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An Analysis of the Effects of Formula Funding Project in the Korea Higher Education System

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Executive Summary

In 2008, the Korean government launched a funding project that used formulas to select which four-year universities received funding from the government. The aim of the project was to improve university performance and educational quality, particularly with respect to undergraduate student outcome. However, there were few empirical studies on the project's actual impact. This study is an examination of three effects of the project. First, I analyze whether the project itself, regardless of funding, can bring about change in five formula indicators of all universities: employment rate, enrollment rate, full-time faculty rate, educational expenses per student, and scholarship rate. Second, in order to examine the effect of funding, I investigate the changes in the five formula indicators between funded universities and non-funded universities. Third, I examine whether the project caused competition among universities and how universities responded to government policy.

Recent studies in the U.S. have not provided empirical evidence that formula funding has increased the quality of universities, and many of these studies pointed out that the small percentage of funds tied to the achievement of these formulas may not be enough incentive for universities to make institutional changes. Observations used in this study are 149 of the 201 public and private four-year universities in Korea. The dependent variables for this study are the five formula indicators.

The results of regression analysis show that formula funding in Korea was an effective policy to improve some performance and educational indicators from 2008 to 2011. However, the study also shows that the change in formula indicators of funded universities is lower compared to that of non-funded universities. Therefore, the results suggest that improving the performance of funded universities is a most urgent task.

1. Introduction

The Korean Government launched the Educational Capacity Enhancement Project in 2008. This approach to supporting funding for higher education institutions was new and represented a change from funding based on projects like human resources development to funding based on formulas used to evaluate each university's performance and educational quality. In order to select which universities will receive funding, the government assesses the best performing universities based on pre-determined formulas which include five indicators: graduate employment rate (hereafter "employment rate"), ratio of student enrollment as of total quota (hereafter "enrollment rate"), full-time faculty rate, educational expenses per student (hereafter "educational expenses") and scholarship provision rates (hereafter "scholarship rate")[1]. The government called the new funding method as formula funding[2].

The aim of the formula funding project was to improve university performance and educational quality (as demonstrated by the five formula indicators), particularly with respect to undergraduate student outcome and output. In addition, the project assumes that competing for funding makes universities improve their educational quality on their own volition. Moreover, the government provides block grants so that a funded university can have substantial discretion to identify problems, design programs, and allocate resources for upgrading its educational quality. As a result, the formula funding that the Korean Government designed can be classified as performance funding because the project ties outcome indicators to funding. The funding can also be classified as block grant funding because that universities received funding have

1. The graduate employment rate and ratio of student enrollment as of total quota are proxy indicators for measuring university performance, and full-time faculty rate, educational expenses per student and scholarship provision rates are proxy indicators for university educational quality.
2. The Ministry of Education, Science, and Technology in Korea added formula funding in an effort to improve the competitiveness of four-year higher education institutions.

flexibility to use the funds based on their own priorities (Ko, 2009). The total amount of grants based on formula funding increased from 64 billion won[3] in 2008 to 240.6 billion won in 2011[4].

In terms of accountability, the block grant fund or performance funding focuses on accountability for program goals and objectives rather than accountability for implementation and administrative process (GAO, 1995). Therefore stakeholders such as legislators, policymakers and auditors have paid more attention to the performances and outcomes of funded universities. More specifically, they have questioned whether the program can affect the university's performance and education quality. They also wanted to investigate whether the program led to organizational changes in higher education or not. However, there is little academic discussion about the effects of formula funding in Korea. Park (2010) examined the effects of the project from 2007 to 2008 and found that there was no difference in indicators between universities with funding and universities without funding. However, Baek (2009) argued that the project promoted differences between universities with high and low educational quality because the project did not support universities with low educational quality that needed government funding to improve educational quality, but did support universities with high educational quality that did not need funding.[5]

The primary goal of this paper is to examine the impact of formula funding on universities performance and educational quality in Korea. Specifically, this study analyzes whether the project itself, regardless of funding, can bring about changes in the five formula indicators. Second, in order to examine the effects of funding, I investigate the differences in five formula indicators between universities with funding and universities without funding. Third, I

3. The exchange rate is 1,074 won to USD$1on January 25, 2013.
4. Revenue from formula funding averaged 3.1 billion won per university in 2011.The percentage of formula funding was about 24% of the total funding given by the Ministry of Education in 2010.
5. http://monthly.chosun.com/client/news/viw.asp?nNewsNumb=200908100054&ctcd=C&cpage=1

examine whether the project causes competition among universities and how universities respond to government policy.

2. Literature Review

Funding formulas can be defined as “a means to allocate public funds for colleges and universities” (Lang, 2005, p.372). Although the terms “funding formulas” and “performance funding formulas” are used interchangeably in recent government policies for higher education, they have different meanings. Lang (2005) classified performance formulas into four types: enrollment-based formulas, staff-based formulas, composite formulas, and incentive or performance formulas. Lang explained that “incentive or performance formulas are unique in that they recognize outputs” (p.379). In general, performance funding uses “a clearly specified formula to tie funding to institutional performance on indicators such as student retention, attainment of certain credit levels, and other student outcomes” (Dougherty and Reddy, 2011, p.1).

There is little empirical literature on the impact of performance funding in higher education in the U.S. because most studies on performance funding programs focused on policy adoption and abandonment (Sanford and Hunter, 2011). Nevertheless, several researchers have examined the empirically impacts of performance funding programs in the U.S. Unfortunately, these recent studies did not provide evidence that performance funding led to increases in the quality of institutional performance. Many pointed out that the small percentage of funds (usually around 5%) tied to performance funding may not be enough incentive for universities to make institutional changes (Sin, 2010; Sanford & Hunter, 2011; Petrides, McClelland, & Nodine 2004). Shin (2010) investigated whether state performance-based policy causes changes in two institutional performance indicators: graduation rates and levels of federal research funding. By

using Hierarchical Linear Modeling growth analysis and the data from 1997 to 2007, he found that states that adopted performance-based accountability did not see a noticeable increase in institutional performance and suggested that the ineffectiveness of performance funding may be a result of not including support for systems that are necessary to bring about the targeted changes.

Sanford and Hunter (2011) examined the impact of changes in Tennessee's performance funding policies on retention and six-year graduation rates at public four-year institutions compared to other public universities from 1995 to 2009. They utilized spline linear-mixed models because these can analyze within-group change and between-group change simultaneously and account for between-group differences by incorporating fixed and random effects. They also found that tying retention and graduation rates to performance funding did not result in improvements. Furthermore, doubling the monetary incentive associated with the retention and six-year graduation rate measures in 2005 was not associated with increases in retention rates. The authors suggested that performance funding in Tennessee was ineffective because it did not provide enough incentive for universities to change.

Because of the short history of performance funding in higher education in Korea, there have been few studies of it. Ko (2009) pointed out that there were some differences in performance funding programs between the U.S. and South Korea. Specifically, state governments in U.S. used formulas to allocate funding for public higher education, whereas the central government in Korea employed formulas to select public and private universities that the government would support. This means that the Korean government provided funding for all types of universities (including private universities) to improve educational quality. Park (2010) examined whether the project had influenced universities' educational performance and

educational quality in the first year. Utilizing Least Squares Dummy Variables (LSDV), he found no evidence that universities with funding had better outcomes than universities without funding in three out of four formula indicators. The exception was educational expense per student. The author cautions that the results have the limitation that one year is not enough time to judge whether the program worked.

3. Theoretical Framework

Many researchers use organizational theory to understand higher education change in response to government policy (Shin, 2010; Sanford & Hunter, 2011). Resource dependency perspective of organizational theory explains that organizations are inescapably bound to the conditions within their environment (Sanford & Hunter 2011, p. 7).

In light of this perspective, this study assumes that public and private universities in Korea would try to improve their educational formula indicators such as graduate employment and enrollment to obtain funding from the government because they are heavily dependent on government subsidies. Moreover, if a university cannot receive the funding, its reputation could deteriorate because failure to get the funding is made known to the public and people would view such a university as having poor educational performance and quality compared to its their peers.

