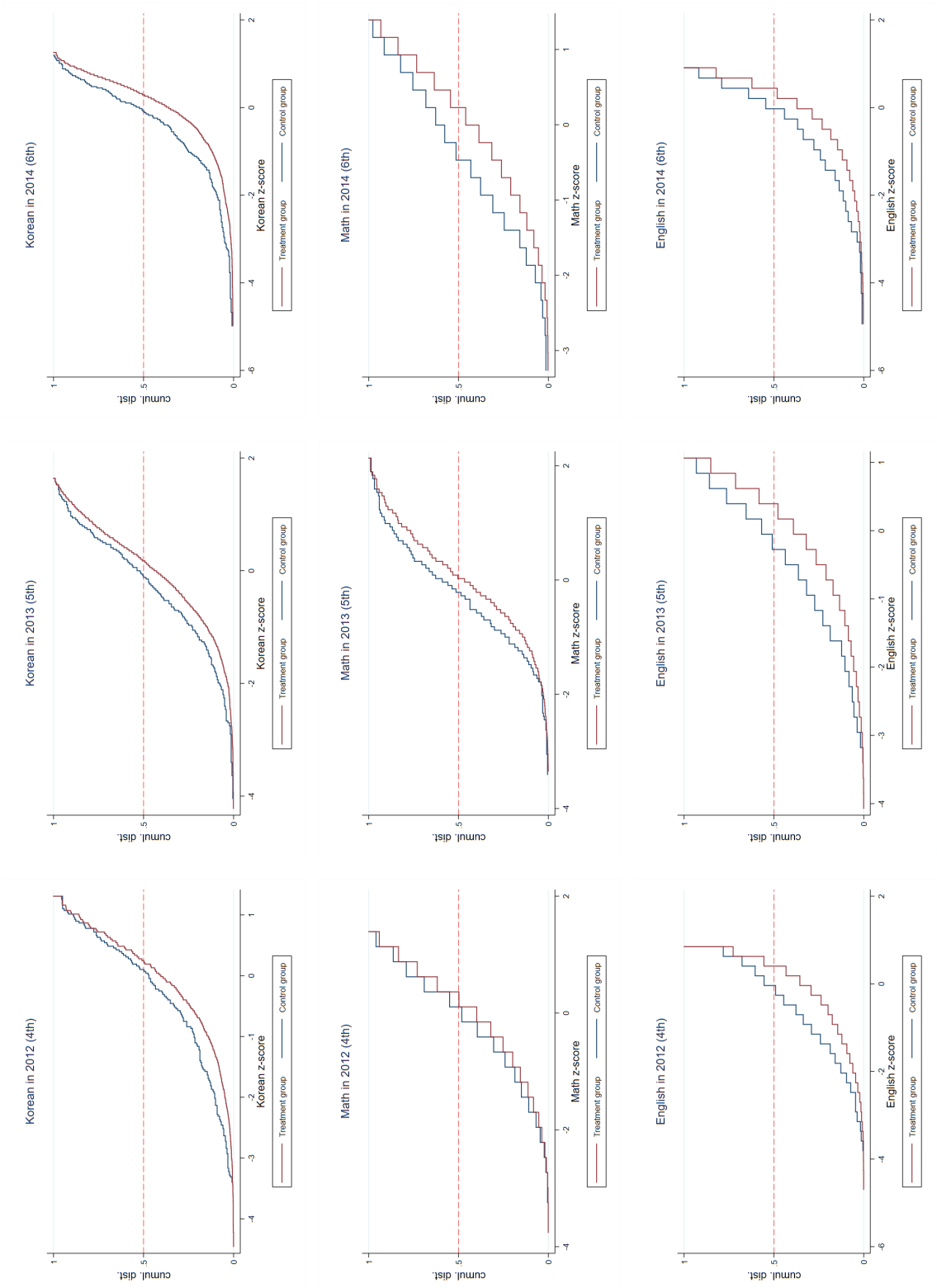


Figure 3.5: Cumulative Distribution of Exam in 2012-2014

Second, I examine the OLS estimation by including previous year's test scores whether the effect is conflated by qualified student's self-selection.[24] Table 3.10 illustrates that the result dramatically changes when I control for the previous exam result. The coefficient of the 9 o'clock attendance policy becomes smaller and statistically insignificant in all three subjects, while the effect of lagged dependent variable remains strong (column (2)).

