ECONOMIC ANALYSIS OF VOCATIONAL HIGH SCHOOLS :

A STUDY OF MEISTER HIGH SCHOOLS AND SPECIALIZED HIGH SCHOOLS

IN THE REPUBLIC OF KOREA

By

YOON, Hee Ryoung

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

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Committee in charge:

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ABSTRACT

Economic Analysis of Vocational High Schools:

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in the Republic of Korea

By

Hee Ryoung YOON

Since 2008 financial crisis, youth unemployment problem in Korea has seriously addressed in the society. The government pointed out that reducing a mismatch between workers' skills and labor market's demand is a critical factor to alleviate the matter, and this acknowledgment called forth to introduce or upgrade secondary vocational education programs such as Meister high school (MHS) and Specialized High School (SHS). This study aims to analyze cost-effectiveness and economic viability of MHS and SHS which are the current vocational high school types in Korea. The cost-benefit analysis and cost-effectiveness analysis will be used, the national level of samples covering public and private MHS and SHS from 2010 to 2015 will be studied. From the cost-effectiveness analysis, the research result pointed out that MHS is more cost-effectiveness regarding employment rate than SHS. However, SHS is more cost-effective when it comes to the wage rate. Also, the study verifies that SHS is more economically viable than MHS by calculating Net Present Value (NPV). It allows us that we can say that SHS is more efficient and cost-effective in terms of wage rate over MHS.

ACKNOWLEDGEMENTS

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ABBREVIATION

CBA	Cost-benefit Analysis
CEA	Cost-effectiveness Analysis
CEM	Coarsened Exact Matching
EDSS	EduData Service System
EIRR	Economic Internal Rate of Return
HSGES	High School Graduates Employment Survey
KIES	Korea Employment Information Service
KOSTAT	Statistics Korea
KRIVET	Korea Research Institute for Vocational Education and Training
KRW	Korean Won
MEST	Ministry of Education, Science, and Technology
MHS	Meister High School
MoE	Ministry of Education
MoEL	Ministry of Employment and Labor
MoF	Ministry of Oceans and Fisheries
NPV	Net Present Value
ODA	Official Development Assistance
OECD	Organization for Economic Co-operation and Development
ROKAF	Republic of Korea Air Force
SHS	Specialized High School
TVET	Technical Vocational Education and Training

1. INTRODUCTION

This study is to analyze economic viability and cost-effectiveness of vocational high schools in Korea using cost-benefit analysis and cost-effectiveness analysis. Meister High School (MHS) which is a new type of vocational high school program and Specialized High School (SHS) which is a modernized but still regarded as a conventional vocational high school program can be reduced as existing formal vocational paths at a secondary education level in Korea. Despite the fact that a few general high school students take a vocational path at trusted institutions outside their original schools instead of focusing on the academic track, the scope of this study is circumscribed within the only two types of vocational high schools.

Korea's economy has concerned about the high youth unemployment since the severe 2008 financial crisis. The youth unemployment rate which is the number of the unemployed between 15 and 24 year-olds reached 10.0% while the average Korea's unemployment rate was 4.9% as of February 2010 (Statistics Korea [KOSTAT], 2010).

Figure 1. Employment Rate in Korea

Employment Rate in Korea (Unit: %)

	Feb, 09'	Nov, 09'	Dec, 09'	Jan, 10'	Feb, 10'
Youth Unemployment Rate	8.7	7.7	7.6	9.3	10
National Unemployment Rate	3.9	3.3	3.5	5	4.9
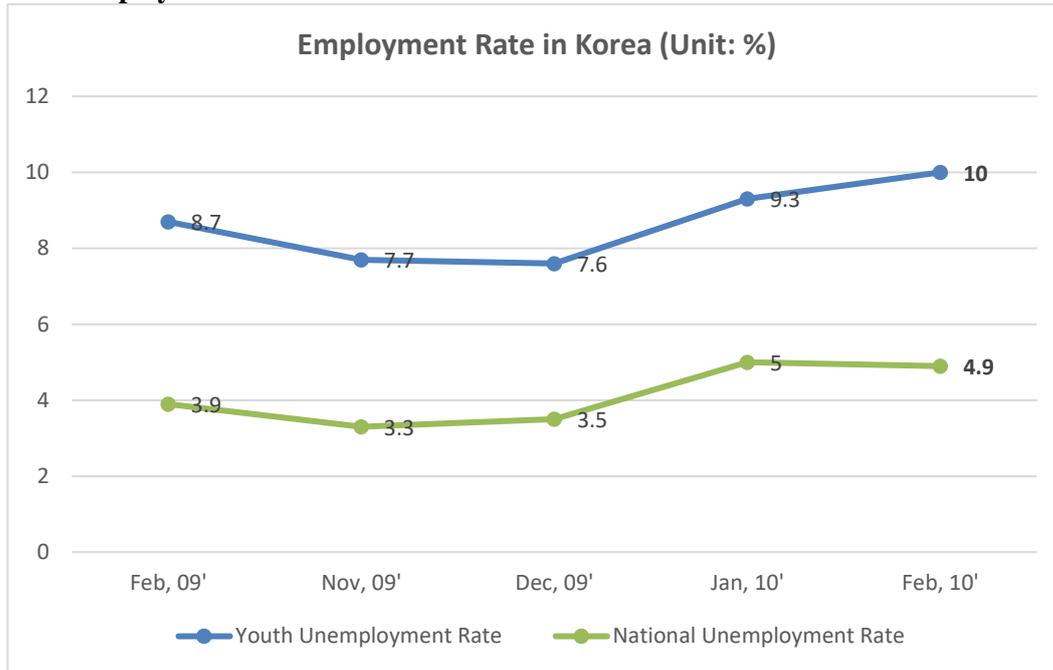
Source: KOSTAT, 2010

The government pointed out that reducing a mismatch between workers' skills and labor market's demand is a critical factor to alleviate the matter, and this acknowledgment called forth a relevant vocational education policy response from Korea. In detail, the concern was expressed that Korea's education has been disproportionately inclined to tertiary education which was caused by widespread credentialism and this tendency is cacophonous with the labor market's current needs particularly for middle-skilled workers, and it would hamper the nation's long-term development. As a result, the government launched a high school tailored for industrial demand commonly called MHS appeared in 2010 as a key to tackle this current challenge by enjoying the government' abundant financial and non-financial supports.

Agreeing with the expectation from the public, MHS seemed to go into their weight well. As of 2013 which was the first year that MHS' first graduates entered the labor market, MHS showed remarkable performance in terms of employment rate (90.3%) while SHS generated mediocre achievement (38.4%) (Ministry of Education [MoE] 2013). The

outstanding performance allowed MHS to attract many attentions from both domestic and outside of the nation as a rising star to fight against the high youth unemployment rate.

However, despite the virtues of MHS, it is plausible that people have been questionable on MHS whether it is an economically viable and cost-effective investment comparing with other educational option such as SHS under the government's limited budget since some people brought up an issue that comparatively greater amount of budget is required to run MHS than SHS. In fact, one (Han, 2012) addressed that as of 2011 the government monetary support was allocated to 6.49 million KRW per MHS student and 4.53 million KRW per SHS student even though the number of MHS students only accounted for 4% of total vocational high school students from MHS and SHS in Korea, and he asserted that the government's selective and asymmetrical financial support on MHS determined a significant difference in the employment rate among two groups so that a budget reallocation for MHS and SHS is necessary to share the benefit from the secondary vocational education with all the vocational high school students not limited only within the particular group. It would imply that the systematic analysis is indispensable to verify whether MHS is an economically viable and cost-effective investment over SHS or vice versa.

The study would contribute to the literature and policymakers in charge of education investment. First, it would provide Korean policymakers with in-depth information to understand the economic viability and cost-effectiveness of the current vocational high schools so that it would play a critical role as a reference for their further investment decision-making such as adjusting budget allocation and reserving the expansion of certain vocational high schools. "In general, a government should not look only into the effectiveness of an investment program. Because of budget constraints, it should assess both the benefit and cost of the investment alternatives and select the most efficient and viable investment alternative. With the resource constraint, the government cannot invest in all effective education programs but has

to select the most efficient program among competing for investment alternatives." (Lee, K. W., Kim, D. H., & Lee, H. K., 2016, p. 85S). Moreover, the several new policy shifts have motivated us to study further this topic and addressed the effectiveness and efficiency of the vocational high schools. The new policy called "Education Activation Plan tailored for High Schools" set the plan to raise the enrollment share in vocational high schools nearly to 30% and employment rate to 65% by 2022. This initiative paid attention that the share of vocational high schools enrollment in Korea (19%) is below the average in OECD countries (47%), and MoE plans to increase the share of the vocational high school students by maintaining an entrance quota for vocational high schools despite the decrease in the total number of high school students (MoE, 2016).