This study also adopts the view that a university has a production function that becomes flatter as the amount of input increases, indicating diminishing marginal product: holding the amount of capital fixed, the marginal product of a unit decreases as the amount of the unit increases. Using the economic concept of diminishing marginal product, Park (2010) assumed that if universities invest the same input to improve educational quality, the increase for educational quality of universities with high indicators is lower than that of universities with low

indicators because of the law of diminishing returns. That is because the starting point for the educational production function between a university with funding and a university without funding is different: a university with funding has a high input point because it has high indicators and is limited in how much it can increase in educational quality, whereas a university without funding has a low input point on the same production curve due to its low indicators and therefore has an advantage for increasing educational quality with the same resources.

4. Research Design

4. 1. Data and variables

Data

Most of the data used in this analysis were collected from the Ministry of Education, Science and Technology (MEST) in South Korea. Additional data were collected from the "Higher Education in Korea" website[6].

Observations used in this study are for Korean public and private four-year universities. According to statistics provided by MEST, there were 201 four-year higher education institutions in Korea in 2012. In order to retain comparability, I selected 149 institutions from among the 201[7]. As shown Table 1, 65 universities among 149 four-year universities in Korea were funded by the government to improve their educational quality in 2008. The number of universities funded by the government has fluctuated from year to year.

6. "The Higher Education in KOREA" website allows the user to search for information about all universities in Korea in an easier and more convenient way according to the provisions of "the Act on Information Disclosure of Educational institutions" (http://www.academyinfo.go.kr).
7. The excluded 52 institutions included 10 teacher universities and 11 religious colleges that the government restricted from applying for the project in 2008, three branch campuses, and universities for which no data could be collected.

Table 1: Subject of Study

Year	2008	2009	2010	2011
Amount of funding (billion won)	49.6	263.7	258.7	240.6
Universities with funding	65	82	79	72
Universities without funding	84	67	70	77
Total	149	149	149	149

Dependent variables

The dependent variables for this study are five indicators: employment rate, enrollment rate, full-time faculty rate, educational expenses per student, and scholarship rate (see Table 2). These indicators are the measures that the government uses to evaluate the results of the project. The goals of formula funding are to support universities that try to offer high-quality education and to encourage universities to train their students in order to meet the demands of business and society. The government selected employment rate and enrollment rate as proxy indicators for the extent to which universities meet the demands of business and society and selected the rate of full-time faculty, educational expenses, and scholarship rate as proxies for the teaching or educational quality of the universities. These proxies are also popular in the United States and other countries. In order to measure the effect of the funding and competition among universities, I created two variables: improvement and competition. The improvement variables are used to gauge how much each university has annually improved in the five indicators. The competition variables are employed to measure the effect of competition among universities by gauging how much each university has increased in the three indicators[8] from 2007 through 2011.

8. The variables used in this study are enrollment rate, education expenses, and scholarship rate I was unable to collect data on employment rate and full-time faculty rate in 2011.

Table 2: Variables

Variable			Description
Control and explanatory variables	Private university		-dummy: If the observed university is “private university”, it is recorded as “1” and if the observed university is “public”, it is recorded as “0”.
	Seoul metro		-dummy: If observation is located in Seoul Metropolitan Region, it is recorded as 1, and if observation is located in other region, it is recorded as "0".
	Size of the university's enrollment	Group 1	- If a university has more than 10,000 students, it is recorded as "1" in the dummy of Group 1. - If a university has between 5,000 and 10,000 students, it is recorded as "1" in the dummy of Group 2. - If a university has less than 5,000 students, it is recorded as "1" in the dummy of Group 3.
		Group 2	
		Group 3	
	Funded		- dummy: If a university is selected to be funded, it is recorded as "1", and if a university is not selected, it is recorded as "0".
	Funded*Group1		- Funded*Group 1
	Funded*Group2		- Funded*Group 2
	Funded*Seoul metro		- Funded*Seoul metro
	Year dummies		- The project has been implemented since 2008, so observations between 2008 and 2011 are recorded as "1" and observations measured in 2007 are recorded as "0" in this dummy.
	Funded group1		- If a university has received funding four times since 2008, it is recorded in 2011 as "1" in the dummy of Funded group1.
	Funded group2		- If a university has received funding one to three times since 2008, it is recorded in 2011 as "1" in the dummy of Funded group2.
	Funded group3		- If a university has never received funding since 2008, is recorded in 2011 as "0" in the dummy of Funded group3
Dependent Variables	Employment rate (in %)		- The graduate employment rate
	Enrollment rate (in %)		- Ratio of student enrollment as of total quota
	Full-time faculty rate (in %)		- Full-time faculty rate
	Educational expenses (in 1000won)		-Educational expenses per student
	Scholarship rate (in %)		-Scholarship provision rate
	Change of employment rate		- The difference in annual change of the employment rate
	Change of enrollment rate		- The difference in annual change of the enrollment rate
	Change of full-time faculty rate		- The difference in annual change of full-time faculty rate
	Change of educational expenses		- The difference in annual change of educational expenses
	Change of scholarship rate		- The difference in annual change of scholarship rate
	Difference in enrollment rate		- The difference in enrollment rate between 2007 and 2011
	Difference in educational expenses		- The difference in educational expenses between 2007and 2011
	Difference in scholarship rate		- The difference in scholarship rate between 2007 and 2011

Control and explanatory variables

The control variables used in this study are (a) private university, (b) Seoul metro region, and (c) size of the university's enrollment. Park and Hong (2009) empirically analyzed the relationship between the educational performance of universities and the institution type, physical location, and size. They found that public universities, universities located in the Seoul metropolitan region and universities with an enrollment above 10,000 students perform better educationally than other universities. Koshal and Koshal (1999) also estimated that economies of scale existed in producing undergraduate and graduate student output and research activities.

The explanatory variables in this study are (a) year variable, (b) funded variable, and (c) funded group variable. First, the project assumes that competing for funding makes universities improve their educational quality. In other words, even universities that were not funded tried to enhance their educational indicators to receive funding the following year. To do this comparison, I use the year dummies in the regression analysis in order to indicate whether the project is implemented in that year. Year dummies from 2008 to 2011 mean that the formula funding project is implemented, which are using as an indicator of the project implementation. Second, in order to measure differences in the indicators between universities with funding and universities without funding, I created the Funded variable, which is also a dummy. Finally, in order to measure the degree of competition among funded universities, I made a group of variables called Funded Group which is divided into three groups by the number of times receiving funding: Funded group1 contains universities that received funding four times since 2008 and have the highest educational indicators among the universities. Funded group2 contains universities that received funding one to three times since 2008 and which are trying to catch up with Funded group1 to obtain steady funding. Funded group3 never received funding because of their low

educational indicators but are trying to improve their educational indicators to catch up with Funded group 1. It also is expected that the size of enrollment and the location of universities may have an impact on the change of formula indicators of funded universities. Thus, I made the Funded*Group1, Funded*Group2, and Funded*Seoul metro variables in order to measure the interaction effect between the Funded variable and other dummy variables.

4. 2. Methodology and Research Model

The primary aim of this study is to examine the impact of the project and funding on the five formula indicators at four-year higher education institutions. To do so, I compiled panel-data over five years[9] and pooled all the observations in Ordinary Least Squares (OLS) regression. However, there are some problems in pooling data. Heteroskedasticity and serial correlation occur often in the pooled data. To control for these possibilities, I used the Least Squares Dummy Variables (LSDV) method, which includes a series of dummy variables for individual years (Jaccard& Wan, 1993) and robust standard errors to examine the results precisely[10]. This study addresses the following research questions:

Research question 1: Did the universities show improvement in the five formula indicators over the five years since the project was implemented in 2008?

Hypothesis 1: If the project is implemented, universities' performance and educational quality will increase.

Model 1:

Equation 1-1: $Y_{employment,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,\ t} + \beta_4 X_{group\_2,t} + \beta_5 X_{2008} + \beta_6 X_{2009} +$

9. The dependent variables were collected from 2007 to 2011. However, funded variables were collected over four year (from 2008 to 2011) because the project was implemented in 2008.

10. I ran Breusch-Pagna/Cook-Weisberg test for heteroskedasticity using Stata. The results showed that some regression model in this study had heteroskedasticity. Thus, I used robust standard errors.

