

**Equal Educational Opportunity and the Free-Tuition Policy:
Can Student Subsidy Improve Fiscal Equity?**

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Abstract

Taiwan commenced the Twelve-Year Basic Education Reform in 2014, and extended compulsory education from nine to twelve years. This epoch-marking reform brought 33 billion NT\$ statutory funding each year, more than half of them went to tuition subsidy for students. In order to explore the equalizing effect of student subsidizing policy on private high school finance, this study adopts horizontal equity measures to calculate the trend of equity in 135 private high school costs in 2012-2013 school year to 2015-2016 school year (SY).

This study generates the following findings: (1). The free-tuition policy does raise school costs and reduce differences, thus equalize school costs in 2012SY to 2014SY. But factors from current policy environment make some schools become thrifty in school spending, thus lower the median and increase the standard deviations of per-student and per-class costs in 2015SY. (2). The trends of per-student and per-class unit costs among total 135 schools equity have been improved from 2012SY to 2014SY, and worsened in 2015SY when measured by coefficient of variation, and Gini coefficient (Lorenz curve). The below-median schools' equity measured by McLoone index showed mostly improving trend for per-student costs and fluctuating trend for per-class costs in four years. (3). The means and medians of per-student and per-class costs in the six-year school group are higher than the three-year school group. Teaching costs make the biggest differences among four kinds of costs, since the six-year high schools usually offer more fancy programs to attract students and tend to pay more to their teachers. The standard deviations, coefficient of variation, and Gini coefficient of four costs in the six-year high schools are also higher than the three-year high school. (4). Among the four levels of costs: teaching costs, current costs, current and equipment costs, and total costs, total costs have the highest inequality. However, the magnitudes of equity in four years are varied by levels of costs and school groups. (5). The equalizing effects of free-tuition policy have its limits. Private high schools became financially conservative in spending when other factors form policy environment, i.e. upcoming declining enrollments, occur in 2015SY. Schools have to cut down costs to cope with new challenges even the subsidizing policy continues.

Keywords: student subsidy, fiscal equity, school costs, high school

1. INTRODUCTION

Taiwan has put 9-year compulsory schooling into practice since 1968. Citizens from the age of 6 to 15 should receive free and obligatory compulsory education; which is divided into two stages – the first 6 years at the elementary school level, and the latter 3 years in junior high schools. In 2014, compulsory education was extended for three more years, covering high school education level, thus called as the “Twelve-Year Basic Education Reform”. Equality of educational opportunity was claimed as the prime goal of this reform. One of the reform policies, and the most costly, is to subsidize full tuition for students, which is also named as “the free-tuition policy”. In order to guarantee sufficient funding for tuition subsidy, the statutory fund for the Twelve-Year Basic Education Reform is about NT\$33billion per year. More than sixty percent of the statutory funding goes to student tuition subsidy. Under the free-tuition program, all vocational high school students and general high school students whose annual household income under NT\$1,480, 000 can enjoy full tuition subsidy from government.

The free-tuition policy since 2014 has been the first universal tuition subsidizing policy with the highest amount for each student in Taiwan. Since the amount of subsidy for each private high school student is about 4.5 times of public high school student each year, the high amount of subsidy not only makes a good incentive for parents to send their children to private schools, but also changes the operation patterns of private high schools.

The high percentages of private high schools and students in Taiwan are the reason why the free-tuition policy is so costly. In 2014-2015 school year (SY), 211 out of 503 high schools in Taiwan are private. They operate 9,637 classes, and enroll 379,134 high school students. At the same time, there are only 19,328 (34.70%) full-time private high teachers (Ministry of Education, 2016). (Table 1) Long before the 2014 reform, the tuition and fee schedule for public and private high schools has been quite different (Table 2). Public high schools charge less tuition and fees from students since they obtain appropriations from government for school operation. On the other hand, private schools get less grants from government than public schools, and heavily depend on tuition and fees from students. Contrary to the funding flow, private school can enjoy ample autonomy than public schools. When government pays for student tuition after 2014, private high schools can enjoy more revenues and still keep their autonomy.

There are two kinds of high schools, in terms of school enrollment composition, the six-year high schools and the three-year high schools. In these years, quite a few private high schools transform from the traditional three-year (enrolling 16-18 years old student) to six-year (enrolling 13-18years old students) to recruit more students in their earlier age. These schools also offer fancy teaching programs and diverse off-campus learning activities to attract students form higher social-economic status families. In 2017, 104 out of total 195 high schools (53.3%) in Taiwan are six-year; and only 91 high schools

(46.7%) are three-year high schools. These private high schools have been diversified in curriculum, organization, size, and financial situation. Some privileged private schools even charge more for extra learning programs. When government intervenes with uniform tuition subsidy, could the diversities among private high schools be reduced thus improve fiscal equity?

The other related issue on private high schools is their unique financial structures. Private high schools have long been enjoying financial autonomy. Tuition and fee collecting from students consist of major portion of school revenue. On the other hand, private high schools make their teachers teach more hours but pay less remuneration than public schools. The lower operating costs in private high schools have long been criticized. When private high school benefited from rising student tuition subsidies in 2014, a thorough and systemic review of private high school education costs is urgently needed.

After 2014, high school education are regulated by the law as “basic education” for all the nations 15 to 18 years old, and students are universally subsidized with full amount of three-year tuition since 2014. Can this free-tuition subsidy policy make private school students enjoy equal expenditures thus improve fiscal equity? The purpose of this study is to explore the equalizing effects of Taiwan’s high school free-tuition policy since 2014, when the twelve-year basic education commenced, as a financial checkup of this epoch-marking reform. To achieve the above purpose, this study compiles 135 private high schools’ final accounts, calculates the student and class unit costs in each school, and compares their magnitude of fiscal equity before and after the reform.

Table 1. Public and private high schools in Taiwan (2014-2015 SY)

Number	Total	Public	Private
school	503(100)	292(58.05)	211(41.95)
class	21,785(100)	12,418(57.00)	9,367(43.00)
student	818,869(100)	439,735(53.70)	379,134(46.30)
teacher	55,695(100)	36,367(65.30)	19,328(34.70)

Note: Numbers in parentheses are the percentages. Source: Ministry of Education (2017).

Table 2 Tuition schedule of high school students (2014-2015SY) Unit : NT\$

Programs	Public/ Private high schools	
	public	private
General Education	6,240	12,170-22,800
Vocational Education	5,400	13,220-22,530
	6,240	25,730-33,560
Practical Skill Training Program	5,400	13,220-22,530
Evening Session	3,700	13,220-21,230

Source: Ministry of Education (2017).