Figure 2.   Plan for Expansion of Vocational High Schools Enrollment Share in Korea
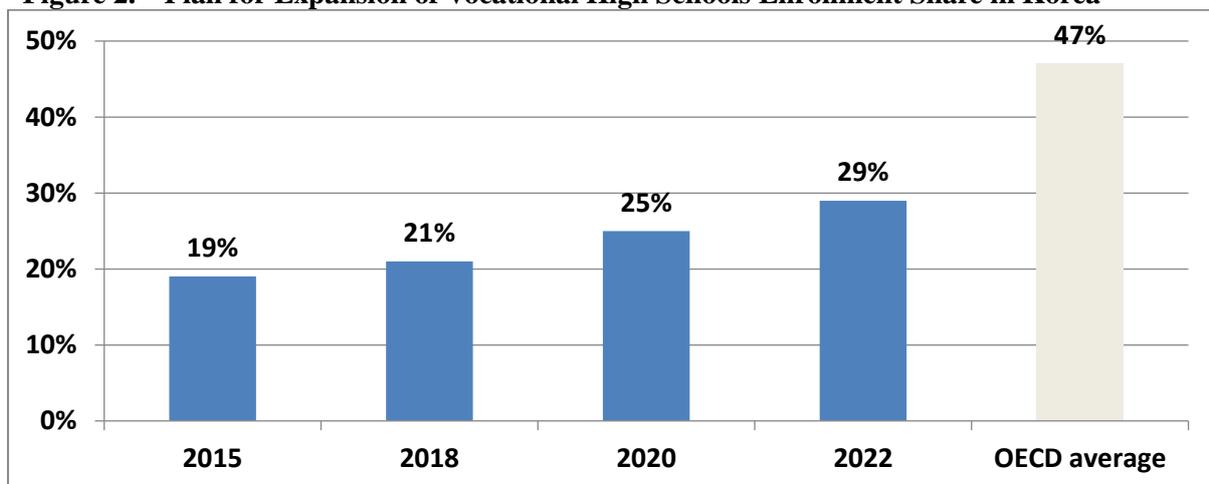
Source: MoE, 2016

Furthermore, the newer program called "apprenticeship" which is a part of Work-Study Parallel Program introduced during the Park Geun-Hye government has disseminated to SHS. Currently, the nine pilot SHSs have operated the apprenticeship program from the year of 2015 showed the great result on the employment rate (79.80%) (see Table 1). With its evidence, MoE has decided to expand this program by 198 SHS (from 9) with 7,000 (from

2,600) students and 2,500 (from 800) enterprises in 2017 (Ko, 2017). Also, MoE and Ministry of Employment and Labor (MoEL) will invest 250 billion KRW and 350 billion KRW respectively toward the selected schools and businesses to provide them with facilities, curriculum development, and operation to prop up the apprenticeship program (MoE, 2016). In addition, participating enterprises will enjoy the extra financial support for the on-the-job-training and training infrastructure such as field instructors at the enterprises, on-the-job-training program and learning material consultation (MoE, 2016). Together with, it would be the proper time to assess the vocational high school programs and adjust the policy direction at the early stage of the implementation if the analysis result is conflicting with the government's original expectation.

Table 1. Employment Rate with Apprenticeship Program

Average Employment Rate of SHS	Employment Rate without the Program	Employment Rate with the program
63.32%	47.74%	79.80%

Source: Data from KRIVET, 2017

Second, the study would provide a basis for comparing two vocational school models to foreign policymakers who ponder borrowing the Korean vocational high school model into their education system and ODA consultants who want to recommend a better education investment option for their client (partner) countries. As an emerging donor of ODA, Korea has made an effort to spread its policy models with a vehicle of accumulated and unique economic development experiences. TVET sector is one of the Korea's representative areas and currently the Korean vocational high schools have drawn more attention from developing countries thanks to the outstanding performance of MHS. Therefore, this study would be a pertinent resource for Korea to develop more substantiated policy models for the international cooperation program if analysis validates which one is more cost-effective or/and economically

viable than the other option.

Third, it would achieve a contributing point discrete from the previous researches. There have been many types of research highlighting the Korean vocational high schools especially MHS only. However, as the counterpart of MHS, SHS has to be widely and deeply studied together.

Therefore, the study to showing a concrete result employs following analysis methods; cost-benefit analysis and cost-effectiveness analysis which has long been used by international organizations as vehicles to assess the projects' viability and cost-effectiveness. With the methods, the following two hypotheses will be tested in this paper to answer the research questions.

- *Hypothesis 1: SHS is a more cost-effective education investment than MHS.*

- *Hypothesis 2: SHS is a more economically viable education investment than MHS.*

2. LITERATURE REVIEW

The purpose of the literature review is to understand the current secondary vocational education system in Korea such as vocational education ladder system, the comparison between MHS and SHS, review the government policy supporting secondary vocational education in chronological order, and examine and find the weakness of the past studies regarding MHS and SHS by topic.

2.1. Current Secondary Vocational Education System in Korea

Before analyzing the two vocational high school models, it would be helpful to grasp the present state of the secondary vocational education system. The Korean vocational education system largely can be categorized into four stages; primary school (six years) and middle school (three years) which are the compulsory education, high school education (three years), and higher education. In the study, we only address the part of vocational education consisting of MHS and SHS at the stage of high school education. Students from both MHS and SHS can choose whether entering tertiary education institutions or getting a job after graduation since there is no obligation to get into the labor market after graduation. Even though the government has encouraged them to get a job first and enter a university later, some students, especially in SHS, still have a tendency to going to a college or university right after graduation due to the preference toward achieving an advanced degree. The figure 3 below shows the current vocational education ladder system in Korea.

Figure 3. Current Vocational Education Ladder System in Korea
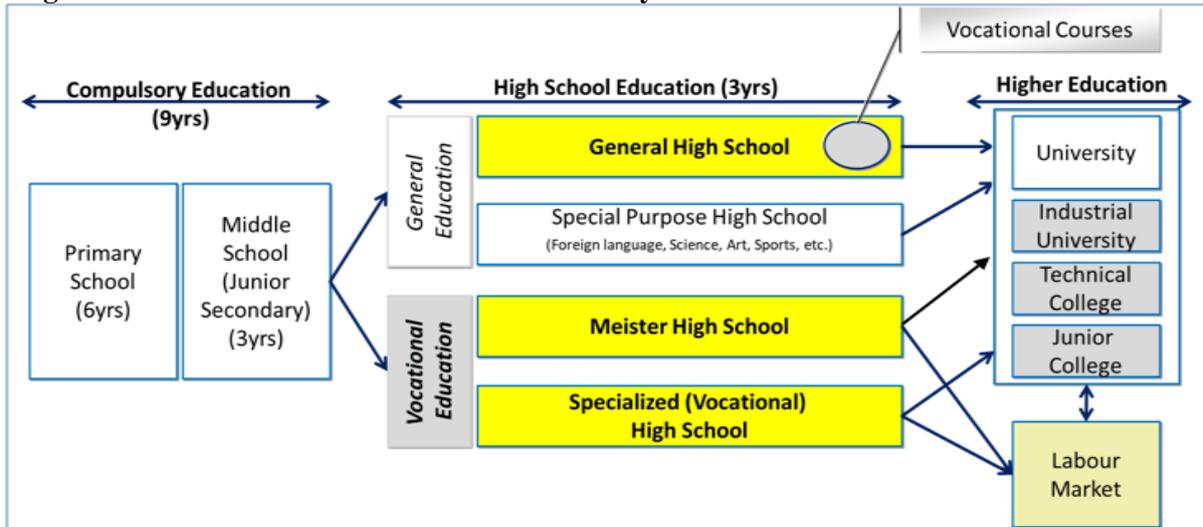
In detail, MHS and SHS have distinct characteristics to be distinguished. First, the definition of Meister High School and Specialized High School are stated clearly in Elementary and Secondary Education Act. On the Article 90, the official name of "Meister High School" is defined as "High School tailored for industrial demand." Moreover, Meister High School is classified as "a special-purpose high school." However, on the Article 91, Specialized High School is defined as a type of school which aims to foster human resource in a particular field by providing experience-based learning, on-the-job training with students at the similar level of talents, aptitude, and competencies. (MoE, 2017)

Table 2. Comparison of MHS and SHS

	MHS	SHS
Type of Schools	Special purpose high school	Specialized (vocational) high school
Governmental body in charge	Mainly MoE, but there are some exceptions; Republic of Korea Air Force (ROKAF) Education & Training Command, Ministry of Oceans and Fisheries (MoF)	MoE
Recruitment Basis	Nation-wide basis	Applicants' residential district basis
Tuition	Full scholarship with a free dormitory	Scholarship
Number of Schools (As of April 2016)	42	472
Employment Rate (As of 2013)	90.3%	38.4%
Government Financial Support per student (As of 2011)	6.49 million KRW	4.53 million KRW

Source: Data from HIFIVE and MoE

2.2. Government Policy supporting Secondary Vocational Education

Korean government's policy toward secondary vocational education has actively developed to tackle down the high youth unemployment rate and creating the labor market-friendly secondary vocational education after starting with the introduction of MHS and modernization of SHS.

On July in 2008, as a part of Lee Myung Bak government's efforts to vary Korean high schools, the administration launched "Fostering Korean Meister High School Plan" as their touting vocational education policy. This plan aimed to strengthen national level support to increase the employment of graduates from secondary vocational schools by transforming the selected vocational high school into Meister high schools. The plan consists of three strategic

parts highlighting 1) career path establishment 2) regulation reform, and 3) national support and cultivation for Meister high schools. (Ministry of Education, Science, and Technology [MEST], 2008) In 2010, the relevant Korean ministries proposed "Secondary Vocational Education Advancement Plan" in 2010. This plan was intended to simplify existing five types of vocational high schools (691 schools as of 2010) into the three categories; Meister High Schools, Specialized High Schools, and General High Schools(50, 350, 291 schools respectively no later than the year of 2015) (see figure 4). In addition to the changes in the vocational education structure, the Korean government introduced the plan to run industrial demand-driven curriculum. They will try to create a climate for "Getting a job first, entering a university later," evaluate the system and provide financial support for the vocational high schools, and support system reform for the better management (The Relevant Korean Ministries, 2010).