$\beta_7 X_{2010} + \beta_8 X_{2011t} + \mu_t$

Equation 1-2: $Y_{enrollment,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,\ t} + \beta_4 X_{group\_2,\ t} + \beta_5 X_{2008} + \beta_6 X_{2009} + \beta_7 X_{2010} + \beta_8 X_{2011t} + \mu_t$

Equation 1-3: $Y_{faculty,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,\ t} + \beta_4 X_{group\_2,\ t} + \beta_5 X_{2008} + \beta_6 X_{2009} + \beta_7 X_{2010} + \beta_8 X_{2011t} + \mu_t$

Equation 1-4: $Y_{expense\ ,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,\ t} + \beta_4 X_{group\_2,t} + \beta_5 X_{2008} + \beta_6 X_{2009} + \beta_7 X_{2010} + \beta_8 X_{2011t} + \mu_t$

Equation 1-5: $Y_{scholarship,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,t} + \beta_4 X_{group\_2,t} + \beta_5 X_{2008} + \beta_6 X_{2009} + \beta_7 X_{2010} + \beta_8 X_{2011t} + \mu_t$

Where $Y_{employment,\ t}$ is the employment rate at university i recorded in year t. $Y_{enrollment,\ t}$ is the enrollment rate at university i recorded in year t. $Y_{faculty,\ t}$ is the full-time faculty rate at university irecorded in year t. $Y_{expense,\ t}$ is the educational expense per student at university i recorded in year t. $Y_{scholarship,\ t}$ is the scholarship rate at university i recorded in year t. $X_{private}$ is the private university. X_{seoul} is Seoul metro region. X_{group_1} is the group 1 which is universities with an enrollment above 10,000 students. X_{group_2} is the group 2 which is university with an enrollment between 5,000 and 10,000 students. $X_{2008\sim2011}$ represents the Year dummies, the variable of interest in this analysis. μ denotes the random error in the model.

Research question 2: Is there a difference in change of formula indicators between universities with funding and universities without funding, controlling for other factors?

Hypothesis 2: If a university is funded, it is more likely to improve its performance and educational quality.

Model 2:

Equation 2-1: $\Delta Y_{employment,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,\ t} + \beta_4 X_{group\_2,t} + \beta_5 X_{funded,t} + \beta_6 X_{fun\_G1,t} + \beta_7 X_{fun\_G2,t} + \beta_8 X_{fun\_Se,t} + \mu_t$

Equation 2-2: $\Delta Y_{enrollment,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,\ t} + \beta_4 X_{group\_2,\ t} + \beta_5 X_{funded,t} + \beta_6 X_{fun\_G1,t} + \beta_7 X_{fun\_G2,t} + \beta_8 X_{fun\_Se,t} + \mu_t$

Equation 2-3: $\Delta Y_{faculty,\ t} = \beta_0 + \beta_1 X_{private,\ t} + \beta_2 X_{seoul,\ t} + \beta_3 X_{group\_1,\ t} + \beta_4 X_{group\_2,\ t} + \beta_5 X_{funded,t} +$

$\beta_6 X_{fun\_G1,t} + \beta_7 X_{fun\_G2,t} + \beta_8 X_{fun\_Se,t} + \mu_t$

Equation 2-4: $\Delta Y_{expense,\,t} = \beta_0 + \beta_1 X_{private,\,t} + \beta_2 X_{seoul,\,t} + \beta_3 X_{group\_1,\,t} + \beta_4 X_{group\_2,t} + \beta_5 X_{funded,t} +$

$\beta_6 X_{fun\_G1,t} + \beta_7 X_{fun\_G2,t} + \beta_8 X_{fun\_Se,t} + \mu_t$

Equation 2-5: $\Delta Y_{scholarship,\,t} = \beta_0 + \beta_1 X_{private,\,t} + \beta_2 X_{seoul,\,t} + \beta_3 X_{group\_1,t} + \beta_4 X_{group\_2,t} + \beta_5 X_{funded,t} +$

$\beta_6 X_{fun\_G1,t} + \beta_7 X_{fun\_G2,t} + \beta_8 X_{fun\_Se,t} + \mu_t$

where $\Delta Y_{employment,\,t}$ is the change in the employment rate at university i recorded in year t, $\Delta Y_{enrollment,\,t}$ is the change in the enrollment rate at university i recorded in year t, $\Delta Y_{faculty,\,t}$ is the change in the full-time faculty rate at university i recorded in year t, $\Delta Y_{expense,\,t}$ is the change in the educational expense per student at university i recorded in year t, $\Delta Y_{scholarship,\,t}$ is the change in the scholarship rate at university i recorded in year t. $X_{private,\,t}$, $X_{seoul,\,t}$, $X_{group\_1,\,t}$, and $X_{group\_2,tt}$ represent all the same variables as in Equation 1. X_{funded} represents Funded (the variable of interest in this analysis), X_{fun_G1} is the Funded*Group1 at university i recorded in year t, X_{fun_G2} is the Funded*Group2 at university i recorded in year t, X_{fun_Se} is the Funded*Seoul metro at university i recorded in year t, and μ denotes the random error in the model.

Research question 3: Is there is a difference in the change of formula indicators between funded group 1 and funded group 2 or funded group 3, controlling for other factors?

Hypothesis 3: If the project is implemented, funded group 2 and funded group 3 are more likely to improve their performance and educational quality than funded group 1 do.

Model 3:

Equation 3-1: $\Delta Y_{enrollment,\,2007\sim2011} = \beta_0 + \beta_1 X_{private,\,2011} + \beta_2 X_{seoul,\,2011} + \beta_3 X_{funded\_group\_2,\,2011} +$

$\beta_4 X_{funded\_group\_3,\,2011} + \mu_t$

Equation 3-2: $\Delta Y_{expense,\,2007\sim2011} = \beta_0 + \beta_1 X_{private,\,2011} + \beta_2 X_{seou,\,2011} + \beta_3 X_{funded\_group\_2,\,2011} +$

$\beta_4 X_{funded\_group\_3,\,2011} + \mu_t$

Equation 3-3: $\Delta Y_{scholarship,\,2007\sim2011} = \beta_0 + \beta_1 X_{private,\,2011} + \beta_2 X_{seoul,\,2011} + \beta_3 X_{funded\_group\_2,\,2011} +$

$\beta_4 X_{funded\_group\_3,\,2011} + \mu_t$

where $\Delta Y_{enrollment,\,2007\sim2011}$ is the change in the enrollment rate at university i between 2011 and 2007, $\Delta Y_{educational\,,\,2007\sim2011}$ is the change in the educational expense per student at university i between 2011 and 2007, and $\Delta Y_{scholarship,\,2007\sim2011}$isthe change in the scholarship rate at university i between 2011 and 2007. $X_{private,\,2011}$ and $X_{seoul,\,2011}$ represent all the same variables as in Equation 1. X_{funded_group2} and X_{funded_group3}