Third, I examine how students change their behaviors after the 9 o'clock attendance policy, in particular by focusing on the time allocation. Table 3.11 shows surprising results. In 2015, the disparity of variables stands out when I examine learning activities, whereas the difference vanishes in non-learning activities. The treatment group uses 1.48 hours per week for homework, 0.64 hours per week for self-study, and 6.18 hours per week for private tutoring in 2015, while the control group spends a smaller amount of time on these activities. Before the 9 o'clock attendance policy in 2014, there is no such discrepancy. It means that students with better learning attitudes are more likely to exploit benefits of the 9 o'clock attendance policy.

Finally, as shown in Table 3.12, the amount of sleep, breakfast frequency, and parenting do not differ between two groups after the treatment in 2015. The treatment group sleeps late about 9 minutes but also wakes up late about 2 minutes, so the total amount of sleep time is similar.[25] I also cannot find any systemical differences between them in breakfast habit and parenting styles. It implies that commonly suggested channels to improve student's performance do not hold for my study.

All in all, my analysis shows that the effect of the school starting time seems to be confounded by student-level self-selection into the policy. Hence, the interpretation of policy effect without considering the self-selection caused by individual's heterogeneities can be glossing over the reality. It requires cautions when we evaluate the effect of the school starting time on

[24] To be specific, I estimate the following equation: $Y_{i,j,t} = \beta T_{i,t} + \gamma Y_{i,j,t-1} + \delta_t + \epsilon_{i,j,t}$.

[25] Although the total amount of sleep does not differ across groups, a growing number of recent literature argues that the quality of sleep such as sleep regularity can be a significant factor on students' academic performance (Luong, Lusher, and Yasenov, 2017). Hence, focusing on the pattern and quality of sleep on students and examining it as a central mechanism will be an important topic.

Table 3.10: Result with Controlling for Previous Test Scores

	(1)	(2)
Dep. Var.: Korean (z-score)		
9 o'clock attendance	0.1340	-0.0731
	(0.0935)	(0.0826)
test scores in previous year	-	0.4846***
	-	(0.0282)
R^2	0.0014	0.2378
N	2,725	2,725
Dep. Var.: Math (z-score)		
9 o'clock attendance	0.2683**	0.0180
	(0.0962)	(0.0917)
test scores in previous year	-	0.5724***
	-	(0.0239)
R^2	0.0054	0.3381
N	2,778	2,778
Dep. Var.: English (z-score)		
9 o'clock attendance	0.2881**	0.0309
	(0.0873)	(0.0807)
test scores in previous year	-	0.5943***
	-	(0.0349)
R^2	0.0063	0.3644
N	2,776	2,776
Year FE	Y	Y

[a] Standard errors in parentheses, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3.11: Comparison of Time Allocation

	2014 (before the 9 o'clock policy)			2015 (after the 9 o'clock policy)		
Variable	Treatment	Control	Diff. (p-value)	Treatment	Control	Diff. (p-value)
learning activities						
homework	1.5373	1.5745	0.4354	1.4811	1.2304	0.0034**
self-study	0.8741	0.8122	0.2755	0.7633	0.6475	0.0465*
private tutoring	5.4480	5.1318	0.4446	6.1841	5.1139	0.0177*
non-learning activities						
exercise	2.9400	3.1187	0.0280	2.5554	2.7419	0.0236*
friend	1.2574	1.2454	0.8845	1.0817	1.1176	0.6639
leisure	1.7699	1.8527	0.3539	1.8478	1.8514	0.9701
computer	0.8609	0.8979	0.6010	0.9880	1.0388	0.5372
smart phone	1.5697	1.4369	0.1969	2.1367	2.0126	0.2608
game	2.4460	2.4874	0.8211	2.8971	2.9064	0.9642
N	2,562	220		2,562	220	

[a] * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.
[c] The unit of variable is average hour per week.

Table 3.12: Other Suggested Channels

Variable	Treatment	Control	Diff. (p-value)
sleep time	3.0219	2.8584	0.0171*
	(23:31)	(23:22)	
wake-up time	4.3591	4.1142	0.0005***
	(07:25)	(07:18)	
breakfast	3.3955	3.3182	0.2674
parent's nurturing attitude	3.9646	3.9839	0.5877
parent's affection	3.9522	3.9727	0.6238
parent's school satisfaction	3.5550	3.5140	0.4081
N	2,562	220	

[a] * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[b] Appendix C provides a detailed explanation of variables.

pupil's cognitive abilities.