Figure 4. Secondary Vocational Education Advancement Plan

2010		2015
Meister High School (21)	→	Meister High School (50)
Special-purpose High School (40)		Specialized High School (350)
Specialized High School (168)		
(General)Vocational High School (275)		General High School (291)
Comprehensive High School (187)		
691 Schools		**400** Schools
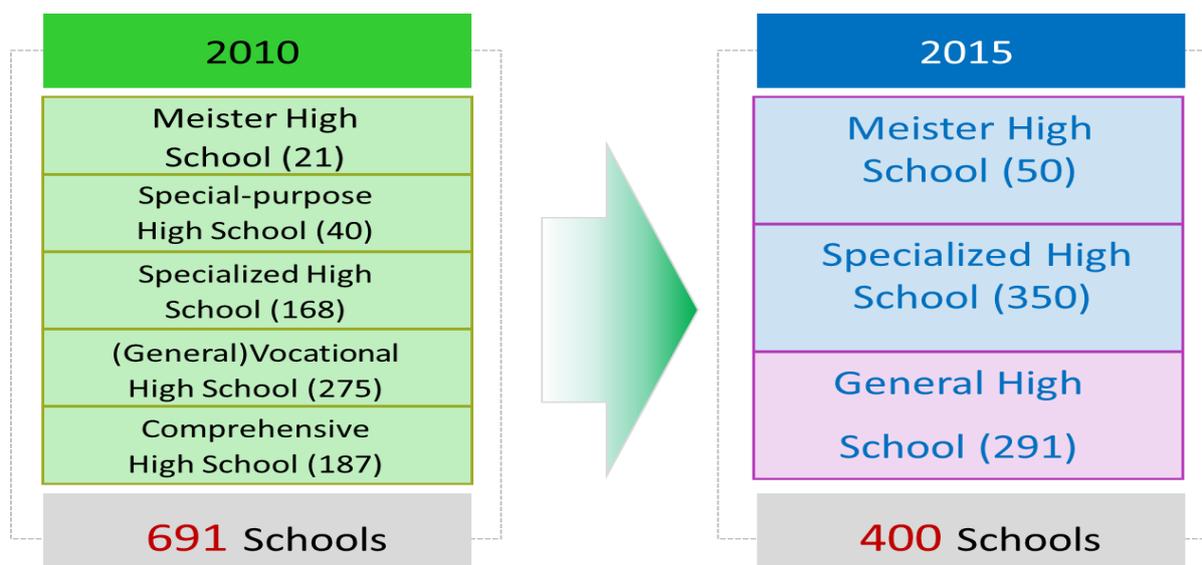
Source: MoE

As of September 2010, the government suggested a plan to build "Hope Ladder on Education." This scheme is directed toward to SHS, the government aimed to carry out 1) full tuition support for SHS students, and 2) expand job-seeking support for SHS (Yang, 2010). Even though the government had tried to activate "Getting a job first, entering a university later" channel by introducing a series of policy plan such as "Setting lifelong Vocational Education and employment system (March 2009)." "Secondary Vocational Education Advancement (May 2010)", it failed to meet the satisfaction of the government and other stakeholders. The government pointed out the failure came from the lower participation of industries, and lack of demand-driven policies. Based on the status, the government suggested the three plans secure a driving force through work-learning parallel system; 1) strengthening vocational education focusing on field training, 2) upgrading environment for the work-learning parallel system and 3) encouraging industries to involve the vocational education. Against flood tide of credentialism and fundamental labor market mismatch in Korea, the government was to achieve goals to assure Korean people of equal job opportunities based on their competencies, not education level and make a more friendly environment that all employees can get paid for their performance and skills at work. To accomplish it, the government set their priorities; 1) supporting people's mosaic of dreams as a professional, 2) open recruitment based on candidates' competencies, 3) human resource management open to further development for employees, and 4) creating an environment for competency-based society (The Relevant Korean Ministries, 2011). The plan aimed to tackle down worries of decreasing quality jobs for high school graduates and accomplish "70% of employment rate", and realize competency-based society. The plan mainly consists of three goals; 1) strengthen work-based secondary vocational education and industry-school cooperation, 2) find and expand tailored job opportunity for high school graduates, 3) strengthening SMEs promotion and upgrade its work environment and welfare system, 4) solve a career discontinuity due to mandatory military

service, and 5) activate career development after getting a job. Moreover, this plan also emphasized the Park Geun-Hye government effort to foster skilled workforce for labor market through benchmarking Swiss apprenticeship vocational schools into Korea (MoE, 2014). Regarding secondary vocational education, the plan aimed to increase the enrollment share of vocational high schools nearly to 30% and accomplish employment rate to 65% by 2022. By maintaining an entrance quota for vocational high schools, the government will adjust the percent of vocational high schools in Korea. The government will support various ways reflecting different situation by region to expand vocational schools, and seek substantiality and quality to make more attractive vocational high schools (MoE, 2016).

2.3. Past Studies on MHS and SHS

The Korean scholars have long been studied the secondary vocational education over the decades, and currently, they have more focused on the MHS which is the new concept of vocational high school in Korea since they have been highlighted with their high employment rate in the labor market. However, it is undeniable that after the launch of MHS the most of the studies have paid attention to the MHS, especially, focusing on the outcomes while SHS which is the counterpart of MHS among vocational high schools has been less acknowledged than MHS. There are only a few studies addressed the both MHS and SHS comparably.

The one stream of the studies examined the one type of vocational high school either MHS or SHS separately. The researches belonging to this stream have mainly studied the policy on "getting a job first, entering a university later," the plan to manage and foster MHS, and MHS' performance in the labor market, and SHS's employment and job quality factor. In detail, studies are addressing the SHS graduates' employment and the effect on the quality jobs for them (Kim 2012; Kim, 2013; Noh, Huh, 2012;), the assessment of the survey tools developing

to analyze MHS' graduates performance in labor market and analysis (Kim, J.W., Kim, H.M., Choi, S.J., Hur, Y.J., 2013), reform plan for attaining sustainability of MHS and performance analysis on MHS fostering policy (Jang, 2010). This group of studies failed to provide us with the comparison of two educational investments.

In contrast to the first group, the second stream of the studies acknowledged the importance to compare the performance between two groups. One study (Lee, 2014) analyzes that how the government policy to expand job opportunities for high school graduates affected on the quality jobs for them and the probability that MHS graduates would be able to get better jobs than SHS. By using regression adjustment, the results show that the government policy leads to the job satisfaction and wage increase of the high school graduates in 2013, and it is statistically proven that the MHS graduates have higher probabilities to get better jobs with better wages comparing to SHS graduates.

The second study (Kim, 2014) addresses the problematic situation that the government' support was disproportionately inclined to the MHS comparing to SHS and the author analyzed whether there are differences in employment among the current hired graduates in the two groups. The analysis using CEM (Coarsened exact matching) verifies that the government policy to foster MHS has positively affected to increase the preferences of the high school graduates, especially, MHS graduates.

The third study (Yang & Kim, 2014) compared the MHS and SHS since MHS has been chosen and transformed from the original SHS. The analysis adopts the difference-in-difference method, and the result pointed out that the policy on MHS raised the employment rate, but it has not affected to increase their real hourly wages and encourage the graduates to remain in the labor market.

To verify their analyses, all of three studies explained above adopted the 2011 or/and 2013 HSGES data conducted by KEIS. However, they did not take into account of MHS and

SHS' costs aspects to compare them. The most recent study (Lee et al., 2016) pointed out the weakness of previous studies which excluded the costs aspects of the educational investments, and the study assessed the economic viability and cost-effectiveness of MHS versus other education investments such as SHS and GHS programs taking into account of inputs (costs) and outputs(benefits and effectiveness) together. Using the both cost-effective analysis with employment and wage rate and cost-benefit analysis with NPV and EIRR, the result shows that the cost-effectiveness of MHS is far lower than SHS, and EIRR of MHS is either equal to or less than SHS. Of course, it is hardly difficult to say that the result of the study is plausible and compelling. However, people would be still questionable that the result could be generalized across the nation with different samples since the study only covers samples in the particular two major cities (Seoul and Daejeon), limited periods (2011 and 2014), and a particular type of schools (private).

Therefore, this study is discrete from the previous research since it will analyze and compare MHS and SHS regarding cost-effectiveness and economic viability with the larger samples covering public and private MHS and SHS from 2010 to 2015 at the national level. In this regard, this study would contribute to the existing literature and provide stakeholders with more unbiased and evident information to help them to make better educational investment decision under the given budget.

3. DATA AND METHODOLOGY

3.1. Data

3.1.1. Samples

The only MHS and SHS which have existed without transforming its school type during the period from 2010 to 2015 are selected as samples for the study. The samples initially provided by EDSS have been chosen from the population using a stratified random sampling regardless of regions, size of schools, and types of school' specialty. It covered 70% of MHS and SHS population, but some samples were deleted from the original ones due to missing data. The final samples used for the study are 14 out of 21 MHS and 281 out of 483 SHS (see Table 3).

For the study, the cohorts are categorized into three groups regardless of school types showing whether is a public or private school: The first cohort entered the labor market in 2013 after studying from 2010 to 2012. The second cohort went into the labor market in 2014 after studying from 2011 to 2013. Moreover, in the following year, the third cohort got jobs in 2015 after studying from 2012 to 2014 (see Table 4).