2. SCHOOL EDUCATION COSTS

This study adopts school education costs as the equity objects. When calculating school costs, it is imperative to determine what kind(s) of school expenditures should be counted in. There are four categories of expenditures for school daily operation:

- (1) The expenditures of teaching, referring to personnel expenditures (salary, fringe benefit, and retirement pension) for teachers, operating expenditures for teaching and learning activities, and teaching supplies purchase.
- (2) The expenditures of administration, referring to staff's personnel expenditures (salary, fringe benefit, and retirement pension), operating expenditures for school administration, and utilities.
- (3) The expenditures of software and hardware materials and equipment, referring to the expenditures on purchasing durable goods of school daily activities, such as teaching materials and equipment.
- (4) The expenditures of purchasing and improving school buildings or facilities, also named as capital outlay.

These four expenditure categories are equivalent to the daily operation of schools. However, when considering the daily practice of school operation, there should be priorities among these four categories: teaching expenditures should be in the top priority, administration expenditures the second, equipment expenditures the third, and school capital outlay the last priority.

2.1 The Inclusive Hierarchy Model (IHM) of School Education Costs

The Inclusive Hierarchy Model (IHM) of school education cost is thus developed based on the above four categories of school expenditures. IHM claims school costs is comprised of four components: the teaching costs, the current costs, the current and equipment costs, and total costs. Teaching costs should be the core of school expenditures. When teaching costs add in administration expenditures, it becomes the second layer, current costs. When current costs add in equipment expenditures, it becomes the third layer, current and equipment costs. When current and equipment costs add in capital outlay, it becomes the fourth layer, total costs. These four components are inclusively layered in sequence: the teaching costs are included in current costs, current costs are included in the current and equipment costs, and finally, the current and equipment costs are included in the total costs (Figure 1).

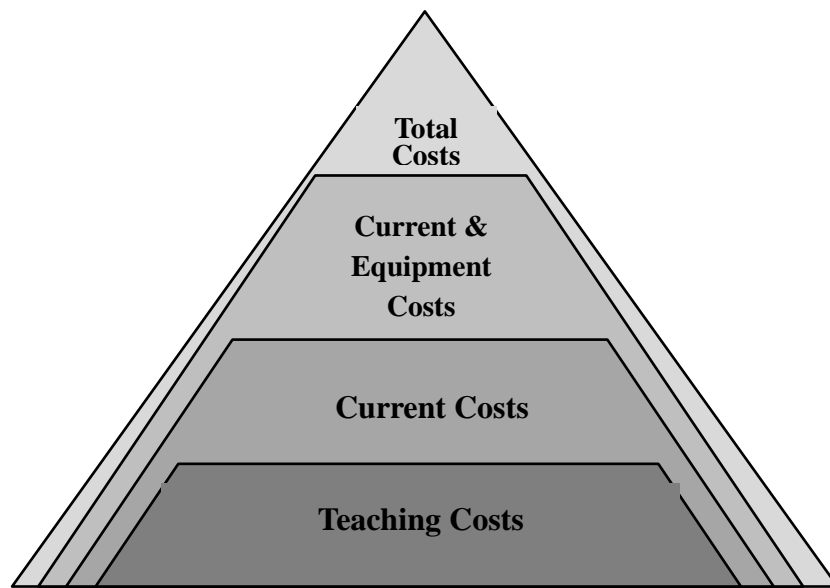


Figure 1. The hierarchy model of school education costs.

2.2 Adopting School Unit Cost as Equity Objects

When applying the IHM school costs model into the measurement of equity, there are eight equity objects for measuring fiscal equity.

2.2.1 Student unit cost

The student unit costs are the four layers school costs divided by the number of student in each school.

Per-student teaching costs = teaching expenditure/ number of student

Per-student Current costs = teaching expenditure+ administration expenditure / number of student

Per-student Current & equipment costs = teaching expenditure+ administration expenditure + equipment expenditure / number of student

Per-student Total costs = teaching expenditure+ administration expenditure + equipment expenditure + building expenditure / number of student

2.2.2 Class unit cost

The class unit costs are the four layers school costs divided by the number of class in each school.

Per-class teaching costs = teaching expenditure/ number of class

Per-class current costs = teaching + administration expenditure / number of class

Per-class current & equipment costs = teaching + administration+ equipment

expenditure / number of class

Per-class total costs = teaching + administration + equipment + building expenditure /
number of class

3. THE MEASUREMENT OF FISCAL EQUITY

In addition to equity objects stated above, there are several determinants to be discussed when measuring equity among private high schools in 2012 to 2015: equity principle, unit of analysis, means vs. medians, school grouping, and equity measures.

3.1 Equity Principle: Horizontal Equity

There are three equity principles for measuring fiscal equity: horizontal equity, vertical equity, and equality of opportunity (Berne & Stiefel, 1984). Horizontal equity principle claims equal treatment for equals. This principle states that students who are alike should receive equal shares. Equity is assessed by measuring the dispersion, or inequality, in the distribution in the objects; no dispersion indicates perfect equity. Vertical Equity principle claims unequal treatment for unequals. This principle states positive requirement that unequals receive appropriately unequal treatment. Equality of opportunity principle claims no correlation between education expenditure and “suspect factors”. This principle states that there should not be differences according to characteristics that are considered illegitimate, such as property wealth per pupil, household income, fiscal capacity, or sex.

Considering the essence of compulsory education with universal attendance and subsidization, this study adopts horizontal equity principle for measuring fiscal equity of private high school costs.

3.2 The Unit of Analysis: Student Unit /Class Unit

When measuring the equity of unit cost in each private high schools, the unit of analysis is another determinant to be decided. The equity objects we adopt, the unit cost per student and unit cost per class, are very sensitive to school/class size, i.e. varied by school/class size. Considering the high diversity of private high schools, this study adopts student and class as the units of analysis, instead of school unit, to avoid the effects of school size. When taking student as the unit, for example, the formula of mean is as follows:

$$\bar{X}_p = \frac{\sum_{i=1}^N P_i X_i}{\sum_{i=1}^N P_i}$$

(N=number of school ; P_i=number of students in ith school ; X_i=the unit costs of ith school)

3.3 The Means vs. Medians of Unit Costs of School

There are enormous differences among private high schools in terms of their school size and operating patterns. Some schools are operating under extremely high or low costs due to their situation. Considering the diversification among schools, this study compares both means and medians of unit costs when analyzing the trend of equity in the four years before and after reform.