3.8 Conclusion

In this paper, I seek to find a link between the 9 o'clock attendance policy and student's academic performance using over 2,000 middle school students in South Korea. At a first glimpse, student's math and English test score seem to be positively affected by the 9 o'clock attendance policy. However, the effect becomes smaller and insignificant in general when I control the extended personal covariates, and it even becomes negative when I apply the individual-fixed effect estimation. The result implies the possibility of student-level self-selection into the policy treatment. From this perspective, my findings cast doubt on the argument that any positive effect of the delaying school starting time on student's academic performance is coming from "a late bird" (policy treatment effect). Rather, "a good bird" (self-selection effect) is likely to be the chief factor that yields such outcomes.

The paper has several limitations. The sample size is relatively small, and the period of analysis is too short to examine long-term persistence effects. Also, I should be careful that the findings would not be generalized to a larger world or another place. The external validity is not guaranteed, and either minor or unobservable conditions may be the core factor that leads to a big difference. Analytically, I cannot precisely examine the policy treatment effect since I cannot handle the student-level self-selection issue.

However, the paper is meaningful in that it is the first study to analyze the effect of the school starting time on student's academic achievement using the individual-level representative samples and comparing the outcomes through various model specifications. My result reasonably casts doubt on the positive effect of postponing the school starting time on student's performance, which has been addressed by many researchers. The unique feature of my study can complement the previous literature and suggest crucial points which should

be reflected in following studies. I hope that it will help policymakers to evaluate the effect of the 9 o'clock attendance policy more rigorously, and pave the way for constructing better educational programs.

Appendix A

Chapter 1 Appendix

A.1 Budgeting Procedure

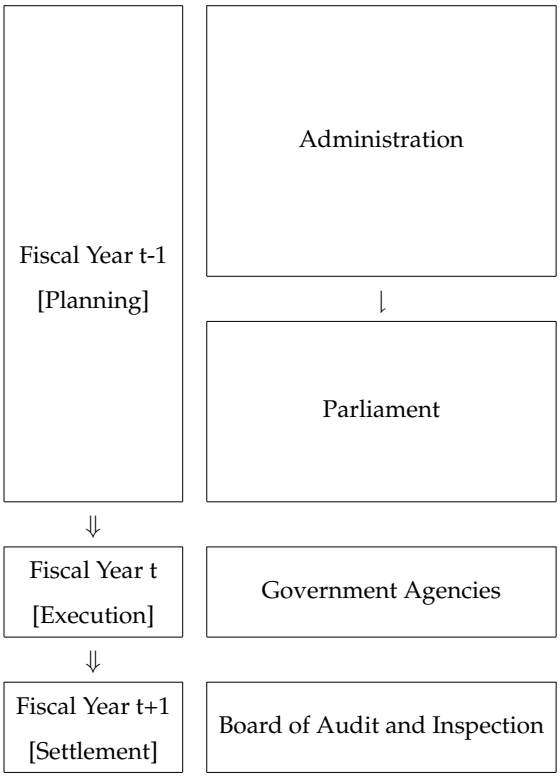
The government spending plan is centrally coordinated by the Ministry of Strategy and Finance and the National Assembly. The fiscal management process goes on three stages: planning $(t-1)\rightarrow$implementing $(t)\rightarrow$settling $(t+1)$. In the planning period $(t-1)$, the government makes the annual budget plan for fiscal period t. The central and local governments, as well as the governmental agencies, implement the budget predetermined in period $t-1$, and it is settled and audited in period $t+1$. In the following explanation, I describe the planning period $t-1$ more specifically.

The Administration Process

The Budgeting Office in the Ministry of Strategy and Finance makes the annual budget draft for an upcoming year. This procedure goes in January and finishes on September 3rd. After formulating the draft, the government passes over it to the National Assembly.[1]

The budgeting process starts with considering the National Fiscal Management Plan and Medium-term Project Plan to secure fiscal soundness and predictability of the national budget. The Ministry of Strategy and Finance delivers a guideline describing how central and local governments should formulate a next-year budget. Total spending and ceiling are set first, and

[1]The National Finance Act, amended in April 2013, changed a timeline of the budget proposal. It should be submitted 120 days before the fiscal year in 2016, contrary to 90 days before the fiscal year in 2013.



Jan.	Medium-term Project Plan
Mar.	Guideline for Budget Ceiling
Apr.	Fiscal Meeting *(by the Cabinet)*
May	Budget Request *(by government agencies)*
Jun. - Aug.	Draft *(by Budget Office of the MOSF)*
Sep. 2.	Submission to the Parliament
Sep. - Nov.	Pre-evaluation Comprehensive Review Review for adjustment of figure
Dec. 2.	Vote at Plenary Session

then fiscal resources are allocated to central and local governments. All of the government agencies should follow the guideline when formulating the budget draft. If they do not keep the rule, the Ministry of Strategy Finance imposes a penalty for noncompliance. It strengthens a budgeting power of the Ministry of Strategy and Finance.