Table 3. Sample Information

		MHS(Public)	MHS(Private)	MHS(Total)	SHS(Public)	SHS(Private)	SHS(Total)
Number of Student	**Cohort 1 (2010-12)**	1,665	492	2,157	32,642	32,178	64,820
	Cohort 2 (2011-13)	1,717	502	2,219	32,465	32,235	64,700
	Cohort 3 (2012-14)	1,605	510	2,115	31,963	30,766	62,729
Number of Schools		11	3	14	154	127	281
Population (As of 2010)		21			483		
Percentage (%)		66.67%			58.18%		

Source: author

Table 4. Cohorts Information

Cohort	Years of Study	Year of Graduation
Cohort 1	2010-2012	2013
Cohort 2	2011-2013	2014
Cohort 3	2012-2014	2015

Source: author

Before analysis, we would consider the different level of samples' abilities since MHS have been selected from the SHS and commonly it is required for students to achieve greater academic performance to enter MHS. The previous research (Lee, 2016) pointed out that the original group transformed into the MHS had ten percentage-point better performance on employment rate compared to the SHS. To confirm or counter it, the study also carried out the analysis by expanding a size of samples. Along with his analysis, former SHS turned into MHS had slightly better performance than SHS in the public school groups in the year of 2011, but the gap between them in the private groups was wider at the same time. Therefore, we can conjecture the MHS would have strong potential to make better performances in labor market.

The result is as follows (see Table 5).

Table 5. Employment Rate between 2011 and 2014

Graduation Year	2011	2014
MHS (Public)		
Employment Rate	27.59	88.13
SHS (Public)		
Employment Rate	25.67	44.38
Difference-in-Difference (Treatment-Control)	1.92	43.75
MHS (Private)		
Employment Rate	36.74	88.74
SHS (Private)		
Employment Rate	25.08	43.97
Difference-in-Difference (Treatment-Control)	11.66	44.77
MHS (Average)		
Employment Rate	32.17	88.44
SHS (Average)		
Employment Rate	25.38	44.18
Difference-in-Difference (Treatment-Control)	6.79	44.26

Source: author

3.1.2. Source of Data

For the study, the several data have been sourced from a different organization such as KEIS, EDSS and MoEL.

Table 6. Source of Data

Name of Data	Source	Year	Variable
HSGES	KEIS	2013	Wage Rate of MHS and SHS, Benefits of MHS and SHS
Edudata	EDSS	2010-14 2013-15	Direct Cost of MHS and SHS, Employment rate of MHS and SHS
Employment and Labor Statistics	MoEL	2010-12 2013-15	Indirect cost of MHS and SHS, Benefits of MHS and SHS
		2010-12	Employment rate of the middle school graduates

Source: author

3.2. Costs and Benefits

To define costs and benefits is necessitated to implement the cost-effectiveness and cost-benefit analysis. In terms of all costs and benefits, they are expressed in 2010 present value which was the initial year of MHS launch in Korea and the cohort 1 started their studies in MHS and SHS. They are shown in domestic market prices since the study assumed that there were no imported goods such as equipment, facilities to operate the schools. Also, all the prices are expressed in Korean currency (KRW: Korean Won). The analysis is estimated based on the discount rate (10%) frequently used by the international development finance institutions' practices. For the analysis, MHS has been set as treatment group while the SHS has been set as control groups.

3.2.1. Costs

The costs are defined as the sum of direct and indirect annual economic costs of MHS and SHS respectively expressed in the 2010 present value. The direct costs consist of recurrent cost for personnel, non-personnel, materials and supplies, and maintenance and capital costs for equipment, furniture, and building construction. The indirect costs are annual earnings of middle school graduates which is the opportunity cost for the three-years of high school education adjusted for their average employment rate in the same year. The following formula is applied to calculate the costs in any one year;

$$Costs = (N)[PV(DC)]+(N)[PV(IC)](U)$$

In the formula, *N* stands for the number of high school graduates either MHS or SHS.

PV(DC) refers to the sum of direct costs of their high school education for three years per student, and *PV(IC)* stands for the sum of the indirect costs which are their opportunity costs due to the high school education per student in 2010 present value. The *U* refers to an employment rate of middle school graduates as an opportunity cost of MHS and SHS investments.

To take a comparable approach to the assessment of two education programs, the two critical assumptions were made to calculate direct costs.

First, the personnel salaries of public schools regardless of the types were assumed since the original data provided by EDSS has not collected the personnel salaries of public schools since they are directly paid from regional education offices while salaries of private schools' personnel are directly charged to their schools. Therefore, the study drew the percent of the personnel salaries of the private MHS and SHS out of the direct costs each year (see Table 7), then assumed that the portion of the personnel salaries would be maintained in the public MHS and SHS respectively.

Table 7. The Percent of the Personnel Salaries of the Private MHS and SHS

MHS (Private)					
Year	2010	2011	2012	2013	2014
Percent of Personnel	40.70%	46.20%	45.50%	51.50%	53.90%
SHS (Private)					
Year	2010	2011	2012	2013	2014
Percent of Personnel	57.80%	54.20%	54.30%	55.90%	58.20%

Source: author

Second, three-year total costs per student was assumed to calculate direct costs per student since the particular data for each cohort's actual annual expenses each year was unavailable. The following formula was used for assumption;

Three-year total direct costs per student =

$$\frac{\begin{array}{c}\textit{One school's actual annual costs}\\ \textit{for the first study year of the cohort}\end{array}}{\begin{array}{c}\textit{The total number of students from 10th to 12th grades}\\ \textit{for the first study year of the cohort}\end{array}} + \frac{\begin{array}{c}\textit{One school's actual annual costs}\\ \textit{for the second study year of the cohort}\end{array}}{\begin{array}{c}\textit{The total number of students from 10th to 12th grades}\\ \textit{for the second study year of the cohort}\end{array}}$$

$$+ \frac{\begin{array}{c}\textit{One school's actual annual costs}\\ \textit{for the third study year of the cohort}\end{array}}{\begin{array}{c}\textit{The total number of students from 10th to 12th grades}\\ \textit{for the third study year of the cohort}\end{array}}$$

3.2.2. Benefits

The benefits are defined as the lifetime earnings gap between high school education either MHS or SHS and the middle school graduates in the 2010 present value adjusted for their initial employment rate. The incremental lifetime earnings due to high school education have sourced from Employment and Labor Statistics as a basis to estimate the incremental lifetime earnings of the MHS and SHS since the data of groups' first annual wage provided by HSGES in 2013 is only allowed.

The underlying assumption is that the differences in earnings between the workers in different education groups are maintained at all ages from 19 to their retirement age of 61, and the gap remains stable over time. To calculate the benefits, it counts their incremental annual earnings from the graduation year which is the first working year at the age of 19 to 61 years old which is the normal average retirement age in Korea reported by OECD in 2014. Therefore, the total years of work experience, 43 years, will be applied to each cohort of MHS and SHS while the benefit data for the middle school graduates have been collected from the age of 16 to 61 year old.

The following formula is applied to calculate the benefits in any one year;

$$Benefits = (N)[PV(IE)](U)$$

In the formula, *N* stands for the number of high school graduates either MHS or SHS. *PV(IE)* refers to the sum of incremental lifetime earnings due to the high school education in 2010 present value. The *U* refers to their initial employment rate upon the graduation of MHS and SHS.

To take a comparable approach to the assessment of two education programs, the one main assumption was made to estimate the lifetime profile earnings of MHS and SHS. The first annual wage of MHS and SHS graduates who entered the labor market in the year of 2014 and 2015 was estimated based on the initial annual wage of the first cohort in 2013 right after graduation since the HSGES has not surveyed since 2014. In 2013, the average initial annual earnings of the high school graduates with less than a year of work experience among the age group from 19 to 23 years old workers was 16,752 thousand KRW while MHS and SHS graduates earned 20,904 and 17,592 thousand KRW respectively. The workers graduated from MHS and SHS earned approximately 1.25 and 1.05 times more than the average high school graduates respectively. Thus, the study assumed that the gap would be maintained in 2014 and 2015 even up to the year of their retirement.

3.3. Analysis Methodology

This study aims to assess cost-effectiveness and efficiency of two Korean vocational high school models. The research adopts the cost-effectiveness analysis and cost-benefit analysis, and the results of two groups will be represented in 4. Analysis Results.

3.3.1. Cost-Effectiveness Analysis

To explain which vocational high school model is better than its counterpart taking into account of costs, the cost-effectiveness analysis adopts employment and wage rate as indicators to verify the hypothesis that *SHS is a more cost-effective education investment than MHS*. However, this methodology fails to show economic viability of the best program so the cost-benefit analysis will be implemented to demonstrate the project's economic viability afterward. In the result, the indicators such as employment rate and wage rate express the performance of each cohort from MHS and SHS.

The equation with the costs and effectiveness indicator to be applied to each cohort is specified as follows;

1) Cost-effectiveness analysis with employment rate

$$\frac{Per\ student\ total\ costs}{per\ employment\ rate} = \frac{per\ student\ three - year\ total\ expenses}{per\ three - year\ employment\ rate\ increase\ over\ three - years}$$

2) Cost-effectiveness analysis with wage rate

$$\frac{Per\ student\ total\ costs}{per\ wage\ rate} = \frac{per\ student\ three - year\ total\ expenses}{per\ three - year\ wage\ rate\ increase\ over\ three - years}$$

3.3.2. Cost-Benefit Analysis

To prove the hypothesis that *SHS is a more economically viable education investment than MHS*, NPV has been adopted among cost-benefit analysis methods since it can present the economic viability of the selected programs and it will show which one is more worth to invest among given options. The cost-benefit analysis assesses the benefits of the investment by the

monetary gains realized through investment (costs).

NPV is defined as the difference between the sum of the present value of the project's future marginal benefits, and the sum of the present value of the project's costs. And, we can say the project is economically viable if NPV is larger than zero. However, we have to pay attention that larger projects tend to have a greater NPV, and therefore tend to choose a large investment, irrespective of investment efficiency.