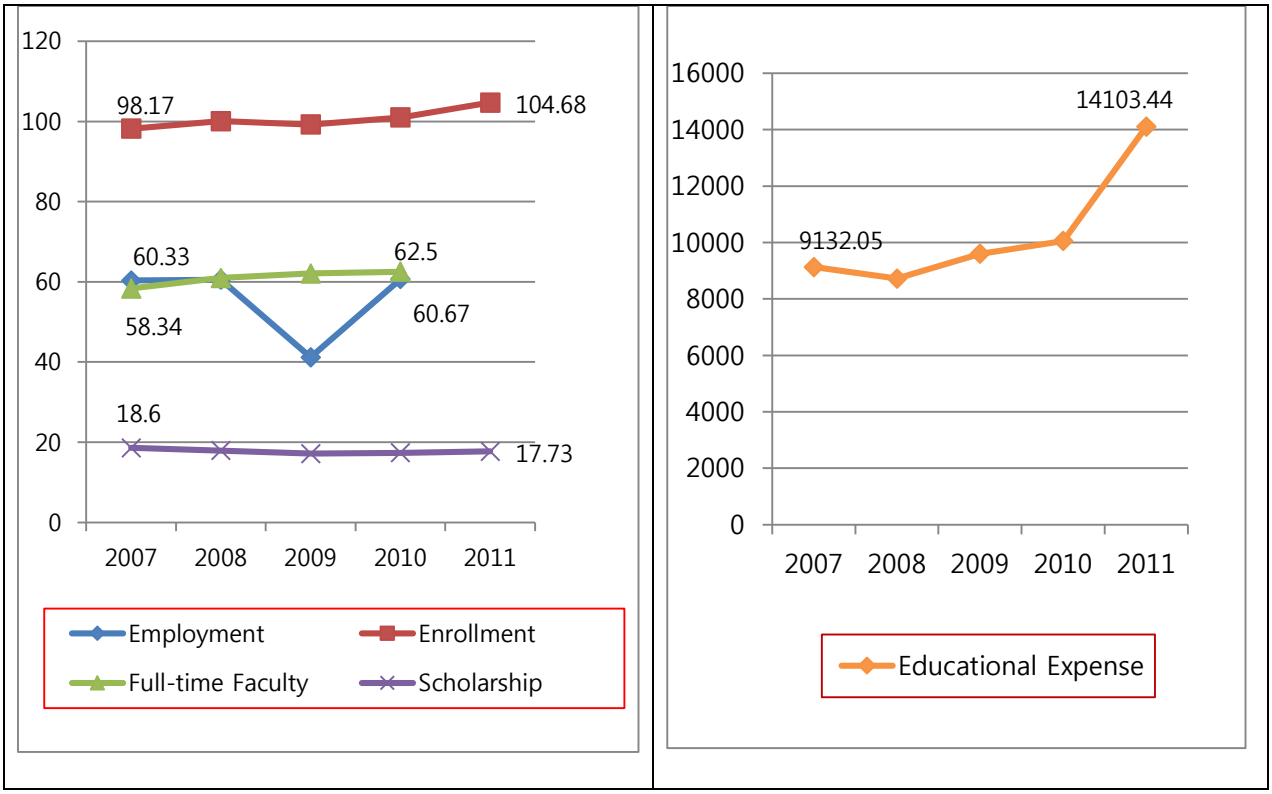
represent the Funded group (the variable of interest in this analysis), and μ denotes the random error in the model.

5. Analysis and Findings

The analyses and results are presented and discussed by research question.

5. 1. Program Effects: Research Question 1

As shown in Figure 1, all indicators in 2011 except scholarship rate increased compared to those in 2007 (i.e., before the project was implemented). The growth of educational expenses was especially higher than that of other indicators.



<Growth of 4 indicators (%)> <Growth of education expense (1000won)>

Figure 1: Growth of five formula indicators (2007~2011)

Table 3 presents the LSDV regression results of the analyses of the impact of the project on the five formula indicators during the years 2008 to 2011 compared to university indicators in

2007 (i.e., before the project was implemented).

Table 3: Least Squares Dummy Variables Regression Results for the effect of the project on five formula indicators

	Estimated Coefficients (t-Statistics)				
Variables	Employment rate	Enrollment rate	Full time faculty rate	Educational expenses	Scholarship rate
Private	-0.32 (-0.31)	-7.43*** (-11.82)	-10.07*** (-7.46)	-1197.63** (-2.22)	-3.20*** (-5.78)
Seoul Metropolitan region	-0.75 (-0.74)	12.91*** (21.19)	4.23*** (3.34)	2420.11*** (3.08)	-0.53 (-0.74)
Group 1	-3.85*** (-2.89)	13.68*** (13.44)	-6.35*** (-3.54)	-2227.05* (-1.69)	-5.46*** (-3.99)
Group 2	-2.91*** (-2.15)	5.77*** (5.58)	-7.46*** (-4.12)	-4227.87*** (-3.24)	-7.04*** (-5.07)
2008 Year	0.19 (0.14)	1.88 (1.57)	2.64 (1.62)	-410.65 (-0.52)	-0.67 (-0.44)
2009 Year	-19.13*** (-14.75)	0.96 (0.84)	3.76** (2.31)	493.21 (0.58)	-1.39 (-1.01)
2010 Year	0.38 (0.32)	2.62** (2.31)	4.19*** (2.63)	976.69 (0.14)	-1.18 (-1.02)
2011 Year	N/A	5.74*** (5.09)	N/A	5078.67*** (2.88)	-0.69 (-0.59)
Observation	585	712	587	712	712
Intercept	63.27*** (37.16)	92.43*** (63.3)	69.72*** (32.70)	11501.89*** (10.01)	25.82*** (16.12)
F-value	53.94	91.93	11.42	7.08	14.94
R-squared	0.37	0.52	0.11	0.06	0.06

Note: Employment rate and full-time faculty rate are analyzed until 2010 because of missing data in 2011.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

First, the formula funding project did not have a statistically significant effect on employment rate in 2008 and 2010, its effect was only statistically significant in 2009. Even

though the project was statistically negative and significant on the employment rate in 2009, there were several things we have to consider. In 2009, the government changed the method of collecting data. Previous to this time, universities collected the number of employed graduates and reported this number to the government. This became a problem because universities would calculate their employment rate falsely in order to raise their employment rate. In order to address this problem, the government calculated each university's employment rate by using the data from the National Health Insurance Service. In Korea, all workers employed in an organization have to join the National Health Insurance Service by law. Thus, employment data collected by the National Health Insurance Service were used to calculate employment rate starting in 2009. As a result, the employment rate decreased in 2009 by a large amount compared to 2007 and 2008. The decrease of employment rate may also have been caused or affected by the increase of the overall unemployment rate because of the 2008 financial crisis. Youth unemployment remained at 7% between 2007 and 2008 but it increased by 1.1% (from 7% to 8.1%) in 2009. Therefore, I assume that the temporary situation influenced the decrease of employment rate in 2009. This result suggests that the project may not have affected the growth of employment rates.

Second, the formula funding project did have a statistically significant effect on enrollment rate in 2010 and 2011. Moreover, the amount of growth of enrollment rate was bigger over time and its statistical significance (*p*-value) was stronger over time. This result showed that the project might bring about the growth of a university's enrollment rate. However, the growth of enrollment rate in 2008~2009 was not statistically significant. The financial crisis in 2008 and the burden of higher education costs may have had a negative effect on the enrollment rate.

Third, compared to 2007, the full-time faculty rate increased by 3.76% (from 58.49% to

62.09%) in 2009 and by 4.19% (from 58.49% to 62.5%) in 2010. This change is statistically significant since 2009 and suggests that the project had a positive effect on improving the university's full-time faculty rate. Growth of the full-time faculty rate in 2008 may not have been statistically significant because universities might have been having difficulty in recruiting qualified staff in a short time after the project was implemented.

Fourth, growth of educational expenses was only statistically significant in 2011. This result shows that that the project had a positive effect on improving the university's educational expenses since 2011.

Finally, the growth of scholarship rate was not statistically significant in any year since 2008. However, it is too early to draw a conclusion that there was no effect of the project on scholarship rate over the period studied because this effect might correlate only with a funded university. In addition, the effect of the project on employment rate, enrollment rate, full-time faculty rate, and educational expenses also may change between a university with funding and a university without funding.

5. 2. Funding Effects: Research Question 2

Table 4 presents the results of analyzing the difference in change of five formula indicators between universities with funding and universities without funding.

Table 4: Least Squares Dummy Variables Regression results for effects of the funding on five formula indicators

	Estimated Coefficients (t-Statistics)				
	Change of Employment rate	Change of Enrollment rate	Change of Full time faculty rate	Change of Education expenses per students(1000won)	Change of Scholarship rate
Private	-3.73*** (-3.84)	-0.74 (-1.65)	0.36 (0.63)	-131.37 (-0.23)	0.11 (0.16)
Seoul Metropolitan region	1.57 (1.47)	-1.66*** (-3.09)	-1.29*** (-2.77)	300.20 (1.59)	0.49 (1.63)
Group 1	1.10 (0.85)	-1.88** (-2.37)	-0.33 (-0.59)	5.38 (0.02)	0.38 (0.83)
Group 2	0.13 (0.1)	-2.41*** (-3.20)	0.32 (0.55)	-199.30 (-0.76)	0.25 (0.55)
Funded	-3.32 (-1.43)	-5.39*** (-4.71)	-1.80 (-1.1)	1923.56** (0.91)	-1.59 (-0.79)
Funded*Group1	1.32 (0.59)	3.66*** (3.27)	0.88 (0.62)	-1271.45 (-0.77)	0.98 (0.59)
Funded*Group2	1.61 (0.69)	4.14*** (3.65)	0.55 (0.38)	-1729.05 (-1.00)	1.10 (0.64)
Funded*Seoul	-0.78 (-0.52)	2.89*** (4.02)	2.40*** (2.73)	565.72 (0.68)	0.51 (0.61)
2009 year	-20.28*** (-21.74)	-2.63*** (-4.43)	-1.41*** (-2.58)	1110.69*** (4.85)	-0.04 (-0.06)
2010 year	19.06*** (27.14)	-0.04 (-0.10)	-1.88*** (-3.90)	724.34*** (3.49)	0.85 (1.08)
2011 year	N/A	0.48 (1.05)	N/A	3873.71*** (3.89)	0.72 (1.25)
Observation	435	560	438	560	560
Intercept	3.63** (2.53)	5.22*** (5.47)	2.98*** (3.90)	-782.86 (-1.11)	-0.91 (-0.96)
F-value	178.24	7.66	4.60	7.19	1.44
R-squared	0.82	0.16	0.06	0.08	0.02