Each sub-government formulates its budget plan considering priorities and major project investment plans before June. During the process, the Fiscal Strategy Meeting of cabinet members chaired by the President is held in April to listen to the needs and difficulties of formulating the new budget plan. It finalizes budget requests and submits them to the Ministry of Strategy and Finance.

The Ministry of Strategy and Finance centrally coordinates the budget plan. It lasts for three months, from June to August. It reviews and revises proposed plan using the budgeting guidelines and reflecting national priorities and macroeconomic outlooks. Budget reviews are

conducted by public officials of the Budget Office. The validity of each project is reviewed in detail in the budget reviews. Because the procedure is centrally-organized by public officials in the Ministry of Strategy and Finance, the person in charge of budgeting has magnificent power in allocating the budget. For instance, if local governments cannot address why planned projects are necessary and cannot provide a valid argument, the plans can be modified or even repealed based on public official's discretionary judgments. Thus, local government officials and members of the National Assembly even seek to use their social capitals to the Ministry of Strategy and Finance's public officials to gain more budgets. Here, social connections through regional homophily can play a crucial role in access to public officials.

The National Assembly Process

After the Ministry of Strategy and Finance finishes coordinates whole budget plans, it hands over the draft to the National Assembly. The finalization process by the National Assembly lasts from September 3rd to December 2nd. Inspection and deliberation by the National Assembly's budget comprise of three steps: (1) preliminary review by the Standing Committee, (2) comprehensive review by the Special Committee on Budget and Accounts, (3) plenary session vote.

Of the three, comprehensive review by the Special Committee on Budget and Accounts is the most important phase for securing the local budget. During the Special Committee meeting, the Minister of the Ministry of Strategy and Finance introduces the budget draft, and it is followed by a review of 50 committee members. The committee holds a questioning session in the presence of affiliated bureaucrats. At the final stage, it constitutes the budget adjustment subcommittee to fine-tune and finalize figures of each budget component. During the review procedure, members of the National Assembly try to increase their electorate district's budget shares. Since official term for the member of the Special Committee on Budget and Accounts

Table A.1: Draft and Finalized Budget (2013-2016)

($ billion)

	2013		2014		2015		2016	
	MOSF	Parliament	MOSF	Parliament	MOSF	Parliament	MOSF	Parliament
Total	342.5	342.0	357.7	355.8	376.0	375.4	386.7	386.4
Welfare, Health	97.1	97.4	105.9	106.4	115.5	115.7	122.9	123.4
Education	49.1	49.8	50.8	50.7	53.0	52.9	53.2	53.2
Culture, Tourism	4.8	5.0	5.3	5.4	6.0	6.1	6.6	6.6
Environment	6.3	6.3	6.3	6.5	6.7	6.8	6.8	6.9
R&D	16.9	16.9	17.5	17.7	18.8	18.9	18.9	19.1
Industry, SMEs, Energy	15.7	15.5	15.3	15.4	16.5	16.4	16.1	16.3
SOC	23.9	24.3	23.3	23.7	24.4	24.8	23.3	23.7
Agriculture, Food	18.3	18.4	18.6	18.7	19.3	19.3	19.3	19.4
National Defense	34.6	34.3	35.8	35.7	37.6	37.5	39.0	38.8
Diplomacy, Unification	4.1	4.1	4.2	4.2	4.5	4.5	4.7	4.7
Public Order, Safety	15.0	15.0	15.7	15.8	16.9	16.9	17.5	17.5
General Public Service	57.3	55.8	58.7	57.2	59.2	58.0	60.9	59.5

[a] Source: Press Release (Ministry of Strategy and Finance, 2012 to 2015).

lasts for only one-year, an incentive of securing more funds becomes much higher.

After completing the process, the modified budget is introduced and finalized in the general meeting of the Special Committee on Budget and Accounts. One interesting aspect of the process by the Special Committee on Budget and Accounts is that, as it is shown in Table A.1., it tends to cut the total size of a next-year budget by 1% compared to the original draft formulated by the government. It implies that the congressional budget process is usually about re-allocation of the budget among policies, projects, and regions. Thus, politician's socioeconomic characteristics such as the position in the party and multi-term serving can play a significant role in securing each local electorate's budget.