The equation with costs and benefits to be applied to each cohort is specified as follows;

$$\boldsymbol{NPV} = \sum_{t=1}^{t=43} \frac{B_t}{(1+i)^t} - \sum_{t=1}^{t=3} \frac{C_t}{(1+i)^t}$$

In the formula, *B* represents to the earnings gap between high school graduates either MHS or SHS and middle school graduates. C_t refers to the annual cost of high school education either MHS or SHS. *i* means the discount rate (10%). Also, the index *t* refers the time periods that t=1 at age 16 is the beginning, and t=43 at age 61 is the graduates' retirement time of the both groups. On the right side, the first term is the sum of the incremental earnings (benefits) from the high school education either MHS or SHS and the second term is the sum of three-year indirect and direct costs. Both are expressed in the 2010 present value. Each NPV for MHS and SHS will be calculated and compared in 4. Analysis Result.

4. ANALYSIS RESULT

4.1. Cost-Effectiveness Analysis

The study will verify the hypothesis that *SHS is more cost-effective than the MHS* by adopting the cost-effectiveness analysis. For this analysis, we will test which education investment option has been more cost-effective with generating relatively fewer costs per employment and wage rate across the three cohorts. Employment rate and wage rate used for analysis are each cohorts' performances.

The study will compare the results of costs per employment or wage rate show which education investment has spent a higher level of per-student three-year total expenses per three-year employment or wage rate increase over three-years. The study will look at the difference-in-differences between MHS and SHS since the three-year costs would create the different performance in the employment or wage rate over three years, not just the employment or wage rate in their graduation year. As the study illustrated earlier in Table 5, MHS and SHS started at a different level of employment rate three years ago, and MHS strated at a higher employment rate three years ago, MHS is more likely to achieve a higher employment three years later than SHS. And the study expect that this tendency would be similar when it comes tom wage rate. Therefore, we have to see the differences two groups have made for three years.

For example, for the Cohort 1 (2010-2012), the difference in employment or wage rate in 2013 (their graduation year) and 2011 (their second study year) will be compared using three-year costs (2010-2012). And, Cohort 2 (2011-2013) and Cohort 3 (2012-2014) will be compared in the same manner. However, the wage rates in 2011 and 2012 were not available, so the assumed wage rates for MHS (18,398.92 thousand KRW) and SHS (14,652.62 thousand KRW) were used for the analysis. The assumption follows the same way to estimate annual

wage of MHS and SHS in 2014 and 2015 based on the annual wage of them in 2013 in 3.2.2.

Benefits.

4.1.1. Costs per Employment Rate

The null-hypothesis that *SHS is more cost-effective than MHS* has been rejected because the results of costs per employment rate show that on average SHS has spent a higher level of per-student three-year total expenses per three-year employment rate increase over three-years (4,031.90 thousand KRW) than MHS (1685.23 thousand KRW). The difference-in-differences has been widen over three cohorts. One thing we should pay attention is that, different from others, the employment rate MHS cohort 3 decreased from their second year (92.55%) to graduation year (83.34%). It brings the significant difference on MHS overall.

Table 8. The Result of Costs per Employment Rate Difference: All MHS and SHS (Unit: Thousand KRW in 2010 present value and %)

MHS (ALL)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	50,914.94	56,107.97	53,048.66	53,357.19
Employment Rate (Second Year)	32.17	44.62	92.55	56.45
Employment Rate (Graduation Year)	92.55	88.44	83.34	88.11
Employment Rate Difference over Three Years (Second Year-Graduation Year)	(60.39)	(43.82)	9.21	(31.66)
Costs per Employment Rate Difference over Three Years	(843.17)	(1,280.57)	5,756.77	(1,685.23)
SHS (ALL)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	33,814.65	37,992.44	37,114.57	36,307.22
Employment Rate (Second Year)	25.38	37.30	39.24	33.97
Employment Rate (Graduation Year)	39.24	44.18	45.51	42.97
Employment Rate Difference over Three Years (Second Year-Graduation Year)	(13.86)	(6.88)	(6.28)	(9.01)
Costs per Employment Rate Difference over Three Years	(2,439.73)	(5,522.16)	(5,914.67)	(4,031.90)
Difference-in-Differences (Treatment-Control)	1,596.56	4,241.59	11,671.44	2,346.67

Source: author

Regarding public schools, on average, SHS incurred a larger amount of expenses (3,612.61 thousand KRW) than MHS (1,421.33 thousand KRW) to raise their employment rate difference by one percentage point. In cohort 1, SHS spent 2,783.49 thousand KRW while MHS incurred 769.69 thousand KRW. In cohort 2, SHS spent 4,486.16 thousand KRW while MHS incurred 1,050.88 thousand KRW. However, in cohort 3, SHS spent 3,871.78 thousand KRW while MHS generated 6,497.51 thousand KRW. The difference-in-differences between two groups has increased over time.

Table 9. The Result of Costs per Employment Rate Difference: Public MHS and SHS (Unit: Thousand KRW in 2010 present value and %)

MHS (Public)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	47,867.13	51,272.34	48,081.58	49,073.68
Employment Rate (Second Year)	27.59	39.34	89.78	52.24
Employment Rate (Graduation Year)	89.78	88.13	82.38	86.76
Employment Rate Difference over Three Years (Second Year-Graduation Year)	(62.19)	(48.79)	7.40	(34.53)
Costs per Employment Rate Difference over Three Years	(769.69)	(1,050.88)	6,497.51	(1,421.33)
SHS (Public)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	30,033.88	34,364.02	33,684.52	32,694.14
Employment Rate (Second Year)	25.67	36.72	36.46	32.95
Employment Rate (Graduation Year)	36.46	44.38	45.16	42.00
Employment Rate Difference over Three Years (Second Year-Graduation Year)	(10.79)	(7.66)	(8.70)	(9.05)
Costs per Employment Rate Difference over Three Years	(2,783.49)	(4,486.16)	(3,871.78)	(3,612.61)
Difference-in-Differences (Treatment-Control)	2,013.80	3,435.29	10,369.29	2,191.29

Source: author

When it comes to private schools, on average SHS incurred a larger amount of expenses (4,455.39 thousand KRW) across the all the cohorts than MHS (2,001.64 thousand KRW) to raise their employment rate difference by one percentage point. In cohort 1, SHS spent 2,220.64 thousand KRW while MHS incurred 921.18 thousand KRW. In cohort 2, SHS spent 6,823.09 thousand KRW while MHS incurred 1,569.09 thousand KRW. However, in

cohort 3, SHS spent 10,531.07 thousand KRW while MHS incurred 5,259.81 thousand KRW.

The difference-in-differences between two groups has widen over time.

Table 10. The Result of Costs per Employment Rate Difference: Private MHS and SHS (Unit: Thousand KRW in 2010 present value and %)

MHS (Private)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	53,962.75	60,943.60	58,015.73	57,640.69
Employment Rate (Second Year)	36.74	49.90	95.32	60.65
Employment Rate (Graduation Year)	95.32	88.74	84.29	89.45
Employment Rate Difference over Three Years (Second Year-Graduation Year)	(58.58)	(38.84)	11.03	(28.80)
Costs per Employment Rate Difference over Three Years	(921.18)	(1,569.09)	5,259.81	(2,001.64)
SHS (Private)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	37,595.43	41,620.86	40,544.61	39,920.30
Employment Rate (Second Year)	25.08	37.87	42.01	34.99
Employment Rate (Graduation Year)	42.01	43.97	45.86	43.95
Employment Rate Difference over Three Years (Second Year-Graduation Year)	(16.93)	(6.10)	(3.85)	(8.96)
Costs per Employment Rate Difference over Three Years	(2,220.64)	(6,823.09)	(10,531.07)	(4,455.39)
Difference-in-Differences (Treatment-Control)	1,299.46	5,254.00	15,790.88	2,453.75

Source: author

The results demonstrate that the SHS incurred a relatively large amount of costs than MHS to increase their employment rate difference by one percentage point. However, we have to pay attention to the fact that on average costs per employment rate difference over three years have increased so far. Referring to MHS cohort 3, we can conjecture that the most current MHS students might not choose entering labor market right after graduation divorced from the government's policy intention, and it would be regarded as the over-investment on MHS only to increase employment rate. Therefore, we cannot say that *SHS is more cost-effective than MHS* regarding costs per employment rate.

4.1.2. Costs per Wage Rate

In contrast to the 4.1.1. Costs per Employment Rate, the null-hypothesis that *SHS is more cost-effective than MHS* is accepted since the results show that on average SHS has spent a lower level of per-student three-year total expenses per three-year wage rate increase over three-years (19.59 thousand KRW) than MHS (24.23 thousand KRW) regardless of cohorts (cohort 1, 2 and 3) or establishment types (public and private). There is a tendency that private schools spent comparatively larger expenses than their counterparts to make the same level of performance. In addition, the costs per wage rate difference over three years have increased continuously in the all groups. However, we have to pay attention that all cohorts have experienced that their wage rate of graduation year is lower than that of second year.

Table 11. The Result of Costs per Wage Rate Difference: All MHS and SHS (Unit: Thousand KRW in 2010 present value and %)

MHS (ALL)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	50,914.94	56,107.97	53,048.66	53,357.19
Wage Rate (Second Year)	18,398.92	16,408.79	15,171.29	16,659.67
Wage Rate (Graduation Year)	15,171.29	14,652.62	13,549.58	14,457.83
Wage Rate Difference over Three Years (Second Year-Graduation Year)	3,227.63	1,756.17	1,621.71	2,201.84
Costs per Wage Rate Difference over Three Years	15.77	31.95	32.71	24.23
SHS (ALL)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	33,814.65	37,992.44	37,114.57	36,307.22
Wage Rate (Second Year)	15,483.82	13,809.01	12,767.57	14,020.13
Wage Rate (Graduation Year)	12,767.57	12,331.08	11,402.80	12,167.15
Wage Rate Difference over Three Years (Second Year-Graduation Year)	2,716.25	1,477.93	1,364.77	1,852.98
Costs per Wage Rate Difference over Three Years	12.45	25.71	27.19	19.59
Difference-in-Differences (Treatment-Control)	3.33	6.24	5.52	4.64

Source: author

Regarding public schools, average SHS incurred a smaller amount of expenses (17.64 thousand KRW) across the all the cohorts than average MHS (22.29thousand KRW) to raise their wage rate difference by one percentage point. In cohort 1, SHS spent 11.06 thousand KRW while MHS incurred 14.83 thousand KRW. In cohort 2, SHS spent 23.25 thousand KRW while MHS incurred 29.20 thousand KRW. Moreover, in cohort 3, SHS spent 24.68 thousand KRW while MHS incurred 29.65 thousand KRW. The average difference-in-differences between two schools is 4.64.