Note. Employment rate and full-time faculty rate are not available for 2011.
*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

The regression shows that there was no statistically significant difference in the change of employment rate between universities with funding and universities without funding from 2008 to 2010. There was also no statistical significance on the interaction effects. Why did

funded universities not try harder to improve their employment rate than non-funded universities even though they received funding from the government? Funded universities had a higher employment rate than non-funded universities in 2008 (see Table 5). If there was diminishing marginal product in improving the educational indicator and universities with funding had higher employment rates than their peers at the beginning of the project, it was more difficult for funded universities to improve in this indicator (Park, 2010). As shown in Figure 2, the increase of 17.6% in the employment rate of funded universities may be relatively lower than the increase of 21.6% for universities without funding in 2010 compared to 2007 because funded universities had a higher employment rate to start with in 2008 (see Table 5). Funded universities might have chosen to invest elsewhere. Nevertheless, the result does not support that if a university is funded, it is more likely to improve its employment rate.

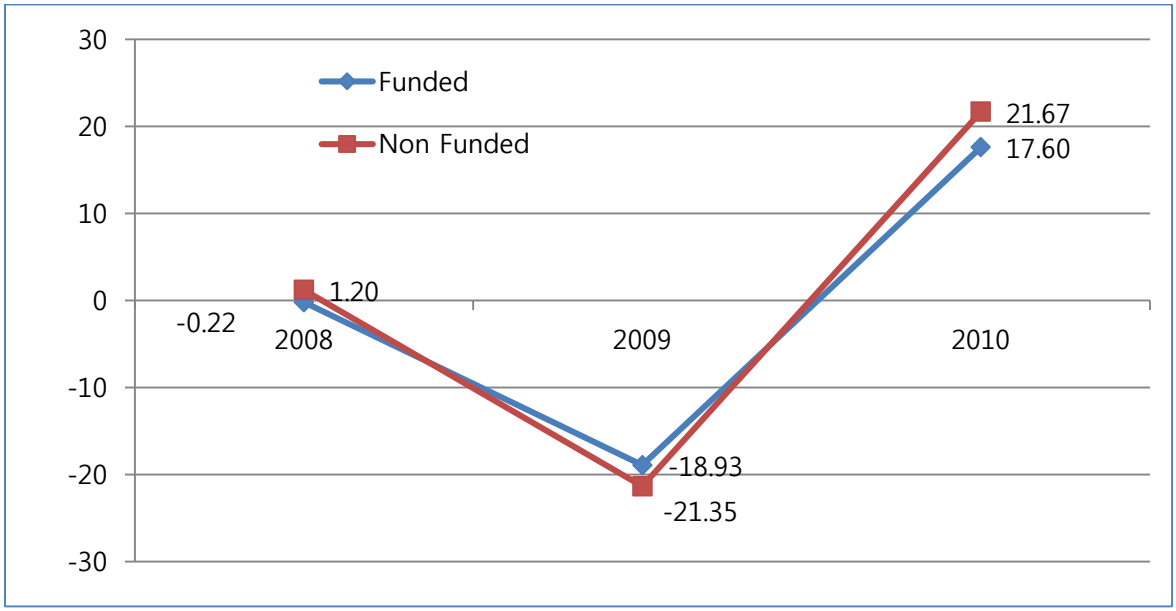


Figure 2: Mean growth of change of employment rate between funded universities and non-funded universities (2008~2010)

Table 5: Difference in Mean of employment rate between universities with Funding and universities without funding

Year		2008	2009	2010
Employment Rate	Funded	64.36	45.26	63.51
	Non-funded	57.59	35.88	57.37
	Difference	6.77	9.38	6.14

The regression results for the impact of funding on the university's enrollment rate show that there was a statistically significant difference in the change of enrollment rate between universities with funding and universities without funding but the change was lower for universities with funding. This may be the result of a gap in enrollment rates between universities with funding and universities without funding at the beginning of the project. As shown in Table 6, the funding might not have been an incentive for the funded universities to improve the enrollment rate because they already had an indicator above 100%. However, the funding might have been an incentive for the non-funded universities without funding to improve the enrollment rate because they had an indicator below 100%.

Table 6: Difference in Mean of enrollment rate between funded universities and non-funded universities

Year		2008	2009	2010	2011
Enrollment Rate	Funded	106.90	103.94	106.15	108.82
	Non-funded	94.76	93.18	94.93	99.42
	Difference	12.14	10.76	11.22	9.40

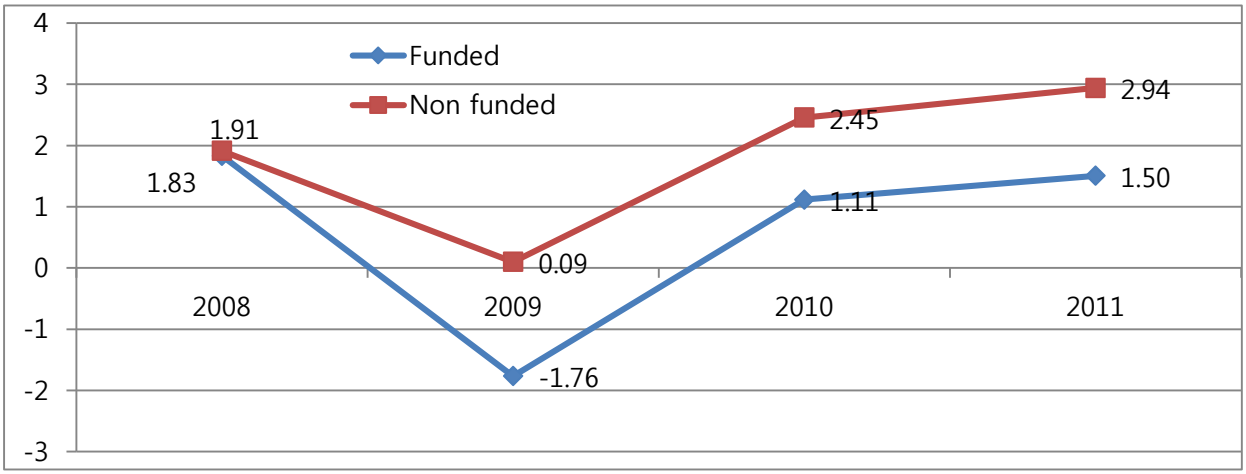


Figure 3: Mean growth of change of enrollment rate between funded universities and non-funded universities (2008~2011)

In addition, there was a statistically significant interaction effect between the Funded variable and the Group1 or Group2 or Seoul metro variables. In other words, the funding might have different effects on the change of enrollment rate of funded universities according to the size of enrollment and the location. The coefficients of Funded*Group1, Funded*Group2, and Funded*Group3 are -3.61%, -3.66%, and -5.39%. In other words, the funding had a stronger impact on the change of enrollment rate for funded universities which had a large enrollment than for funded universities which had a small enrollment. The coefficients of Funded*Seoul metro and Funded*Other region are -4.16% and -5.39%. That is, funding had a stronger impact on the change of enrollment rate of funded universities located in the Seoul metropolitan than that of funded universities located in other regions. These results do not support that if a university is funded, it is more likely to improve its enrollment rate.