3.4 School Grouping

There are basically two kinds of high schools in Taiwan: the six-year and the three-year high schools. The six-year high schools, enrolling student from 13 year old, are mostly college-bound. These schools usually offer advanced general education curriculum and abundant extra-curricular activities, to attract affluent students from higher socio-economic status families. The three-year high schools, including schools offering general education, vocational education, practical skill training program, or evening session, are traditional high schools with students from various family background. To examine the difference between these two groups, this study analyzes the equity of unit cost in these two groups.

3.5 Equity Measures

Horizontal equity principle states the pursuit for minimum dispersion among unit of analysis. In this study, the dispersion among school's unit cost is measured by a group of horizontal equity measure: mean, median, standard deviation, coefficient of variation, McLoone index, and Gini coefficient.

Coefficient of Variation is the ratio of standard deviation to the mean. The higher of ratio represents higher inequity.

$$\text{Coefficient of Variation} = \frac{SD}{\bar{X}}$$

McLoone index is the ratio of the actual sum of per-pupil objects for pupils below the

median to the sum of per-pupil objects that would exist if each pupil below the median were at the median per-pupil object.

$$\text{McLoone index} = \frac{\sum_{i=L}^J X_i P_i}{M_p \sum_{i=L}^J P_i}$$

Gini Coefficient shows how far the distribution of per-pupil object is from providing each percentage of pupils (e.g. 5 percent of pupils) with an equal percentage of object (e.g. 5 percent of expenditures); based on the Lorenz curve.

$$\text{Gini Coefficient} = \frac{\sum_{i=1}^N \sum_{j=1}^N P_i P_j |X_i - X_j|}{2 \left(\sum_{i=1}^N P_i \right)^2 \bar{X}}$$

P_i = number of pupils in district 1; N=number of schools; X_i=average revenue (expenditures) per pupil in school i; X_p=mean revenues per pupil per pupil for all pupils; M_p=median revenues per pupil for all pupils.

4. DATA

This study adopts 135 private high schools' annual final accounts, including revenues, expenditures, assets, and liabilities, from 2012-2013 SY to 2015-2016SY, the time before and after the basic education reform was implemented, as the database. Among the 135 schools, 75 of them are six-year high schools, and 60 of them are three-year high schools.

5. EMPIRICAL RESULTS

The free-tuition policy has been implemented since 2014. Could this high amount student subsidy policy change per-student and per-class unit costs of private high schools? Have the differences among schools been increased or decreased after the tuition subsidizing policy? Are there differences between the per-student and per-class unit costs in six-year and three-year high school?

5.1 Per-Student Costs and 4-year trend of fiscal equity among schools

5.1.1 Per-student costs in 2012 to 2015SY of total schools (n=135)

The means, medians and standard deviations of the four student unit costs in 135 private high schools from 2012-2013 to 2014- 2015SY are presented in Table 3. The average per-student total cost of private high schools in four year is NT\$76,360, which is consisted of teaching costs NT\$48,904, current costs NT\$66,230, and current and equipment cost NT\$70,364. There has been an increasing trend in the means and medians of per-student costs looking in four years.

When comparing the means with the medians of per-student costs in four years, the medians are much smaller than the means. The existence of per-student cost outliers in some schools makes the means exceed medians. Comparing standard deviation with means, the standard deviation is approximately half of means. The high standard deviation also prove the diversity of private high school finance (Table 3) .

Table 4 shows the magnitude of per-student costs in 2012SY to 2015SY measured by three horizontal equity measures: coefficient of variation, McLoone index, and Gini coefficient. The trends of equity improve for the first three years (2012SY to 2014 SY) and worsen in the last year(2015SY) when measured by coefficient of variation and Gini coefficient. However, McLoone index, which measures the ratio of students whose unit costs are below median, tells another story. Since the higher of McLoone index indicates higher degree of equality, the equity trend in four years measured by McLoone index are mostly improving , and the most equitable year shows in 2015. Some new regulations on private schools personnel expenditures accompanying with free-tuition policy, guarantee a certain benchmark teacher salary, thus raised schools' teaching costs.

Table3. Per-student costs of private high school (2012-2015SY)

Unit : NT\$

group		School number=135			
		Teaching costs	Current costs	Current & equipment costs	Total costs
measure	cost year				
Mean	2012	45,981	62,414	65,822	73,315
	2013	47,889	64,956	68,004	73,122
	2014	50,259	68,151	73,984	79,060
	2015	51,900	69,927	74,291	80,514
	4-yr mean	48,904	66,230	70,364	76,360
Median	2012	44,330	58,362	61,528	64,648
	2013	45,551	61,826	64,906	68,661
	2014	47,705	62,703	66,481	70,795
	2015	48,453	62,753	66,355	71,832
	4-yr mean	46,200	60,484	64,284	68,627
Standard deviation	2012	21,640	28,835	29,921	51,702
	2013	18,079	24,319	25,459	27,127
	2014	19,220	25,569	27,191	29,933
	2015	25,528	34,088	35,479	39,361
	4-yr mean	21,353	28,502	29,879	38,601

Table 4. Horizontal equity measures for per-student costs (2012-2015SY)

measure	group	School number=135			
	cost	Teaching costs	Current costs	Current & equipment costs	Total costs
	year				
Coefficient of Variation	2012	0.4706	0.4620	0.4546	0.7052
	2013	0.3775	0.3744	0.3744	0.3710
	2014	0.3824	0.3752	0.3675	0.3786
	2015	0.4919	0.4875	0.4776	0.4889
	4-yr mean	0.4366	0.4304	0.4246	0.5055
McLoone Index	2012	0.8437	0.8920	0.8895	0.8971
	2013	0.8635	0.8998	0.8975	0.8842
	2014	0.8665	0.8904	0.8975	0.8865
	2015	0.8691	0.9013	0.9023	0.8855
	4-yr mean	0.8617	0.8980	0.8901	0.8774
Gini Coefficient	2012	0.1421	0.1336	0.1355	0.1687
	2013	0.1371	0.1348	0.1353	0.1442
	2014	0.1370	0.1392	0.1455	0.1575
	2015	0.1502	0.1519	0.1545	0.1779
	4-yr mean	0.1442	0.1424	0.1465	0.1648

5.1.2 Per-student costs in 2012 to 2015SY in two groups of high schools

In order to examine the differences between the per-student costs in six-year and three-year high schools, Table 5 shows the means, medians and standard deviations of the four student unit costs in two groups of private high schools from 2012-2013 to 2014-2015SY. The average per-student costs of the six-year high schools are much higher than the three-year high schools. Teaching costs make the biggest differences among four kinds of costs, since the six-year high schools usually offer more fancy programs to attract students and tend to pay more to their teachers. There are also higher percentages of certified teachers in six-year high schools. In addition, the medians of the six-year high schools are also higher than the three-year school. This confirms the assumptions that enrolling students in their earlier age makes the six-year high school more competitive and affluent. However, the standard deviations of four costs in the six-year high schools are much higher than the three-year high school, implying there are significant differences among these schools.