Table 12. The Result of Costs per Wage Rate Difference: Public MHS and SHS (Unit: Thousand KRW in 2010 present value and %)

MHS (Public)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	47,867.13	51,272.34	48,081.58	49,073.68
Wage Rate (Second Year)	18,398.92	16,408.79	15,171.29	16,659.67
Wage Rate (Graduation Year)	15,171.29	14,652.62	13,549.58	14,457.83
Wage Rate Difference over Three Years (Second Year-Graduation Year)	3,227.63	1,756.17	1,621.71	2,201.84
Costs per Wage Rate Difference over Three Years	14.83	29.20	29.65	22.29
SHS (Public)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	30,033.88	34,364.02	33,684.52	32,694.14
Wage Rate (Second Year)	15,483.82	13,809.01	12,767.57	14,020.13
Wage Rate (Graduation Year)	12,767.57	12,331.08	11,402.80	12,167.15
Wage Rate Difference over Three Years (Second Year-Graduation Year)	2,716.25	1,477.93	1,364.77	1,852.98
Costs per Wage Rate Difference over Three Years	11.06	23.25	24.68	17.64
Difference-in-Differences (Treatment-Control)	3.77	5.94	4.97	4.64

Source: author

When it comes to private schools, along with the previous result of the public schools, SHS incurred a lower amount of expenses (21.54 thousand KRW) than MHS (26.18 thousand KRW) to raise their wage rate difference by one percentage point. In cohort 1, SHS spent 13.84 thousand KRW while MHS incurred 16.72 thousand KRW. In cohort 2, SHS spent 28.16 thousand KRW while MHS incurred 34.70 thousand KRW. Moreover, in cohort 3, SHS spent

29.71 thousand KRW while MHS incurred 35.77 thousand KRW. The average difference-in-differences between two schools is 4.63.

Table 13. The Result of Costs per Wage Rate Difference: Private MHS and SHS (Unit: Thousand KRW in 2010 present value and %)

MHS (Private)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	53,962.75	60,943.60	58,015.73	57,640.69
Wage Rate (Second Year)	18,398.92	16,408.79	15,171.29	16,659.67
Wage Rate (Graduation Year)	15,171.29	14,652.62	13,549.58	14,457.83
Wage Rate Difference over Three Years (Second Year-Graduation Year)	3,227.63	1,756.17	1,621.71	2,201.84
Costs per Wage Rate Difference over Three Years	16.72	34.70	35.77	26.18
SHS (Private)				
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
Three-year Costs per Student	37,595.43	41,620.86	40,544.61	39,920.30
Wage Rate (Second Year)	15,483.82	13,809.01	12,767.57	14,020.13
Wage Rate (Graduation Year)	12,767.57	12,331.08	11,402.80	12,167.15
Wage Rate Difference over Three Years (Second Year-Graduation Year)	2,716.25	1,477.93	1,364.77	1,852.98
Costs per Wage Rate Difference over Three Years	13.84	28.16	29.71	21.54
Difference-in-Differences (Treatment-Control)	2.88	6.54	6.07	4.63

Source: author

Therefore, without any exception, the results explain that the SHS incurred a relatively lower amount of costs than MHS to increase their wage rate difference by one percentage point. In sum, we can claim that *SHS is more cost-effective than MHS* in terms of costs per wage rate.

4.2. Cost-Benefit Analysis

The study will verify the hypothesis that *SHS is more economically viable education investment than the MHS* by adopting the cost-benefit analysis, specifically, NPV. For this analysis, we will test whether two education investment option has been economically viable

and worth to invest government' budget, and which one is more able to provide monetary gains through spending costs from the economy's whole point of view.

4.2.1. NPV

The two investment education options show a positive NPV, so they are an economically viable investment. However, the null-hypothesis that *SHS is more economically viable education investment than the MHS* have been accepted since the analysis result using NPV explains that on average NPV of SHS (3,667.96 billion KRW) is approximately eighteen times greater than that of MHS (201.82 billion KRW). It supports that SHS is worthier to invest over MHS.

Table 14. The Result of NPV: All MHS and SHS (Unit: Billion KRW in 2010 present value, Discount rate: 10%)

MHS (ALL)			
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
NPV	184.18	225.57	195.70	201.82
SHS (ALL)			
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
NPV	3,206.22	4,035.49	3,762.16	3,667.96
Difference-in-Difference (Control-Treatment)	3,022.04	3,809.92	3,566.46	3,466.14

Source: author

In the public schools, SHS (1,586 billion KRW) have a larger NPV than MHS (151.72 billion KRW) on average. In cohort 1, SHS has 1,487.44 Billion KRW while MHS has 139.45. For the following year, both groups' NPV increased together. SHS has 1,913.59 billion KRW, and MHS has 170.82 billion KRW. In cohort 3, SHS has 1,812.17 billion KRW while MHS has 144.89 billion KRW.

Table 15. The Result of NPV: Public MHS and SHS (Unit: Billion KRW in 2010 present value, Discount rate: 10%)

MHS (Public)			
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
NPV	139.45	170.82	144.89	151.72
SHS (Public)			
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
NPV	1,487.44	1,913.59	1,812.17	1,737.73
Difference-in-Difference (Treatment-Control)	1,347.99	1,742.77	1,667.28	1,586.01

<div align="right">Source: author</div>

In terms of private schools, SHS (1,930.23 billion KRW) have a larger NPV than MHS (151.72 billion KRW) on average. In cohort 1, SHS has 1,487.44 billion KRW while MHS has 44.73. In cohort 2, SHS has 2,121.90 billion KRW, and MHS have 54.75 billion KRW. In cohort 3, SHS has 1,950 billion KRW while MHS has 50.81 billion KRW.

Table 16. The Result of NPV: Private MHS and SHS (Unit: Billion KRW in 2010 present value, Discount rate: 10%)

MHS (Private)			
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
NPV	44.73	54.75	50.81	50.10
SHS (Private)			
Cohort	Cohort 1(2010-12)	Cohort 2 (2011-13)	Cohort 3(2012-14)	Average
NPV	1,718.78	2,121.90	1,950.00	1,930.23
Difference-in-Difference (Control-Treatment)	1,674.05	2,067.15	1,899.19	1,880.13

<div align="right">Source: author</div>

Considering the size of SHS in Korea, it is not surprising that the NPV analysis result verifies that *SHS is more economically viable education investment than the MHS.* The full NPV results are presented in the appendix.

5. CONCLUSION

For the last decade, it seemed that government' priority has directed toward vocational high schools to tackle down the high youth unemployment rate and minimize mismatch between labor market needs for middle-skilled workers and society' eagerness pursuing an advanced degree, sometimes, independent from the proper skills. It is undeniable that the society has more paid positive attention to the promising new type of vocational high school, MHS, which gives you a guarantee to get a job after graduation.

However, some people have doubted that the high employment rate, the virtue of the MHS, might originate from the surprisingly generous financial supports not their certain characteristics of MHS program. Also, SHS, the counterpart of MHS, has been less bolstered by the government than MHS. It is true that SHS has been upgraded thanks to the policy effort to increase employment of high school graduates and introduce the pilot program called "apprenticeship" in SHS. Still, there are a few studies adressing their performance comparing two investment options considering costs parts which would provide policy decision makers with objective and plausible ideas.

In this regard, this study aims to assess economic viability and cost-effectiveness of current two vocational high schools in Korea: MHS and SHS. The cost-effectiveness analysis using employment and wage rates and cost-benefit analysis using NPV adopts for the analysis. And 14 MHS (6,491 students) and 281 SHS (192,249 students) are studied to verify that *SHS is a more cost-effective education investment than MHS and SHS is a more economically viable education investment than MHS.* The results show that in *SHS is a less cost-effective education investment than MHS* in terms of employment rate. However, *SHS is a more cost-effective education investment than MHS* in terms of wage rate. And the result of NPV indicates that two of them are economically viable, but SHS had a larger NPV than MHS.

The study of result would say that gradually increased government' support toward SHS , especially, the apprenticeship program seems to be a due answer at this moment. Even though the SHS incurred relatively smaller costs per wage rate than MHS, the low employment rate of SHS has been problematic. Therefore, the pilot program which has shown the speedy rising employment rate would be a weapon to solve SHS's chronic problem and the chance to decrease costs per employment rate at the same time. However, the government still needs to create a better work environment that evaluates workers based on their competencies, and provide more quality job opportunities with higher wages to the high school graduates not only focusing on eye-catching figures such as high employment rate.