The difference in the change of full-time faculty rate between universities with funding and universities without funding was not statistically significant. That might be because program

requirements that the funding cannot be used for payroll costs did not provide universities with motivation to upgrade their full-time faculty rate. In other words, even though a university is funded by the government, employing full-time faculty may not a rational choice for universities because doing so can raise labor costs in the long run. As seen in Figure 4, the mean growth of change of full-time faculty rate of funded universities decreased from 2008 to 2010. In addition, there was a statistically significant interaction effect between the Funded variable and the Seoul metro variable. The coefficient of Funded*Seoul metro is -0.69% and the coefficient of Funded*Other region is -1.8%. The result shows that funding had a larger impact on the change of full-time faculty rates of funded universities located in the Seoul metropolitan area compared to other regions. These results do not support that if a university is funded, it is more likely to improve its full-time faculty rate.

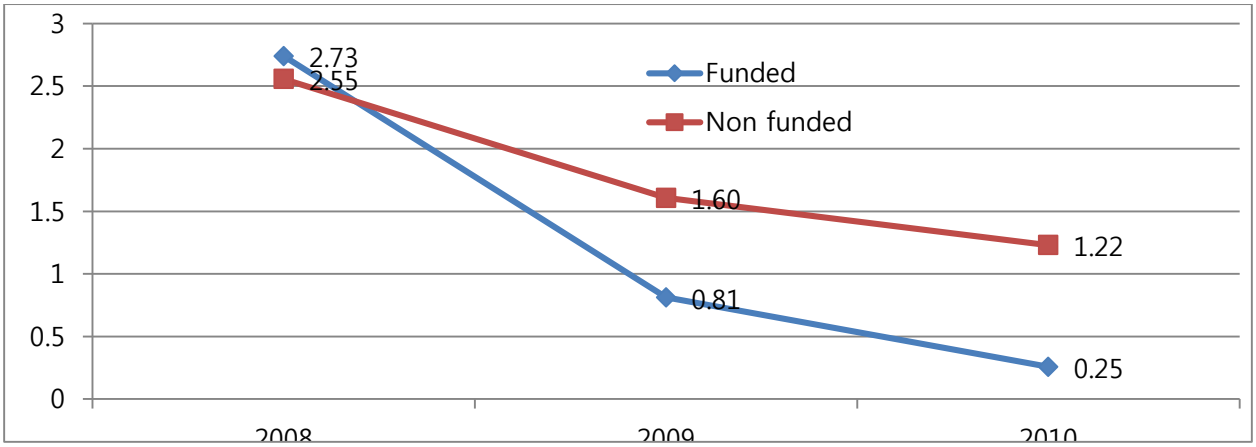


Figure 4: Mean growth of change of full-time faculty rate between funded universities and non-funded universities (2008~2010)

There was a statistically significant difference in change of educational expenses between universities with funding and universities without funding, but there was no statistically significant interaction effect. Rye (2011) found that increased educational expense was a decisive

factor indicating whether a university was selected for funding by the government. As seen in Table 7 and Figure 5, the amount of educational expenses of universities with funding was two times bigger than that of their peers.

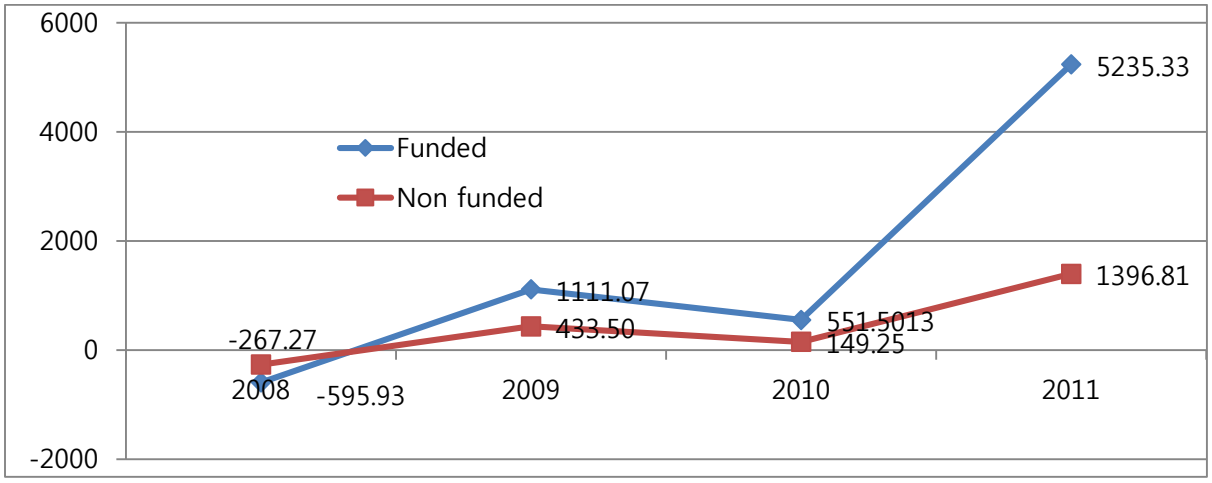


Figure 5: Mean growth of change of educational expenses between funded universities and non-funded universities (2008~2011)

Table 7: Difference in Mean of educational expenses between universities with Funding and universities without funding

Year		2008	2009	2010	2011
Educational Expenses (1,000won)	Funded	11204.06	11442.17	12402.33	17731.11
	No funded	6800.29	7239.38	7320.47	9486.40
	Difference	4403.77	4202.79	5081.86	8244.71

What factors caused the difference in educational expenses between funded universities and non-funded universities? Funding might be a major factor in the increase of educational expenses in the universities with funding because it was counted as educational expenses. As shown in Table 8, funded universities received an average of 439,410 won per student from the government. This result supports that if a university is funded, it is more likely to increase its

educational expenses.

Table 8: The amount of the funding per students in universities with funding(2011)

	Mean	Max	Min	The number of University
The amount of funding per students (1,000won)	439.41	1,858.17	80.06	72

The difference in the change of scholarship rate between universities with funding and universities without funding was not statistically significant and there was also no statistically significant interaction effect. Figure 6 shows that universities without funding spent more money in improving the scholarship rate than their peers over the period studied. However, as shown in Table 9, universities with funding had a scholarship rate of 22.81% in 2008; this was 8.65% higher compared to universities without funding. Thus, universities with funding might spend more money in improving other indicators such as educational expenses rather than spend money in improving their scholarship rate. As a result, the result does not support that if a university is funded, it is more likely to improve its scholarship rate.

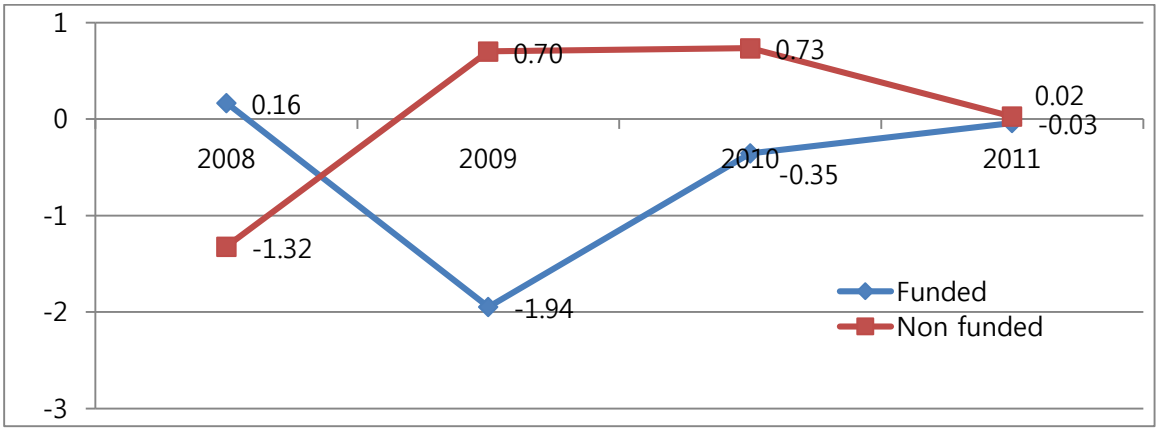


Figure 6: Mean growth of change of scholarship rate between funded universities and non-funded universities (2008~2011)

Table 9: Difference in Mean of Scholarship rate between universities with Funding and universities without funding

Year		2008	2009	2010	2011
Scholarship Rate	Funded	22.81	19.36	19.43	18.74
	Non-funded	14.16	14.38	14.91	16.46
	Difference	8.65	4.98	4.52	2.28

5. 3. Competition Effects: Research Question 3

The government assumed that universities would try to improve their educational formula indicators to obtain funding because they are heavily dependent on government subsidies. So, I assume that Funded group2, which is subject to funding based on the change of indicators, and Funded group3, which never received funding, would try to catch up with the change of the educational indicators shown by Funded group1 which received funding four times. If there is no difference in the change of indicators between Funded group1 and Funded group2 or Funded group3, I can assume that the project has a competition effect by making universities compete with their peers. The analyses are discussed by group because the government selected a university to receive funding based on the size of its enrollment.