Table 6 shows the horizontal equity measures, including coefficient of variation, McLoone index, and Gini coefficient of per-student costs in two groups of schools from 2012 to 2015SY. When comparing the overall magnitude of inequality in the two school groups, the six-year high schools show more inequitable than the three-year school group. The three-year high schools tend to be more homogeneous than the six-year school group. When comparing the magnitude of equality measured by coefficient of variation and Gini coefficient for two school groups in four years, consistent with the equity pattern of total schools (n=135), most of the highest inequality figures show in 2015, the second year after free-tuition policy was implemented. There are some exceptions, e.g., the current and equipment costs for the three-year schools reach to the highest inequality in 2014, due to a vast categorical grant plan for vocational high school equipment at that time. The magnitude of inequality measured by McLoone index in two school groups in four years show inconsistent patterns. Per-student teaching costs in both school groups have been becoming inequitable in four years.

Figure 2, 3, 4, & 5 display the Lorenz curve of per-student costs in 2012 to 2015SY. The four costs of the six-year high schools (portrayed with dotted lines) are further from the perfect equity line than the four costs of three-year high schools (portrayed with solid lines). When comparing the magnitude of inequality of the four costs, total costs rank the highest inequitable, current and equipment cost, current cost the next, and teaching costs is the least inequitable for six-year schools. The three-year high schools, with lower degree of inequality than six-year schools their counterparts, show a slightly higher equity in their per-pupil teaching costs. However, the three-year schools cannot be regarded as more equitable in teaching costs than the six-year schools, since they tend to pay less to teachers.

Table 5. Per-student costs in two school groups (2012-2015SY)

Unit : NT\$

group		6-yr. high schools				3-yr. high schools			
		Teaching costs	Current costs	Current & equipment costs	Total costs	Teaching costs	Current costs	Current & equipment costs	Total costs
measure	year								
Mean	2012	51,890	68,755	71,848	78,370	38,858	54,770	58,557	67,221
	2013	52,691	69,932	72,740	76,713	41,718	58,563	61,920	68,507
	2014	54,163	71,987	77,336	83,913	44,666	62,657	69,183	72,108
	2015	56,325	74,872	79,220	87,794	45,582	62,869	67,255	70,122
	4-yr mean	53,737	71,345	75,240	81,629	42,478	59,430	63,882	69,355
Median	2012	46,600	61,683	62,925	65,394	37,030	55,648	57,490	64,432
	2013	46,857	62,434	64,536	68,429	38,795	58,308	60,815	62,413
	2014	48,395	66,573	69,256	75,015	43,255	60,947	65,356	68,727
	2015	49,999	64,040	68,992	73,901	44,367	60,494	64,377	65,189
	4-yr mean	48,547	63,557	65,792	70,676	40,599	58,293	61,803	64,791
Standard deviation	2012	27,305	37,323	38,829	68,054	6,417	6,891	7,771	15,629
	2013	22,130	30,779	32,359	32,649	7,065	7,838	8,352	16,551
	2014	23,343	31,742	33,434	36,153	8,056	9,782	12,569	15,001
	2015	31,774	43,073	44,761	48,538	8,537	9,354	10,549	14,630
	4-yr mean	26,399	36,059	37,713	48,607	7,953	9,099	10,736	15,623

Note : the number of 6-year high schools : 2012SY n=75 , 2013SY n=75 , 2014SY n=76 , 2015SY n=77 。
the number of 3-year high schools: 2012SY n=60 , 2013SY n=60 , 2014SY n=59 , 2015SY n=59 。

Table 6. Horizontal equity measures for per-student costs in two school groups (2012-2015SY)

measure		group	6-yr. high schools				3-yr. high schools			
			Teaching costs	Current costs	Current & equipment costs	Total costs	Teaching costs	Current costs	Current & equipment costs	Total costs
cost year										
Coefficient of Variation	2012		0.5262	0.5428	0.5404	0.8684	0.1651	0.1258	0.1327	0.2325
	2013		0.4200	0.4401	0.4449	0.4256	0.1693	0.1338	0.1349	0.2416
	2014		0.4310	0.4409	0.4323	0.4308	0.1804	0.1561	0.1817	0.2080
	2015		0.5641	0.5753	0.5650	0.5529	0.1873	0.1488	0.1569	0.2086
	4-yr mean		0.4913	0.5054	0.5012	0.5955	0.1872	0.1531	0.1681	0.2253
McLoone Index	2012		0.9214	0.8979	0.9094	0.9108	0.9098	0.8854	0.9111	0.8718
	2013		0.9211	0.8850	0.8873	0.8830	0.9286	0.9030	0.9126	0.9298
	2014		0.9124	0.8557	0.8707	0.8601	0.8796	0.9036	0.9059	0.8840
	2015		0.8858	0.8764	0.8789	0.8573	0.8745	0.9234	0.9180	0.9260
	4-yr mean		0.9005	0.8825	0.8911	0.8752	0.8844	0.9031	0.9039	0.9059
Gini Coefficient	2012		0.1394	0.1600	0.1665	0.2007	0.0925	0.0697	0.0735	0.1192
	2013		0.1423	0.1668	0.1697	0.1666	0.0934	0.0717	0.0728	0.1067
	2014		0.1460	0.1670	0.1709	0.1805	0.1010	0.0857	0.0999	0.1092
	2015		0.1659	0.1887	0.1911	0.2079	0.1047	0.0800	0.0851	0.1034
	4-yr mean		0.1497	0.1720	0.1767	0.1936	0.1043	0.0828	0.0905	0.1120

Note : the number of 6-year high schools : 2012SY n=75 , 2013SY n=75 , 2014SY n=76 , 2015SY n=77 °
the number of 3-year high schools: 2012SY n=60 , 2013SY n=60 , 2014SY n=59 , 2015SY n=59 °