Appendix

Year	Int age	Working year	Project year	NPV MHS(PV)_Public whole project	NPV MHS(PV)_Private whole project	NPV MHS(PV)_Total whole project
				Cohort 1 (2010-2012)		
2010	16	0	1	(32,932,185)	(9,731,312)	(42,663,497)
2011	17	0	2	(34,593,382)	(11,807,313)	(46,400,695)
2012	18	0	3	(35,259,370)	(11,832,906)	(47,092,276)
2013	19	1	4	1,587,390	500,689	2,088,079
2014	20	2	5	8,681,836	2,738,395	11,420,231
2015	21	3	6	3,369,564	1,062,816	4,432,380
2016	22	4	7	9,690,754	3,056,624	12,747,379
2017	23	5	8	8,603,718	2,713,755	11,317,473
2018	24	6	9	10,825,607	3,414,576	14,240,183
2019	25	7	10	9,611,271	3,031,554	12,642,825
2020	26	8	11	8,436,053	2,660,871	11,096,924
2021	27	9	12	7,489,759	2,362,394	9,852,153
2022	28	10	13	6,649,614	2,097,398	8,747,012
2023	29	11	14	5,719,041	1,803,880	7,522,922
2024	30	12	15	5,077,522	1,601,534	6,679,056
2025	31	13	16	4,507,963	1,421,886	5,929,849
2026	32	14	17	4,002,293	1,262,390	5,264,683
2027	33	15	18	3,553,346	1,120,784	4,674,130
2028	34	16	19	4,289,157	1,352,871	5,642,028
2029	35	17	20	3,808,031	1,201,116	5,009,147
2030	36	18	21	3,380,875	1,066,384	4,447,259
2031	37	19	22	3,001,633	946,765	3,948,398
2032	38	20	23	2,664,933	840,564	3,505,496
2033	39	21	24	2,539,091	800,871	3,339,962
2034	40	22	25	2,254,274	711,035	2,965,310
2035	41	23	26	2,001,407	631,277	2,632,683
2036	42	24	27	1,776,904	560,465	2,337,369
2037	43	25	28	1,577,584	497,596	2,075,180
2038	44	26	29	1,349,442	425,636	1,775,078
2039	45	27	30	1,198,071	377,892	1,575,963
2040	46	28	31	1,063,681	335,502	1,399,183
2041	47	29	32	944,365	297,868	1,242,233
2042	48	30	33	838,433	264,456	1,102,889
2043	49	31	34	698,818	220,419	919,237
2044	50	32	35	620,430	195,694	816,123
2045	51	33	36	550,834	173,742	724,577
2046	52	34	37	489,046	154,253	643,299
2047	53	35	38	434,188	136,950	571,139
2048	54	36	39	338,071	106,633	444,704
2049	55	37	40	300,149	94,672	394,821
2050	56	38	41	266,480	84,052	350,533
2051	57	39	42	236,589	74,624	311,213
2052	58	40	43	210,050	66,253	276,303
2053	59	41	44	161,844	51,048	212,892
2054	60	42	45	143,689	45,322	189,011
2055	61	43	46	127,571	40,238	167,810
2056			47			
2057			48			
	NPV (thousand KRW)			139,445,315	44,729,881	184,175,197
	NPV(Billion KRW)			139	45	184

Year	Int age	Working year	Project year	NPV SHS(PV)_Public whole project	NPV SHS(PV)_Private whole project	NPV SHS(PV)_Total whole project
				Cohort 1 (2010-2012)		
2010	16	0	1	(474,212,204)	(559,277,774)	(1,033,489,978)
2011	17	0	2	(502,847,486)	(568,329,075)	(1,071,176,561)
2012	18	0	3	(455,906,024)	(528,304,917)	(984,210,941)
2013	19	1	4	(15,658,312)	(18,008,354)	(33,666,666)
2014	20	2	5	34,216,134	39,351,384	73,567,519
2015	21	3	6	(4,025,700)	(4,629,888)	(8,655,587)
2016	22	4	7	41,133,475	47,306,899	88,440,375
2017	23	5	8	36,519,428	42,000,363	78,519,792
2018	24	6	9	52,799,481	60,723,770	113,523,250
2019	25	7	10	46,876,828	53,912,229	100,789,057
2020	26	8	11	40,848,547	46,979,208	87,827,756
2021	27	9	12	36,266,461	41,709,430	77,975,892
2022	28	10	13	32,198,360	37,030,777	69,229,137
2023	29	11	14	25,079,195	28,843,149	53,922,345
2024	30	12	15	22,265,998	25,607,739	47,873,737
2025	31	13	16	19,768,364	22,735,254	42,503,618
2026	32	14	17	17,550,896	20,184,982	37,735,878
2027	33	15	18	15,582,167	17,920,781	33,502,948
2028	34	16	19	21,609,813	24,853,073	46,462,886
2029	35	17	20	19,185,785	22,065,240	41,251,026
2030	36	18	21	17,033,667	19,590,126	36,623,793
2031	37	19	22	15,122,957	17,392,651	32,515,608
2032	38	20	23	13,426,576	15,441,673	28,868,249
2033	39	21	24	12,682,886	14,586,368	27,269,253
2034	40	22	25	11,260,214	12,950,177	24,210,391
2035	41	23	26	9,997,127	11,497,523	21,494,650
2036	42	24	27	8,875,724	10,207,816	19,083,540
2037	43	25	28	7,880,111	9,062,780	16,942,891
2038	44	26	29	6,451,465	7,419,719	13,871,184
2039	45	27	30	5,727,788	6,587,430	12,315,218
2040	46	28	31	5,085,287	5,848,501	10,933,788
2041	47	29	32	4,514,858	5,192,460	9,707,317
2042	48	30	33	4,008,415	4,610,008	8,618,423
2043	49	31	34	3,232,836	3,718,028	6,950,864
2044	50	32	35	2,870,200	3,300,968	6,171,168
2045	51	33	36	2,548,243	2,930,690	5,478,932
2046	52	34	37	2,262,400	2,601,947	4,864,346
2047	53	35	38	2,008,620	2,310,080	4,318,700
2048	54	36	39	1,557,437	1,791,181	3,348,618
2049	55	37	40	1,382,735	1,590,260	2,972,995
2050	56	38	41	1,227,630	1,411,876	2,639,506
2051	57	39	42	1,089,924	1,253,502	2,343,426
2052	58	40	43	967,664	1,112,894	2,080,558
2053	59	41	44	862,324	991,744	1,854,068
2054	60	42	45	765,595	880,497	1,646,092
2055	61	43	46	679,716	781,730	1,461,446
2056			47			
2057			48			
		NPV (thousand KRW)		1,487,440,403	1,718,780,159	3,206,220,562
		NPV(Billion KRW)		1,487	1,719	3,206

Year	Int age	Working year	Project year	NPV MHS(PV)_Public whole project	NPV MHS(PV)_Private whole project	NPV MHS(PV)_Total whole project
				Cohort 2 (2011-2013)		
2010	16	0	1			
2011	17	0	2	(41,357,338)	(13,647,023)	(55,004,360)
2012	18	0	3	(43,345,609)	(14,084,814)	(57,430,422)
2013	19	1	4	(34,988,859)	(12,117,476)	(47,106,335)
2014	20	2	5	2,054,776	614,409	2,669,185
2015	21	3	6	8,227,001	2,459,998	10,686,999
2016	22	4	7	5,185,785	1,550,629	6,736,414
2017	23	5	8	18,467,371	5,522,024	23,989,395
2018	24	6	9	16,405,058	4,905,362	21,310,420
2019	25	7	10	12,500,203	3,737,751	16,237,954
2020	26	8	11	11,105,290	3,320,651	14,425,941
2021	27	9	12	12,208,292	3,650,465	15,858,756
2022	28	10	13	10,844,585	3,242,696	14,087,280
2023	29	11	14	9,633,206	2,880,475	12,513,680
2024	30	12	15	6,932,457	2,072,910	9,005,367
2025	31	13	16	6,158,834	1,841,585	8,000,419
2026	32	14	17	5,471,541	1,636,074	7,107,615
2027	33	15	18	4,860,944	1,453,496	6,314,441
2028	34	16	19	4,318,485	1,291,293	5,609,778
2029	35	17	20	2,559,107	765,212	3,324,319
2030	36	18	21	2,274,257	680,037	2,954,294
2031	37	19	22	2,021,111	604,343	2,625,454
2032	38	20	23	1,796,141	537,073	2,333,214
2033	39	21	24	1,596,211	477,291	2,073,502
2034	40	22	25	2,612,871	781,288	3,394,159
2035	41	23	26	2,319,778	693,649	3,013,427
2036	42	24	27	2,059,563	615,841	2,675,403
2037	43	25	28	1,828,536	546,760	2,375,297
2038	44	26	29	1,623,425	485,429	2,108,853
2039	45	27	30	1,169,990	349,845	1,519,835
2040	46	28	31	1,038,749	310,602	1,349,351
2041	47	29	32	922,230	275,761	1,197,991
2042	48	30	33	818,781	244,828	1,063,609
2043	49	31	34	726,936	217,365	944,302
2044	50	32	35	504,284	150,789	655,073
2045	51	33	36	447,717	133,874	581,592
2046	52	34	37	397,496	118,857	516,353
2047	53	35	38	352,908	105,525	458,432
2048	54	36	39	313,321	93,688	407,009
2049	55	37	40	251,451	75,188	326,638
2050	56	38	41	223,245	66,754	289,998
2051	57	39	42	198,203	59,266	257,468
2052	58	40	43	175,970	52,618	228,588
2053	59	41	44	156,231	46,715	202,946
2054	60	42	45	142,333	42,560	184,893
2055	61	43	46	126,367	37,786	164,153
2056			47	112,192	33,547	145,740
2057			48			
	NPV (thousand KRW)			170,820,203	54,748,036	225,568,239
	NPV(Billion KRW)			171	55	226