A.2 Analyzing Unit

I construct a unique panel dataset covering total eight-year, while previous studies using Korean example use two-year or four-year data (Kim, 2010; Choi and Lee, 2011; Hur and Kim, 2014). One difficulty is that there exists a discrepancy between the administrative district and electoral constituency. According to Cox (2009) and Kim (2010), many studies commit analytical errors when they define the analyzing unit. That is, existing literature uses administrative district instead of electoral constituency when examing the impact of politicians on the budget since budgets are allocated based on the administrative unit. However, it can lead to a wrong estimation because the purpose is to precisely examine the impact of *bureaucrats* and *politicians* on the budget allocation. Thus, electoral constituency unit should be the choice.

To be specific, there are three issues. First, the National Subsidy is allocated to local regions based on the administrative district, which is not identical to the electoral constituency. Second, politician serves for his region by electoral constituency (not by administrative unit). Third, I have to define the scope of the bureaucrat's hometown. To resolve the issue, I define the analyzing unit as follows:

1. When the administrative district is the same to the electoral constituency, I calculate per capita budget as usual.

2. When one administrative district is divided into several electoral constituencies, I calculate per capita budget to the same with Case 1. I codify the variable $BudgetCommittee_{i,t}$ equal to 1 if at least one politician in the analyzing unit is a member of the Special Committee of Budget and Accounts.

3. When several administrative districts constitute one electoral constituency, I aggregate total budget of each administrative districts and divide it by total population.

Defining the analyzing unit i above can cause a difference with bureaucrat's hometown since

people usually consider their hometown based on administrative district. However, according to the National Election Commission which defines electoral constituency, it considers multiple aspects of socioeconomic properties and cultural characteristics when it demarcates electoral constituency. For example, it examines whether each local district shares homogeneities or whether the demarcation has any possibility to distort election result. To be specific, the Public Official Election Act Article 25 articulates that "*election constituency shall be demarcated in the area under jurisdiction of the City/Do (a unit of metropolitan in South Korea), in consideration of the population, administrative districts, geographical features, traffic, and other conditions, but an autonomous Gu, Si, or Gun (a unit of municipality in South Korea) shall not be divided to make part of it belong to another constituency for the National Assembly member.*" Thus, each electoral constituency preserves socioeconomic and cultural proximity, which is aligned with the bureaucrat's hometown.

A.3 A Simple Framework of the Transparency Mechanism

Consider a career-concern model in which bureaucrat's motivation to sustain a higher position after retirement meets with local government's incentive to get more budgets. Using hometown connection, high-ranked public officials and local governments may make an implicit contract, through which bureaucrats will get benefits such as high-ranked position if he allocates more budget to the local district. In this situation, local governments face two possible value functions as follows:[2]

$$V_t = qY_H + (1-q)Y_L + \beta \max\{V_{t+1}, W_{t+1}\}$$
$$W_t = Y_H + \beta\left((1-p)\max\{V_{t+1}, W_{t+1}\} + p(Y_L - l)\right)$$

where V_t is a value of local government without an implicit contract, W_t is a value of local government with an implicit contract (V_{t+1} and W_{t+1} are value function in the next period),

[2]Here, I focus on local governments rather than bureaucrats. It is based upon the logic provided by Basu (2011).

Y_i is the amount of local budget ($i \in \{H, L\},\ Y_H > Y_L$), q is a probability of getting Y_H without an implicit contract ($0 < q < 1$), p is a probability of being investigated by third-party agency and found out to be guilty ($0 < p < 1$), l is a penalty cost associated with these behaviors, and β is a discounting rate. To consider an interesting case, I assume that $qY_H + (1-q)Y_L > (1-\beta)(Y_L - l)$.

The first equation shows the case when there is no implicit contract. The local government obtains an average amount of budget $\mathbb{E}(Y)$ $(= qY_H + (1-q)Y_L)$ in the current period and faces the same problem in the next period with the present. The second equation is when there exists an implicit contract. The local government gets Y_H in the current period by using social capital, and it is punished and obtains only $Y_L - l$ in next period when it is caught with the probability of being investigated p.

The local government is indifferent between two situations when $V_t = W_t$. If I solve the equations with a stationary equilibrium condition where $V_t = V_{t+1}$ and $W_t = W_{t+1}$, it yields a threshold

$$\bar{p} = \frac{(1-\beta)\left(Y_H + \mathbb{E}(Y)\right)}{\beta\left(\mathbb{E}(Y) - (1-\beta)(Y_L - l)\right)}$$

where the local government chooses to make the implicit contract with bureaucrats if $p \leq \bar{p}$, and otherwise if $p > \bar{p}$.