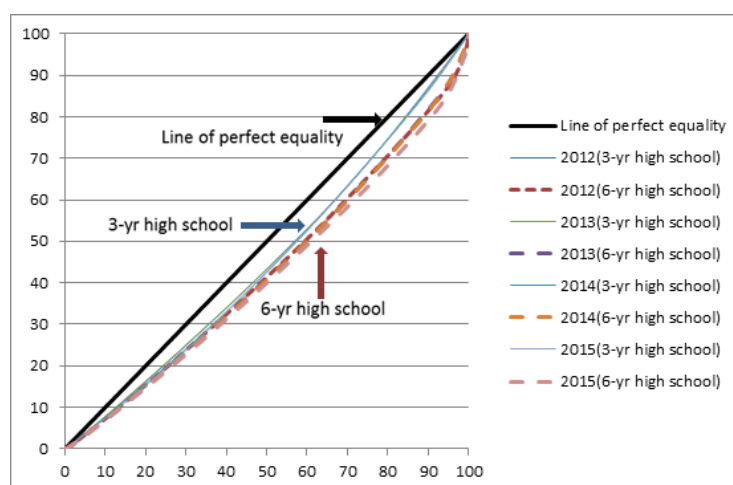


Figure2. Lorenz curve of per-student teaching costs (2012-2015SY)

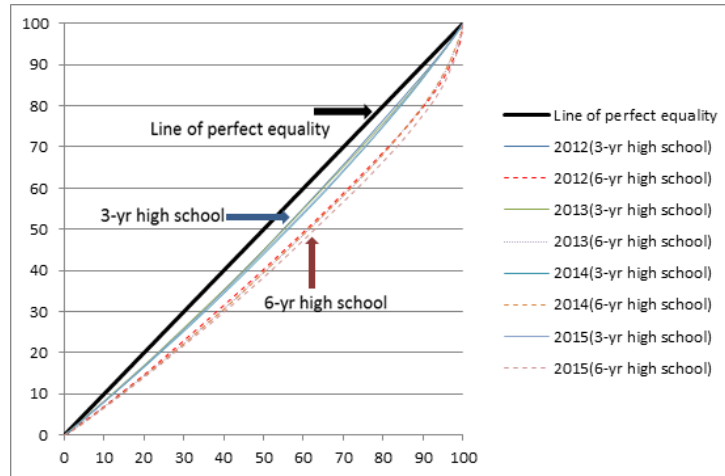


Figure 3. Lorenz curve of per-student current costs (2012-2015SY)

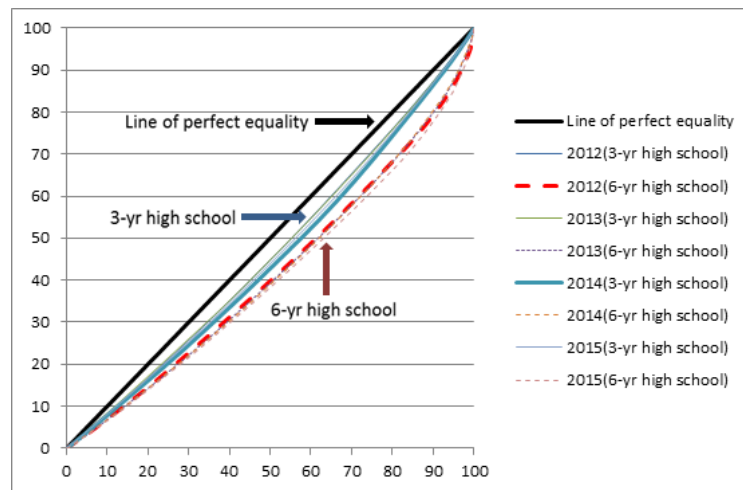


Figure 4. Lorenz curve of per-student current and equipment costs (2012-2015SY)

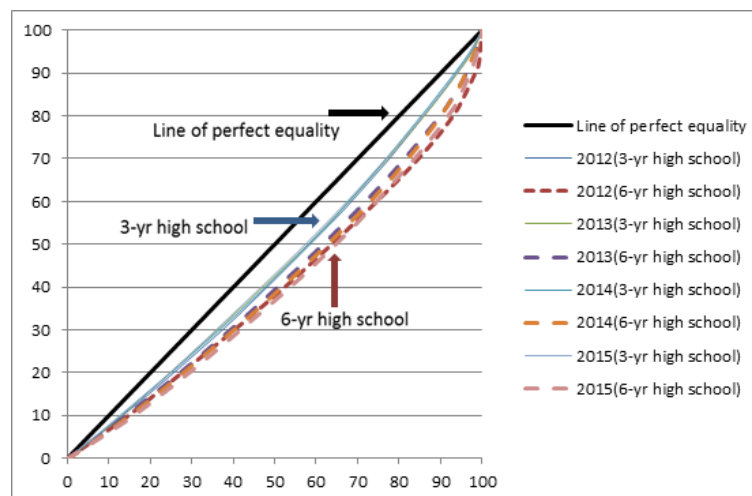


Figure 5. Lorenz curve of per-student total costs (2012-2015SY)

5.2 Per-Class Costs and the 4-year trend of equity

5.2.1 Per-class costs in 2012 to 2015SY of total schools (n=135)

The means, medians and standard deviations of the four class unit costs in 135 private high schools from 2012-2013 to 2014- 2015SY are presented in Table 7. The average per-class total cost of private high schools in four year is NT\$3,190,997, which is consisted of teaching costs NT\$2,043,628, current costs NT\$2,767,680, and current and equipment cost NT\$2,940,438. Median of per-class total costs of private high schools in four year is NT\$2,928,111, which is consisted of teaching costs NT\$1,994,020, current costs NT\$2,637,171, and current and equipment cost NT\$2,767,557. The differences between means and medians of per-class costs are much smaller than the differences between means and medians of per-student costs. Per-class cost is less likely to be influenced by class size, and make a better indicator for evaluating school financial situation.

The means of four class unit costs show an increasing trend in four years. The medians show increase only in 2012SY to 2014SY, but decrease in 2015SY, except teaching costs, which steadily increase for the whole four years. Austerity could have been happened in some less affluent schools in 2015SY despite the implementation of tuition subsidy policy since 2104. Some factors from policy environment, such as declining enrollment caused by demographic trend, could influence the schools' attitude of future financial investment. At the same time, standard deviations of per-class costs show an increasing trend in four years, except the total costs per class which has the highest diversity in 2012SY. The private schools tend to be more conservative in capital outlay after 2013-2104 school year.