Year	Int age	Working year	Project year	NPV SHS(PV)_Public whole project	NPV SHS(PV)_Private whole project	NPV SHS(PV)_Total whole project
				Cohort 2 (2011-2013)		
2010	16	0	1			
2011	17	0	2	(597,361,985)	(673,880,790)	(1,271,242,775)
2012	18	0	3	(584,149,642)	(659,415,004)	(1,243,564,646)
2013	19	1	4	(532,689,825)	(602,685,604)	(1,135,375,430)
2014	20	2	5	(13,424,242)	(13,639,117)	(27,063,359)
2015	21	3	6	37,864,563	38,470,643	76,335,206
2016	22	4	7	14,045,297	14,270,113	28,315,410
2017	23	5	8	120,260,915	122,185,872	242,446,786
2018	24	6	9	106,842,626	108,552,802	215,395,428
2019	25	7	10	75,770,199	76,983,015	152,753,214
2020	26	8	11	67,327,367	68,405,043	135,732,410
2021	27	9	12	81,465,667	82,769,647	164,235,314
2022	28	10	13	72,371,994	73,530,417	145,902,410
2023	29	11	14	64,293,386	65,322,498	129,615,883
2024	30	12	15	42,105,892	42,779,860	84,885,752
2025	31	13	16	37,413,936	38,012,802	75,426,738
2026	32	14	17	33,244,792	33,776,925	67,021,717
2027	33	15	18	29,540,208	30,013,043	59,553,251
2028	34	16	19	26,248,420	26,668,565	52,916,985
2029	35	17	20	11,520,883	11,705,292	23,226,174
2030	36	18	21	10,245,750	10,409,748	20,655,498
2031	37	19	22	9,111,723	9,257,570	18,369,292
2032	38	20	23	8,103,190	8,232,894	16,336,084
2033	39	21	24	7,206,267	7,321,615	14,527,882
2034	40	22	25	15,546,642	15,795,490	31,342,132
2035	41	23	26	13,802,736	14,023,669	27,826,405
2036	42	24	27	12,254,447	12,450,598	24,705,046
2037	43	25	28	10,879,835	11,053,983	21,933,818
2038	44	26	29	9,659,416	9,814,029	19,473,445
2039	45	27	30	6,206,605	6,305,951	12,512,557
2040	46	28	31	5,510,395	5,598,597	11,108,991
2041	47	29	32	4,892,279	4,970,588	9,862,867
2042	48	30	33	4,343,500	4,413,024	8,756,524
2043	49	31	34	3,856,278	3,918,004	7,774,282
2044	50	32	35	2,283,381	2,319,930	4,603,311
2045	51	33	36	2,027,248	2,059,697	4,086,946
2046	52	34	37	1,799,847	1,828,656	3,628,502
2047	53	35	38	1,597,953	1,623,531	3,221,484
2048	54	36	39	1,418,707	1,441,415	2,860,122
2049	55	37	40	1,153,769	1,172,236	2,326,005
2050	56	38	41	1,024,347	1,040,744	2,065,091
2051	57	39	42	909,444	924,001	1,833,445
2052	58	40	43	807,429	820,353	1,627,782
2053	59	41	44	716,858	728,332	1,445,190
2054	60	42	45	871,636	885,588	1,757,225
2055	61	43	46	773,863	786,250	1,560,112
2056			47	687,057	698,054	1,385,110
2057			48			
	NPV (thousand KRW)			1,913,588,728	2,121,899,657	4,035,488,385
	NPV(Billion KRW)			1,914	2,122	4,035

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Int age	Working year	Project year	NPV MHS(PV)_Public whole project	NPV MHS(PV)_Private whole project	NPV MHS(PV)_Total whole project
			Cohort 3 (2012-2014)		
16	0	1			
17	0	2			
18	0	3	(36,867,903)	(13,166,908)	(50,034,810)
19	1	4	(37,191,769)	(13,788,091)	(50,979,860)
20	2	5	(33,329,833)	(12,235,188)	(45,565,021)
21	3	6	2,104,077	676,360	2,780,437
22	4	7	5,650,569	1,816,386	7,466,954
23	5	8	7,069,340	2,272,453	9,341,793
24	6	9	13,317,452	4,280,920	17,598,371
25	7	10	11,823,599	3,800,718	15,624,317
26	8	11	9,487,033	3,049,624	12,536,657
27	9	12	8,422,848	2,707,540	11,130,388
28	10	13	8,048,363	2,587,161	10,635,525
29	11	14	7,145,558	2,296,953	9,442,511
30	12	15	6,344,022	2,039,298	8,383,320
31	13	16	5,188,791	1,667,947	6,856,738
32	14	17	4,606,751	1,480,849	6,087,600
33	15	18	4,090,000	1,314,738	5,404,739
34	16	19	3,631,215	1,167,261	4,798,475
35	17	20	3,223,892	1,036,326	4,260,218
36	18	21	2,562,526	823,729	3,386,255
37	19	22	2,275,081	731,329	3,006,410
38	20	23	2,019,879	649,294	2,669,173
39	21	24	1,793,304	576,461	2,369,765
40	22	25	1,592,145	511,798	2,103,943
41	23	26	1,701,921	547,086	2,249,006
42	24	27	1,511,012	485,718	1,996,730
43	25	28	1,341,518	431,233	1,772,751
44	26	29	1,191,036	382,861	1,573,897
45	27	30	1,057,435	339,914	1,397,349
46	28	31	858,967	276,117	1,135,084
47	29	32	762,615	245,144	1,007,759
48	30	33	677,070	217,646	894,716
49	31	34	601,122	193,232	794,353
50	32	35	533,692	171,556	705,249
51	33	36	385,786	124,011	509,797
52	34	37	342,511	110,101	452,612
53	35	38	304,091	97,750	401,841
54	36	39	269,980	86,786	356,766
55	37	40	239,696	77,051	316,746
56	38	41	187,540	60,285	247,825
57	39	42	166,503	53,523	220,025
58	40	43	147,826	47,519	195,345
59	41	44	131,244	42,189	173,432
60	42	45	116,522	37,456	153,978
61	43	46	112,810	36,263	149,073
		47	100,156	32,195	132,351
		48	88,921	28,584	117,505
NPV (thousand KRW)			144,888,733	50,813,753	195,702,486
NPV(Billion KRW)			145	51	196

Year	Int age	Working year	Project year	NPV SHS(PV)_Public whole project	NPV SHS(PV)_Private whole project	NPV SHS(PV)_Total whole project
				Cohort 3 (2012-2014)		
2010	16	0	1			
2011	17	0	2			
2012	18	0	3	(504,479,452)	(560,584,941)	(1,065,064,393)
2013	19	1	4	(618,267,673)	(664,344,950)	(1,282,612,623)
2014	20	2	5	(555,703,196)	(601,720,764)	(1,157,423,960)
2015	21	3	6	(8,753,459)	(8,808,630)	(17,562,090)
2016	22	4	7	24,661,858	24,817,296	49,479,154
2017	23	5	8	42,809,289	43,079,105	85,888,395
2018	24	6	9	98,381,670	99,001,744	197,383,414
2019	25	7	10	87,345,946	87,896,465	175,242,412
2020	26	8	11	61,542,237	61,930,122	123,472,359
2021	27	9	12	54,638,887	54,983,262	109,622,148
2022	28	10	13	54,320,908	54,663,278	108,984,186
2023	29	11	14	48,227,593	48,531,559	96,759,151
2024	30	12	15	42,817,780	43,087,650	85,905,430
2025	31	13	16	32,377,617	32,581,684	64,959,301
2026	32	14	17	28,745,737	28,926,914	57,672,650
2027	33	15	18	25,521,254	25,682,108	51,203,361
2028	34	16	19	22,658,469	22,801,280	45,459,749
2029	35	17	20	20,116,811	20,243,602	40,360,413
2030	36	18	21	13,821,452	13,908,565	27,730,017
2031	37	19	22	12,271,064	12,348,406	24,619,470
2032	38	20	23	10,894,588	10,963,253	21,857,841
2033	39	21	24	9,672,514	9,733,477	19,405,991
2034	40	22	25	8,587,523	8,641,648	17,229,171
2035	41	23	26	10,076,715	10,140,226	20,216,940
2036	42	24	27	8,946,384	9,002,771	17,949,154
2037	43	25	28	7,942,845	7,992,907	15,935,752
2038	44	26	29	7,051,876	7,096,322	14,148,198
2039	45	27	30	6,260,849	6,300,309	12,561,158
2040	46	28	31	4,813,417	4,843,755	9,657,172
2041	47	29	32	4,273,484	4,300,419	8,573,903
2042	48	30	33	3,794,116	3,818,030	7,612,146
2043	49	31	34	3,368,521	3,389,752	6,758,272
2044	50	32	35	2,990,665	3,009,514	6,000,179
2045	51	33	36	1,822,197	1,833,682	3,655,880
2046	52	34	37	1,617,797	1,627,993	3,245,790
2047	53	35	38	1,436,324	1,445,377	2,881,702
2048	54	36	39	1,275,208	1,283,246	2,558,454
2049	55	37	40	1,132,165	1,139,301	2,271,465
2050	56	38	41	842,217	847,525	1,689,741
2051	57	39	42	747,743	752,456	1,500,199
2052	58	40	43	663,867	668,051	1,331,918
2053	59	41	44	589,399	593,114	1,182,513
2054	60	42	45	523,285	526,583	1,049,868
2055	61	43	46	729,168	733,764	1,462,932
2056			47	647,376	651,456	1,298,831
2057			48	574,758	578,380	1,153,138
	NPV (thousand KRW)			1,812,167,136	1,949,997,006	3,762,164,143
	NPV(Billion KRW)			1,812	1,950	3,762

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