Theoretical model predicts that newly released information about budget usage can self-regulate incentive of both local government and executives. Here, improving the budgetary transparency can be interpreted in two ways. One is to make p greater, which makes the local government not to offer an implicit contract to high-ranked bureaucrat. The other is to lower $\bar{p}$ by increasing l. If the cost of connection to a bureaucrat is high enough, the local government will not offer any implicit contract to the bureaucrat.

Appendix B

Chapter 2 Appendix

B.1 Variable Explanation

The following Table B.1. describes the variables that I exploit in the analysis.

Table B.1: Variable Description

Variable	Explanation
School Choice	1 if a student wins the lottery, 0 otherwise.
Sex	1 if a student is female, 0 otherwise.
Siblings	Number of student's siblings.
Birth Order	1 if he(she) is a first child, 0 otherwise.
Food Program	1 if a student is supported by government's free lunch program, 0 otherwise.
Private Tutoring	1 if a student use private tutoring service, 0 otherwise.
Average Cost of Tutoring	The unit of Average Tutoring Cost is 10-dollar per month.
Family Income	The unit of Family Income is 10-dollar per month.
Number of Books in Household	1 (<50), 2 (50-99), 3 (100-199), 4 (200-299), 5 (400-499), 6 (500-999), 7 (>=1000).
Family Type	1 if a family has both father and mother, 0 otherwise (such as single parent family).
Father Schooling	1 if father's schooling is equal or greater to 4yr-college degree, 0 otherwise.
Mother Schooling	1 if mother's schooling is equal or greater to 4yr-college degree, 0 otherwise.
Father Age	1 if father's age is between 40 and 49, 0 otherwise.
Mother Age	1 if mother's age is between 40 and 49, 0 otherwise.
School Type (Sex Composition)	1 if co-ed school, 0 if single-sex school.
School Type (Foundation)	1 if private school, 0 if public.
Class Size	Number of student per classroom.
Exam Score	Standardized test score by subtracting the means and dividing by the standard deviation.
Satisfaction	1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), 5 (strongly agree).
Self-studying	1 (0-1hr/week), 2 (1-2hr/week), 3 (2-3hr/w7ek), 4 (3-4hr/week), 5 (4-5hr/week), 6 (5-6hr/week), 7 (6-7hr/week), 8 (7-8hr/week), 9 (8-hr/week).
Watching TV	0 (none), 1 (0-1hr/week), 2 (1-2hr/week), 3 (2-3hr/w7ek), 4 (3-4hr/week), 5 (4-5hr/week), 6 (5-6hr/week), 7 (6-7hr/week), 8 (7-hr/week).
Playing Computer Game	0 (none), 1 (0-1hr/week), 2 (1-2hr/week), 3 (2-3hr/w7ek), 4 (3-4hr/week), 5 (4-5hr/week), 6 (5-6hr/week), 7 (6-7hr/week), 8 (7-hr/week).
Reading Book	0 (none), 1 (0-1hr/week), 2 (1-2hr/week), 3 (2-3hr/w7ek), 4 (3-4hr/week), 5 (4-5hr/week), 6 (5-6hr/week), 7 (6-7hr/week), 8 (7-8hr/week), 9 (8-9hr/week), 10(9-10hr/week), 11(10-hr/week).
Number of Reading Book	0 (none), 1 (1/month), 2 (2/month), 3 (3/month), 4 (4/month), 5 (5/month), 6 (6/month), 7 (7/month).

Appendix C

Chapter 3 Appendix

C.1 Variable Explanation

The following Table C.1. describes the variables that I exploit in the analysis.