Table 8 shows the magnitude of per-class costs in 2012SY to 2015SY measured by three horizontal equity measures: coefficient of variation, McLoone index, and Gini coefficient. The trends of equity improve for the first three years (2012SY to 2014 SY) and worsen in the last year(2015SY) when measured by coefficient of variation and Gini coefficient. The only exception is total costs, which is most inequitable in 2012SY. The pattern of equity trend for per-class cost is very similar to the equity trend of per-student costs. However, the equity patterns of four per-class costs in four years measured by McLoone index are mostly fluctuating. In 2015, even with new regulations on private high school teacher compensation, there still show a slightly decline of equity on per-class teaching costs.

Table 7. Per-class costs of private high schools (2012-2015SY) Unit: NT\$

measure	year	School number=135			
		Teaching costs	Current costs	Current & equipment costs	Total costs
Mean	2012	1,983,126	2,691,862	2,838,841	3,162,010
	2013	2,015,770	2,734,191	2,862,497	3,077,897
	2014	2,060,473	2,794,019	3,033,163	3,241,258
	2015	2,120,402	2,856,940	3,035,235	3,289,482
	4-yr mean	2,043,628	2,767,680	2,940,438	3,190,997
Median	2012	1,965,973	2,553,944	2,669,759	2,822,752
	2013	1,988,013	2,637,592	2,734,965	2,931,389
	2014	2,013,901	2,686,617	2,843,937	3,056,684
	2015	2,024,240	2,638,109	2,839,092	2,936,365
	4-yr mean	1,994,020	2,637,171	2,767,557	2,928,111
Standard deviation	2012	832,901	1,137,987	1,182,992	2,197,855
	2013	706,156	960,118	1,001,533	1,101,468
	2014	680,275	925,612	985,538	1,146,086
	2015	955,414	1,297,859	1,343,791	1,543,491
	4-yr mean	801,042	1,089,965	1,139,209	1,566,441

Table 8. Horizontal equity measures for per-class costs (2012-2015SY)

measure	group	School number=135			
	cost year	Teaching costs	Current costs	Current & equipment costs	Total costs
Coefficient of Variation	2012	0.4200	0.4228	0.4167	0.6951
	2013	0.3503	0.3512	0.3499	0.3579
	2014	0.3302	0.3313	0.3249	0.3536
	2015	0.4506	0.4543	0.4427	0.4692
	4-yr mean	0.3920	0.3938	0.3874	0.4909
McLoone Index	2012	0.7958	0.8562	0.8653	0.8587
	2013	0.8027	0.8385	0.8494	0.8313
	2014	0.8177	0.8442	0.8635	0.8327
	2015	0.8108	0.8211	0.8336	0.8373
	4-yr mean	0.8124	0.8477	0.8584	0.8440
Gini Coefficient	2012	0.1576	0.1474	0.1470	0.1862
	2013	0.1561	0.1473	0.1454	0.1594
	2014	0.1507	0.1461	0.1479	0.1652
	2015	0.1632	0.1595	0.1576	0.1883
	4-yr mean	0.1577	0.1507	0.1507	0.1757

5.2.2 Per-class costs in 2012 to 2015SY in two groups of high schools

In order to examine the differences between the six-year and three-year high schools, Table 9 shows the means, medians and standard deviations of the four class unit costs in two groups of private high schools from 2012-2013 to 2014-2015SY. The average per-class costs of the six-year high schools are much higher than the three-year high schools. Teaching costs make the biggest differences among four costs, since the six-year high schools usually offer more fancy programs to attract students and tend to pay more to their teachers. There are higher percentages of certified full-time teachers in the six-year schools than the three year schools. The three-year high schools, mostly offering diversified vocational education training programs, tend to hire more part-time teachers with practicing experiences. The medians of the six-year high schools' per-class costs are also higher than the three-year schools. Again, this confirms the assumptions that enrolling students in their earlier age makes the six-year high school more competitive and affluent. Also, the standard deviations of four costs in the six-year high schools are much higher than the three-year high schools, implying there are significant differences among these six-year schools.

In the six-year school group, there has been an increasing trend in the means of per-class costs in four years, but the medians of per-class teaching costs start to decline in 2014SY, while the other three per-class costs decline in 2015SY. On the other hand, the three-year high schools' means of per-class costs also show a steady trend in the first three years and decline in the last year, except per-class teaching costs which show an increasing trend in four years. The medians of four per-class costs decrease in 2015SY.

Table 10 shows the horizontal equity measures, including coefficient of variation, McLoone index, and Gini coefficient of four per-class costs in two groups of schools from 2012-2013 to 2015-2016SY. When comparing the overall magnitude of inequality measured by the three measures in the two school groups, the six-year high schools show more inequitable than the three-year school group. Consistent with the equity pictures in Table 6, the three-year high schools tend to be less inequitable than the six-year school group. When comparing these two school groups' magnitudes of equality measured by coefficient of variation and Gini coefficient in four years, the highest inequality figures show in 2015SY for the six-year high schools, while the three-year high schools show the highest inequity figure in 2014SY. The per-class costs of three-year school group become more equitable since 2014SY, cannot give total credit to free-tuition at the same time. More schools become more thrifty in spending, as the reaction to some changes, such as decline enrollment in student age cohort, in policy environment.

The trend of measured by McLoone index for per-class costs in the six-year high school group has been becoming equitable in four years. The trend in the three-year

school group, however, is worsening for per-class teaching costs when the other three costs are improving in 2015SY.

Figure 6, 7, 8, & 9 display the Lorenz curve of per-class costs in 2012SY to 2015SY. The four costs of the six-year high schools (portrayed with dotted lines) are further from the perfect equity line (45°) than the three-year high schools (portrayed with solid lines). When comparing the magnitude of inequality of the four costs, total costs rank the highest inequitable, current and equipment cost, current cost the next, and teaching costs is the least inequitable for six-year schools. The curves of these two school groups are slightly different: the curves of three-year high schools' costs are distributed evenly like new moon, while the curves of six-year high schools' costs are distributed proportionate much higher at the higher end. The figures improve the existence of outliers in six-year groups, and make the distribution of per-class costs more inequitable.