Group 1

Group1 includes universities which have more than 10,000 students. Table 10 shows descriptive statistics on the change in the three indicators among funded groups in Group1[11]. The average enrollment rate of all funded groups in 2011 had increased compared to the mean in 2007. Funded group2 had a change of enrollment rate of 5.9%, Funded group1 had a change of enrollment rate of 5.22, and Funded group3 had a change of enrollment rate of 2.98.

11. The variables studied in this research question are enrollment rate, education expenses, and scholarship rate because these three indicators had complete data during the period of 2007 to 2011.

Table 10: Descriptive statistics on change of indicators among Funded Groups in Group1

Variable		Observation	Mean	Standard Deviation	Min	Max
Difference in enrollment rate	Funded Group1	24	5.22	4.53	-2.96	15.24
	Funded Group2	13	5.90	6.05	-1.36	17.44
	Funded Group3	9	2.98	2.41	-0.62	6.61
Difference in educational expenses	Funded Group1	24	7539.05	7617.66	3102.03	37356.36
	Funded Group2	13	3065.59	2515.05	-356.40	9441.62
	Funded Group3	9	1967.39	639.99	814.88	2577.89
Difference in scholarship rate	Funded Group1	24	-1.06	3.35	-7.14	5.57
	Funded Group2	13	0.41	2.97	-4.56	5.99
	Funded Group3	9	1.0	1.34	-0.69	3.41

As shown in Table 11, the regression shows that the difference in the change of enrollment between Funded group2 and Funded group1 was not statistically significant. However, the difference in the change of enrollment between Funded group3 and Funded group1 was statistically significant and negative. Therefore, we can assume that Funded group 2 did try to catch up with the change of enrollment rate of Funded group1 but Funded group3 failed.

Table 11: Ordinary Least Squares Regression results for effects of competition among funded groups(Group 1)

Group 1	**Estimated Coefficients (t-Statistics)**		
	Difference in Enrollment rate	Difference in Educational expenses (1000won)	Difference in Scholarship rate
Private	0.72 (0.28)	-2664.50 (-0.74)	0.51 (0.49)
Seoul Metropolitan region	-0.09 (-0.06)	5050.199** (1.95)	2.66*** (3.64)
Funded group2	0.40 (0.17)	-3084.90** (-2.3)	1.49 (1.48)
Funded group3	-2.56* (-1.74)	-4841.42*** (-3.39)	1.63* (1.87)
Observation	46	46	46
Intercept	4.87** (2.67)	6667.65*** (3.24)	-2.56*** (-2.92)
F-value	1.40	3.84	6.39
R-squared	0.05	0.31	0.30

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As seen in Table 10, the education expenses per student of all Funded groups had a positive change between 2007 and 2011. In particular, the educational expenses of Funded group1 increased more than two times compared to Funded group2 and more than three times compared to Funded group3. The regression shows that the difference in the change of educational expenses between Funded group2 or Funded group3 and Funded goup1 was statistically significant. As I discussed, the funding had a big effect on the change of educational expenses of universities with funding. Thus, Funded group2 and Funded group3 could not try to catch up with the change of education expenses of Funded group1. This result suggests that Funded group2 and Funded group3 did not in fact try to catch up with the change of educational expenses of Funded group1.

As seen in Table 10, the scholarship rate of Funded group 2 and Funded group3 had a positive change but Funded group1 had a negative change of scholarship rate between 2007 and 2011. The regression shows that the difference in the change of scholarship rate between Funded group2 and Funded group1 was not statistically significant. The difference in the change of scholarship rate between Funded group3 and Funded group1 was statistically significant but the difference was positive. Therefore, the result suggests that Funded group2 and Funded group3 did try to catch up with the change of scholarship rate of Funded group1.

Group 2

Group2 includes universities that have between 5,000 and 10,000 students. Table 12 presents descriptive statistics on the change in the three indicators among Funded groups in group2. The average enrollment rate of all Funded groups in 2011 increased compared to the mean enrollment rate in 2007. However, the enrollment rate of Funded group1 had an increase of

6.61%, which was two times more than Funded group2 and six times more than Funded group3.

Table 12: Descriptive statistics on change of indicators among Funded Groups in Group2

Variable		Observation	Mean	Standard Deviation	Min	Max
Difference in enrollment rate	Funded Group1	19	6.61	6.91	-1.24	20.05
	Funded Group2	14	1.11	7.54	-19.47	8.68
	Funded Group3	16	3.13	3.99	-5.36	9.42
Difference in educational expenses	Funded Group1	19	3816.02	3397.15	-573.79	11858.29
	Funded Group2	14	1779.86	997.51	743.14	4112.91
	Funded Group3	16	1519.27	807.09	267.23	3390.37
Difference in scholarship rate	Funded Group1	19	-2.08	2.69	-6.83	2.59
	Funded Group2	14	0.43	2.30	-3.21	3.94
	Funded Group3	16	0.48	2.57	-3.28	7.32

As seen in Table 13, the regression shows that the difference in the change of enrollment rate between Funded group2 or Funded group3 and Funded group1 was statistically significant. Therefore, the regression suggests that Funded group2 and Funded group3 did not try to catch up with the change of enrollment rate of Funded group1.

Table 13: Ordinary Least Squares Regression results for competition effects among funded groups (Group 2)

Group 2	**Estimated Coefficients (t-Statistics)**		
	Difference in Enrollment rate	Difference in Educational expenses(1000won)	Difference in Scholarship rate
Private	-0.78 (0.29)	1464.92* (1.28)	1.05 (1.05)
Seoul Metropolitan region	-0.10 (-0.05)	852.57 (1.26)	1.69** (2.17)
Funded group2	-5.83** (-2.35)	-2516.05** (-2.29)	2.33** (2.37)
Funded group3	-3.95* (-1.70)	-3387.43** (-2.45)	1.57 (1.51)
Observation	49	49	49
Intercept	6.35*** (3.25)	2962.20*** (5.95)	-3.09*** (-4.37)
F-value	1.52	2.72	4.50
R-squared	0.12	0.29	0.32

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As seen in Table 12, educational expenses of funded group1increased more than two times compared to those of Funded group2 and Funded group3. The regression shows that the difference in the change of educational expenses between Funded group 2 or Funded group3 and Funded goup1 was statistically significant. This result suggests that Funded group2 and Funded group3 did not try to catch up with the change of educational expenses of Funded group1.

As seen in Table 12, the scholarship rate of Funded group2 and funded group3 had a positive change but Funded group1 had a negative change of scholarship rate between 2007 and 2011. As seen in Table 13, the regression shows that the difference in the change of scholarship rate between Funded group2 and Funded group1 was statistically significant and positive. The difference in the change of scholarship rate between funded group3 and funded group1 was not statistically significant. These results suggest that Funded group2 and Funded group3 did try to catch up with the change of scholarship rate of Funded group1.

Group 3

Group3 includes universities which have less than 5,000 students. As seen in Table 14, Funded group2 and Funded group3 increased their enrollment rate by 12.68% and 10.74% respectively in 2011 compared to the rate in 2007. However, the change of enrollment rate of Funded group1 decreased by 0.01% between 2007 and 2011. Thus, as seen in Table 15, the regression shows that the difference in the change of enrollment rate between Funded group2 and Funded group1 was statistically significant and positive, but the difference in the change of enrollment rate between Funded group3 and Funded group1 was not statistically significant. The regression suggests that Funded group2 and Funded group3 did try to catch up with the change of enrollment rate of Funded group1.