Table C.1: Variable Explanation

	Variable	Scale	Explanation
Personal covariates	sex	1: male, 0: female	
	number of children	#	
	birth order	#	
	monthly income	10-thousand KRW per month	
	father schooling	6: PHD, 5: Master, 4: 4-year College, 3: 2-year College, 2: High School, 1: Below	
	mother schooling	6: PHD, 5: Master, 4: 4-year College, 3: 2-year College, 2: High School, 1: Below	
	private tutoring fee	10-thousand KRW per month	
	private tutoring fee per student	10-thousand KRW per month	
	family type	1: two-parent, 0: others	
	housing type	1: own, 0: others	
	breakfast	4: More than 5 days, 3: 3-4 days, 2: 1-2 days, 1: Never (per week)	
Time allocation	sleep time	6: After 0200, 5: 0100-0200, 4: 2400-0100, 3: 2300-2400, 2: 2200-2300, 1: Before 2200	
	wake-up time	6: After 0800, 5: 0730-0800, 4: 0700-0730, 3: 0630-0700, 2: 0600-0630, 1: Before 0600	
	homework	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	self-study	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	private tutoring	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	exercise	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	friend hanging around	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	leisure	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	computer	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	smart phone	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
	game	# of hours per week (5.5: More than 5 hours, 4.5: 4-5 hours, 3.5: 3-4 hours, 2.5: 2-3 hours, 1.75: 1.5-2 hours, 1.25: 1-1.5 hours, 0.75: 0.5-1 hours, 0.25: Less than 0.5 hours, 0: Never)	
Extended personal covariates	delinquency	1: Yes, 0: No	I average the value of following survey questions: -무단결석- -선구 피동됨- -무단 결석- -가출-
	mental health	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -모든 일에 관심과 흥미가 없는 편- -모든 일에 걱정이 많은 편- -이 무 이유 없이 불안할 때가 있다- -이무 이유 없이 우울 감을 느낄 때가 있다- -이 무 이유 없이 살고 싶지 않을 때가 있다- -이 무 이유 없이 죽고 싶은 생각이 들 때가 있다-
	class understanding	5: Higher than 81%, 4: 61-80%, 3: 41-60%, 2: 21-40%, 1: Below 20%	I average the value of following survey questions: -국어- -수학- -영어-
	class attention	5: More than 41min, 4: 31-40min, 3: 21-30min, 2: 11-20min, 1: 0-10min	I average the value of following survey questions: -국어- -수학- -영어-
	reading activity	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -책을 선물 받으면 기쁘다- -책을 산문을 읽는다- -계획적으로 독서한다- -시간이 날 때면 책을 읽는다-
	class attitude	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -수업시간 집중한다- -수업 자료 적으로 참여한다- -숙제 꼬박꼬박한다- -예습한다- -복습한다-
	stress	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -시험 잘두면 긴장된다- -시험 직전 더 떨린다- -시험 때면 마는 것도 잊어버린다- -시험이 끝나면 으면 좋겠다- -결과에 대해 걱정한다- -시험을 피하고 싶다- -시험은 그닞 걱정된다-
	teacher evaluation	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -수업내용 지식이 많다- -쉽게 잘 가르쳐신다- -수업 중 갈 이해하는지 확인하신다- -학생 수준에 맞게 가르치신다-
	self-esteem	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 기치있는 사람이라고 생각한다- -나는 중요 생활을 가졌다고 생각한다- -대부분의 사람들처럼 일을 갈할 수 있다- -스스로에 대해 긍정적인 태도를 가지고 있다- -스스로에 대하여 대체로 만족한다-
	self-effectiveness	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -어려운 내 일이라도 이해할 자신이 있다- -선생님이 제시한 복잡한 내용을 이해할 자신이 있다- -학교에서 내준 과제물을 잘할 수 있다는 자신 감이 있다- -배운 내용들을 능숙이게 시험할 수 있다고 믿 는다-
	belief in self-growth	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -능력 있는 사람은 태어날 때부터 정해져 있다- -나의 능력은 시간이 지나도 크게 변하지 않는다- -내가 노력해도 능력은 크게 변하지 않는다-
	career maturity	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	-나은 내가 뭘 해야만은 알을 것다-