Table 9. Per-class costs in two school groups (2012-2015SY)

Unit : NT\$

measure	group	year	6-yr. high schools				3-yr. high schools			
			cost	Teaching costs	Current costs	Current & equipment costs	Total costs	Teaching costs	Current costs	Current & equipment costs
Mean		2012	2,260,318	2,994,924	3,129,676	3,413,770	1,656,147	2,334,365	2,495,768	2,865,029
		2013	2,252,501	2,989,540	3,109,560	3,279,413	1,722,078	2,417,401	2,555,985	2,814,346
		2014	2,280,485	3,030,941	3,256,172	3,533,096	1,764,710	2,475,525	2,733,372	2,848,938
		2015	2,377,783	3,160,745	3,344,311	3,706,271	1,780,435	2,455,653	2,626,985	2,738,958
		4-yr mean	2,292,175	3,043,249	3,209,377	3,481,912	1,728,429	2,418,215	2,599,380	2,822,070
Median		2012	2,136,893	2,702,110	2,819,814	2,904,570	1,635,417	2,351,143	2,552,060	2,752,359
		2013	2,173,524	2,748,715	2,851,413	2,981,825	1,778,328	2,462,175	2,523,546	2,836,853
		2014	2,166,051	2,815,387	2,961,957	3,251,443	1,802,520	2,531,247	2,670,026	2,757,727
		2015	2,161,994	2,772,596	2,916,408	3,219,818	1,786,711	2,531,741	2,634,288	2,704,451
		4-yr mean	2,166,051	2,767,363	2,893,813	3,076,094	1,744,016	2,463,591	2,601,926	2,732,518
Standard deviation		2012	1,009,066	1,434,203	1,496,354	2,856,211	336,749	400,113	437,700	861,733
		2013	814,190	1,172,540	1,231,595	1,241,997	372,969	422,553	442,732	844,226
		2014	768,584	1,099,898	1,168,423	1,331,434	371,789	453,100	533,850	654,062
		2015	1,155,366	1,611,968	1,671,402	1,874,863	390,208	440,704	456,243	594,668
		4-yr mean	948,228	1,343,626	1,406,443	1,936,851	370,762	432,147	476,486	751,445

Note : the number of 6-year high schools : 2012SY n=75 , 2013SY n=75 , 2014SY n=76 , 2015SY n=77 °
the number of 3-year high schools: 2012SY n=60 , 2013SY n=60 , 2014SY n=59 , 2015SY n=59 °

Table 10. Horizontal equity measures for per-class costs in two school groups (2012-2015SY)

measure		group	6-yr. high schools				3-yr. high schools			
			Teaching costs	Current costs	Current & equipment costs	Total costs	Teaching costs	Current costs	Current & equipment costs	Total costs
year										
Coefficient of Variation	2012	0.4464	0.4789	0.4781	0.8367	0.2033	0.1714	0.1754	0.3008	
	2013	0.3615	0.3922	0.3961	0.3787	0.2166	0.1748	0.1732	0.3000	
	2014	0.3370	0.3629	0.3588	0.3768	0.2107	0.1830	0.1953	0.2296	
	2015	0.4859	0.5100	0.4998	0.5059	0.2192	0.1795	0.1737	0.2171	
	4-yr mean	0.4137	0.4415	0.4382	0.5563	0.2145	0.1787	0.1833	0.2663	
McLoone Index	2012	0.8609	0.8821	0.8793	0.8899	0.8454	0.8533	0.8430	0.8182	
	2013	0.8373	0.8969	0.8614	0.8660	0.7974	0.8384	0.8652	0.7904	
	2014	0.8633	0.8586	0.8697	0.8394	0.8147	0.8361	0.8701	0.8595	
	2015	0.8812	0.8866	0.8901	0.8465	0.8218	0.8352	0.8650	0.8554	
	4-yr mean	0.8578	0.8683	0.8721	0.8589	0.8185	0.8408	0.8561	0.8414	
Gini Coefficient	2012	0.1467	0.1618	0.1655	0.2010	0.1150	0.0972	0.0981	0.1575	
	2013	0.1496	0.1653	0.1654	0.1647	0.1232	0.0991	0.0986	0.1414	
	2014	0.1434	0.1606	0.1640	0.1777	0.1178	0.1025	0.1082	0.1217	
	2015	0.1610	0.1805	0.1811	0.2083	0.1231	0.0994	0.0964	0.1155	
	4-yr mean	0.1509	0.1677	0.1701	0.1908	0.1215	0.1008	0.1024	0.1363	

Note : the number of 6-year high schools : 2012SY n=75 , 2013SY n=75 , 2014SY n=76 , 2015SY n=77 ◦
 the number of 3-year high schools: 2012SY n=60 , 2013SY n=60 , 2014SY n=59 , 2015SY n=59 ◦

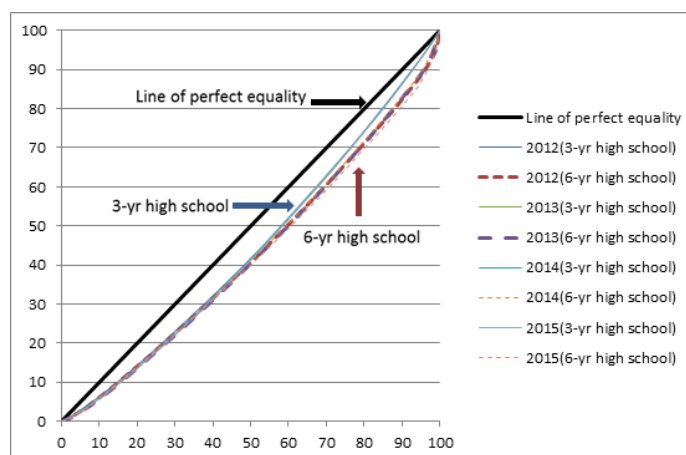


Figure6. Lorenz curve of per-class teaching costs (2012-2015SY)

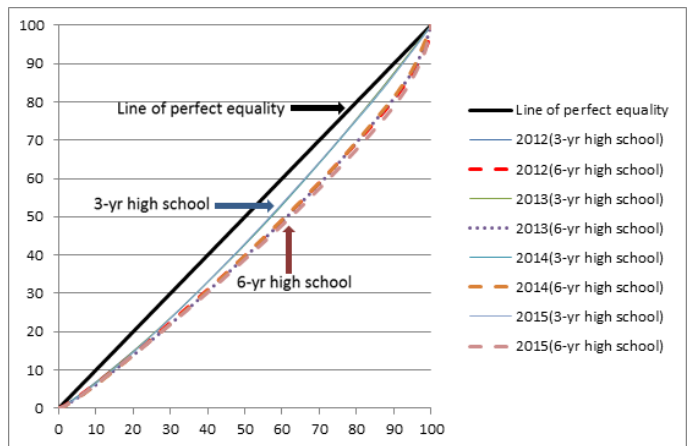


Figure 7. Lorenz curve of per-class current costs (2012-2015SY)