Table 14: Descriptive statistics on change of indicators among Funded Groups in Group3

Variable		Observation	Mean	Standard Deviation	Min	Max
Difference in enrollment rate	Funded Group1	11	-0.01	6.77	-11.19	7.30
	Funded Group2	9	12.68	9.63	-0.28	29.76
	Funded Group3	10	10.74	17.49	-10.70	47.68
Difference in educational expenses	Funded Group1	11	16588.97	36600.41	-11488.50	119012.30
	Funded Group2	9	514.44	6225.42	-12748.52	11964.47
	Funded Group3	10	969.67	1413.17	-1209.01	3421.49
Difference in scholarship rate	Funded Group1	11	-8.53	21.65	-72.01	5.72
	Funded Group2	9	-3.96	8.67	-20.47	4.09
	Funded Group3	10	-2.29	4.06	-7.94	4.57

As seen in Table 14, the educational expenses of all Funded groups had a positive increase. The regression shows that the difference in the change of educational expenses between Funded group2 or Funded group3 and Funded group1 was not statistically significant. Therefore, the regression suggests that Funded group2 and Funded group3 did try to catch up with the change of educational expenses of Funded group1.

Finally, the regression shows that the difference in the change of scholarship rate between Funded group2 or Funded group3 and Funded group1 was not statistically significant. It seems like there was a competition among Funded groups in Group3. However, as seen in Table 14, the scholarship rate of all Funded groups in Group3 decreased between 2007 and 2011. That means that universities in Group3 did not try to improve their scholarship rate. As a result, there was no effect of competition among Funded groups in Group3 to improve scholarship rate.

Table 15: Ordinary Least Squares Regression results for competition effects among Funded groups (Group 3)

Group 3	Estimated Coefficients (t-Statistics)		
	Difference in Enrollment rate	Difference in Educational expenses(1000won)	Difference in Scholarship rate
Private	1.81 (0.42)	5943.25 (0.51)	-0.42 (-0.06)
Seoul Metropolitan region	-1.78 (-0.46)	-1227.84 (-0.12)	9.54 (1.69)
Funded group2	12.31*** (3.04)	-16668.39 (-1.25)	5.95 (0.74)
Funded group3	9.95 (1.61)	-17023.59 (-1.14)	8.83 (1.01)
Observation	30	30	30
Intercept	-0.84 (-0.21)	12172.79 (1.19)	-11.65* (-1.84)
F-value	3.35	1.00	1.06
R-squared	0.20	0.11	0.11

*$p < 0.10$, **$p < 0.05$, ***$p < 0.01$

6. Policy Implications and Conclusion

This study examined: (a) the impact of the project on five indicators, (b) the impact of the funding on five indicators, and (c) institutional change to improve educational indicators. The results of the analysis are summarized in Table 16, and the conclusions are presented below.

Table 16: Summary of Results

		Employment rate	Enrollment rate	Full-time faculty rate	Educational expenses	Scholarship rate
Program Effect		No	Yes	Yes	Yes	No
Funding Effect		No	No	No	Yes	No
Competition Effect	Group 1	N/A	Yes	N/A	No	Yes
	Group 2	N/A	No	N/A	No	Yes
	Group 3	N/A	Yes	N/A	Yes	No

The project itself might have an effect on improving some educational qualities in all universities.

The project may have brought about the growth of enrollment rate, full-time faculty rate, and educational expenses over the five years since the project was implemented in 2008. However, there was no evidence that the project had any effect on the growth of employment rate and scholarship rate.

The funding might not affect improving formula indicators of funded universities compared to non-funded universities.

The findings of this study show that there was no difference in the change of the indicators except for educational expenses between universities with funding and universities without funding from 2008 to 2011. Why do funded universities seem to have lower performance and educational indicators? Many studies in the U.S pointed out that a low percentage of funds (usually around 5% or 6%) is tied to performance funding (Petrides, McClelland, &Nodine 2004; Sin, 2010; Sanford & Hunter, 2011). Shin (2010) used the resource dependence perspective of organization theory to explain what this might result in:

> Universities selectively and strategically respond to demands impacting their survival and growth. If the financial incentives linked with institutional performance are attractive, universities might incorporate the new accountability into their internal systems. Otherwise, universities might not be motivated to change. (pp. 63-64)

However, resource dependence perspective is not enough to explain the situation of the project in Korea. Reputation may also play a part. Failure to get funding is public knowledge that may threaten the university's reputation in that the public may think such a university has poor educational quality. To prevent their reputations from deteriorating, non-funded universities may

have tried harder to improve their indicators. Therefore, a follow-up study on the project needs to focus on the impact of the percentage of the funding in a funded university on institutional changes. Despite the monetary incentives, if a funded university is not more likely to improve its performance and educational quality compared to its peers, it will be difficult for the government to continue to support the performance funding project.

The project makes universities compete with their peers.

The project has a competition effect of making universities compete with their peer university. For example, Funded group2, which is subject to funding depending on the change of indicators, and Funded group3, which never received funding, did try to catch up with the change of indicators of Funded group1 which received funding four times. The findings of this study suggest that formula funding in Korea has been an effective policy to improve some performance and educational indicators.

The government needs to consider replacing some indicators.

The project did not affect the change of employment rate and scholarship rate. In particular, some researchers pointed out that the employment rate indicator was not under the control of the universities because job placement rates were dependent on the state of the local economy, which varies over time and by region (Banta et al., 1996; Bell, 2005; Dougherty & Hong, 2006; Dougherty and Reddy, 2011). However, this study could not find a reason why some universities did not raise their scholarship rate. The impact of the project on scholarship rate needs additional study.

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Appendix

Table A-1: Youth Unemployment rate(15~29 years old)

Year	2007	2008	2009	2010	2011
Unemployment Rate	7.2	7.2	8.1	8.0	7.6

* source: http://www.index..go.kr/egams/stts/jsp/potal/stts/po_STTS_IdxMain.jsp? idx_cd=1063

Table A-2: Descriptive Statistics: Growth of 5 educational indicators(2007-2011)

Variable	Year	N	Mean	Standard Deviation	Min	Max
Employment rate	2007	148	60.33	11.95	20.9	90.7
	2008	149	60.54	12.89	5.2	92.29
	2009	145	41.18	10.41	10.73	68.84
	2010	143	60.67	8.19	28.87	84.29
Enrollment rate	2007	149	98.17	14.63	41.2	145.3
	2008	149	100.05	13.34	52.99	128.21
	2009	146	99.22	12.53	54.23	127.72
	2010	143	100.97	12.14	59.87	128.27
	2011	125	104.68	11.26	66.41	129.97
Full-time Faculty rate	2007	149	58.34	14.55	28.6	131.3
	2008	149	60.98	15.25	29.73	127.27
	2009	146	62.09	14.77	29.21	140.62
	2010	143	62.5	14.13	35.2	147.05
Education Expense per students	2007	149	9132.05	7001.59	4294	69017
	2008	149	8721.4	6815.32	1855.47	64954.02
	2009	146	9599.85	7766.29	4092.21	72906.34
	2010	143	10056.86	7852.6	5100.36	68640.59
	2011	125	14103.44	1847.05	6209.86	188029.3
Scholarship rate	2007	149	18.6	11.82	6.3	115.3
	2008	149	17.93	14.97	4.79	162.26
	2009	146	17.17	12.53	7.42	133.11
	2010	143	17.34	8.43	7.72	89.2
	2011	125	17.73	8.11	8.01	86.02

Table A-3: Descriptive Statistics: Change of 5 indicators of funded universities and no funded universities (2008-2011)

	Variable	Observation	Mean	Standard Deviation	Min	Max
Funded	Change of employment rate	224	-0.94339	17.32647	-65.476	28.682
	Change of enrollment rate	294	0.563772	4.307307	-28.9	14.33
	Change of full-time faculty rate	224	1.180746	5.218788	-42.927	33.538
	Change of educational expense	294	1569.084	7653.813	-16431.4	120965
	Change of scholarship rate	294	-0.60797	7.080639	-79.599	46.966
Non funded	Change of employment rate	211	0.774839	18.28643	-43.366	54.721
	Change of enrollment rate	266	1.813703	4.665115	-20.598	24.329
	Change of full-time faculty rate	214	1.863472	3.436197	-15.714	12.858
	Change of educational expense	266	329.9928	1344.761	-3053.56	13446.55
	Change of scholarship rate	266	-0.06039	2.792961	-9.065	16.849