Extended other covariates	civic mind	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I averagethe value of following survey questions: -봉사활동을 적 극적으로 참여한다- -살은 동네사람들은 서로 도우며 살아야 한다- -괴롭힘 당하는 사람을 적극적으로 도울 것이다- -남녀 상관없이 학생회장이 될 수 있다- -한국 시는 외국사람들도 한국인과 같은 대우를 받아야 한다-
	social relation	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -다른 사람과 어울리기 좋아한다- -친구들은 나와 함께 놀기를 좋아한다- -친 구보다 많다- -다른 사람과 있는 것이 즐겁다- -내 친 구들은 나를 좋는다-
	friend relation	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -친구들과 있을 때 마음이 편하다- -놀이를 학교 친구가 있다- -친구들로부터 많은 것을 배운다- -모둠활동 시 협조하려고 노력한다- -내가 말하는 바를 솔직히 말한다- -친 구이 말을 귀담아 듣는다-
	teacher relation	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -내게로 니해쳐 잘해주시려고 노력한다- -나에게 많은 관심이 있다- -가 개이 대하기 편하다- -상당히 고 싶은 선생님이 있다- -편이게 대화할 수 있다- -마음 터놓고 얘기할 수 있는 선생님이 있다-
	learning motivation 1	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 부모님이 하라고 시키므로 공부한다- -나는 선생님이 하라고 시키므로 공부한다-
	learning motivation 2	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 성적이 나쁘면 창피하기 때문에 공부한다- -나는 선생님이 나를 무시하는 것을 참지하기 않으므로 공부한다- -나는 친구들이 나를 똑똑한 학생으로 봐주기를 원하므로 공부한다- -나는 경쟁 상대를 이기기 위해서 공부한다-
	learning motivation 3	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 지식을 얻어가는 것이 가치 있는 일이라고 믿기 때문에 공부한다- -나는 모르는 것을을 알아가기 위해서 공부한다- -나는 공부한 내용이 실생활에 유용하게 쓰일 것 같아 공부한다- -나는 나중에 좀 더 어려운 내용을 이해하는데 도움이 될 것 같아 공부한다-
	learning motivation 4	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 지식을 얻는 것이 즐거우므로 공부한다- -나는 공부하는 것이 재미있기 때문에 공부한다- -나는 어려운 도전들로부터 기쁨을 얻기 때문에 공부한다- -나는 생각하는 것을 좋아하기 때문에 공부한다-
	learning motivation 5	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 더 자신이 학교에서 뭘 하고 있는지 모르겠다- -나는 공부를 왜 해야 하는지 모르겠다- -나는 솔직히 학교에서 시간을 낭비하는 것 같은 느낌이다- -나는 왜 학교에 가는지 모르겠다-
Extended other covariates	activity together with parents	4: 5 or more/year, 3: 3-4/year, 2: 1-2/year, 1: Never	I averagethe value of following survey questions: -과학관이나 박람회 관람- -미술관이나 박물관 관람- -공연이나 음악회 관람- -서점에 같이 감- -영화에 같이 감- -운동경기장에 가서 운동경기를 같이 관람- -여내 여행을 같이 감- -해외 여행을 같이 감-
	parent's nurturing attitude	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 지내가 방과 후에 어디에 가는지 알고 있다- -나는 지내가 시간을 어떻게 보내는지 알고 있다- -나는 지내가 성적을 걱국 언제 올라갈지 알고 있다- -지내가 나의 결정을 무조건 따르게 하기보다는 왜 그래야 하는지 설명해 준다- -나는 지내에게 화내는 이유를 잘 설명해 준다- -내가 잘못이나 실수를 했을때는 지내가 이해할 만한 합리적인 이유가 있다- -지내가 나쁜 행동을 했을 때, 조내기 전에 먼저 왜 그것이 출자 못한가를 설명해 준다- -지내가 무리한 요구를 할때 왜 안 되는가 그 이유를 설명해 준다-
	parent's affection	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I averagethe value of following survey questions: -나는 지내의 관심을 즐겁한다- -지내가 갈할 때나 못할 때나 지내를 좋아한다- -내 조 대하실 때 나는 지내의 생각을 즐겨한다- -나는 지내가 걸정한 것을 믿는다- -지내가 화가 나 있을 때 지내를 이해하려고 한다-
	teacher effectiveness	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -학생들이 수업에 집중하지 않을 때 왜 그런지 파악할 수 있다- -학생들의 학업 능력에 대해 판단할 수 있다- -과과 을때 따라 수업식을 달라할 수 있다- -수업에 대한 학생들의 관심정도를 파악할 수 있다- -학생들이 학업에 필요를 가지지 못하는 이유를 분석해 낼 수 있다- -문제행동을 하는 학생들이 왜 그렇게 행동하는지 이유를 분석해 낼 수 있다- -생활지도를 할 때 학생 개인의 특성을 충분히 파악하여 접용할 수 있다- -문제행동을 하는 학생을 보면 내가 지도할 수 있는지를 판단할 수 있다- -가정환경의 불우한 학생들의 지도에 세심한 관심을 기울일 수 있다-
	teacher morale	5: Totally Agree, 4: Agree, 3: Neutral, 2: Disagree, 1: Totally Disagree	I average the value of following survey questions: -나는 사기다해가 높다- -나는 일이를 갖고 근무한다- -나는 우리 학교에 자부심을 갖고 있다-
School characteristics	student number	# of student per cohort	
	teacher's average career year	# of average career year	
	pupil to teacher ratio	#	
	time allocation for class by teacher	portion of preparing for class out of total working time (%)	-업무외 간 비율 (중국수업에 투자하는 비율)-

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