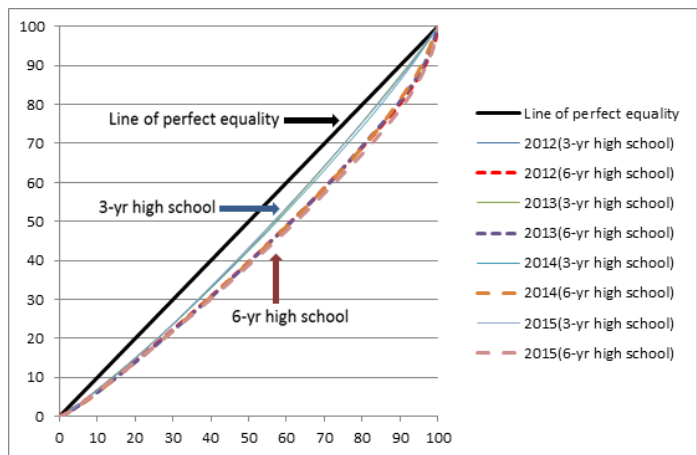


Figure 8. Lorenz curve of per-class current and equipment costs (2012-2015SY)

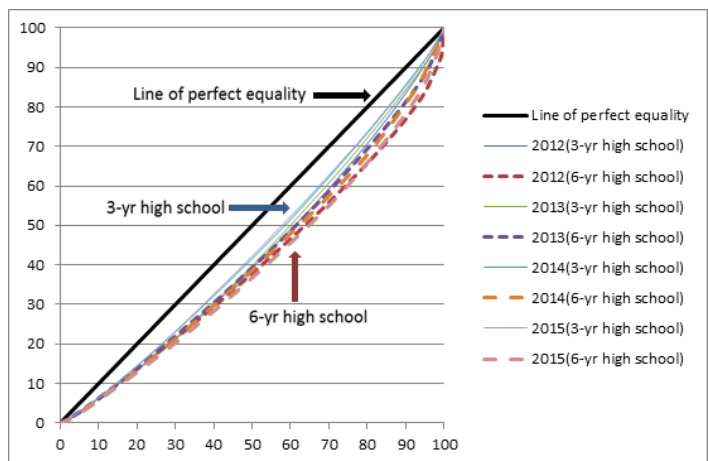


Figure 9. Lorenz curve of per-class total costs (2012-2015SY)

6. SUMMARY

This study explores the equalizing effects of the 2014 free-tuition policy on private high school finance in Taiwan. 135 private high schools' final accounts in 2012SY to 2015SY were compiled as the database. The Inclusive Hierarchy Model (IHM) of school education costs was developed to calculate per-student and per-class unit costs of each schools. Horizontal equity was adopted as the equity principle, since the prime policy goal of 2014 Basic Education Reform was claimed as equality of education opportunity. Dispersion measures, including mean, median, standard deviation, coefficient of variation, McLoone index, and Gini coefficient, were adopted as the equity measures.

This study generates the following findings:

1. For the total 135 private high schools, there has been an increasing trend for the means of per-student and per-class unit costs in 2012 SY to 2015SY. The medians of four costs also increase in the first three years, but decline in 2015SY. The standard deviations of per-student and per-class costs decrease after 2012SY, and increase in 2015SY. This universal subsidizing policy does raise school costs and reduce differences, thus equalize school costs in the first three years. But factors from current policy environment, such as the trend of declining enrollment in the coming years, make some schools become more thrifty in school spending, thus lower the median and increase the standard deviations of per-student and per-class costs in 2015SY.
2. The trends of per-student and per-class unit costs among total 135 schools equity have been improved from 2012SY to 2014SY, and worsened in 2015SY when measured by coefficient of variation, and Gini coefficient (Lorenz curve). The below-median schools' equity measured by McLoone index showed mostly improving trend for per-student costs and fluctuating trend for per-class costs in four years. The inconsistent equity results varied by measures in 2015 indicate the effects of free-tuition policy have been weakened by other factors from policy environment.
3. This study also compares two groups of schools: the six-year high schools from 7 to 12 grades and the three-year high schools from 10 to 12 grades. The means and medians of per-student and per-class costs in the six-year school group are higher than the three-year school group. Teaching costs make the biggest differences among four kinds of costs, since the six-year high schools usually offer more fancy programs to attract students and tend to pay more to their teachers. The standard deviations, coefficient of variation, and Gini coefficient of four costs in the six-year high schools are also higher than the three-year high school, implying there are significant differences among these six-year schools. The new matriculation regulations and curriculum of the 2014 Twelve-Year Basic Education Reform have made two school stratum, thus weakened equalizing effects of tuition subsidy policy.

The magnitudes of inequality measured by McLoone index in two school groups in four years also show inconsistent patterns. Per-student teaching costs in both school groups have been becoming inequitable and the other three costs show some improvement within four years. The trend of equity measured by McLoone index for per-class costs in the six-year high school group has been becoming equitable in four years. The trend in the three-year school group, however, is worsening for per-class teaching costs when the other three costs are improving in 2015SY.

4. Related policies with categorical grants earmarked on specified school spending can make a difference on school equity picture. For example, the three-year school group has been benefited by a mass of grants for school vocational training program since 2014, thus made their current & equipment costs increased dramatically.
5. Among the four levels of costs: teaching costs, current costs, current and equipment costs, and total costs, total costs have the highest inequality. However, the magnitudes of equity in four years are varied by levels of costs and school groups.
6. The equalizing effects of tuition subsidizing policy have limits. Among the four years, 2012 SY has the highest degree of inequality, especially on school capital outlay, when most private schools were optimistic toward future as they received ample grants for the first time. However, private high schools became financially conservative in spending when other factors form policy environment, i.e. upcoming declining enrollments, occur in 2015SY. Schools have to cut down costs to cope with new challenges even the subsidizing policy continues.

This study also makes some suggestions for future policymaking:

1. Per-class cost is less likely to be influenced by size, and makes it a better indicator for evaluating school financial situation. In addition to per-student spending released by Taiwan officials, per-class costs could be more accurate in portraying real situation in school finance. Long-term database and indicator performance can also provide valuable information for policymakers.
2. The cost gaps between three-year and six-year high school groups should be taken into account when making future high school education policies.
3. Private high schools have heavily relied on governmental funding since 2014 when free-tuition policy was implemented. This has jeopardized their financial independence and governance autonomy. Before making further subsidizing policy, a thorough and global scrutiny on private school finance structure should be the prime task.

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