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Valuing Medical Schools in Japan: National versus Private Universities

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Abstract

Medical school usually has the highest tuition fees among the university departments. The reason why students pay such expensive fees is that they estimate that their earnings will greatly increase after graduation. We construct a model about student behavior on entering college and estimate the value-added of medical schools using college data from Japan. Our results show that a school with a long tradition of providing high quality education is evaluated as rendering high value-added to students. Those empirical results enable us to simulate the effects of the privatization of a public university. This simulation indicates that there is no difference between public and private schools when the tuition fees of the public university become as high as those of the private university.

JEL: I21, L33

Keywords: Value-added of University, Medical school tuition fee, Public and private schools, Privatization

1. Introduction

Medical school usually has the most expensive tuition fees among the various

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schools in universities. For example, according to “Tuition and Student Fees, First-Year Medical School Students 2004-2005” by the Association of American Medical Colleges, average first-year student payments for medical school in the US, including tuition fee, amount to approximately US$35,000. In Japan, first-year students must pay 3,800,000 yen (or 37,000 US dollars, based on an exchange rate of $1=¥105). In comparison, the average university tuition fee in the US is about $2,100 for a public school and $20,000 for a private school. In Japan, a private school costs about 1,400,000 yen, whereas a public school costs about 800,000 yen. This example shows that medical school is extremely expensive compared to other fields of higher education.

A student who enters medical school is prepared to pay the requisite tuition fees because he or she expects the value-added from the school to outweigh its burden. The value-added components, including human capital accumulation and the development of human networks, directly increase the student’s income. The purpose of this paper is to measure how the student expects to gain from the school. The estimated value-added for each student can be used to evaluate the total value of medical education.

The evaluation of medical schools is important for the determination of social policies, not only when higher education is being considered, but also when decisions are made about the national medical systems, such as determining the total number of medical doctors, providing primary and secondary care network systems, and so on. However, as Schneider (2002) and Chun (2002) mentioned, it is not easy to evaluate value-added of higher education because their output is not clearly defined. In a recent work, Cawley et al. (1999) found there was a relation between wages and test scores but it has not only an intuitive and simple relation but also theoretical background.

Cawley et al. (1999) insisted that the test scores do not fit the measure of value-added. Yunker (2004) provided a method for measuring higher education in an accounting school. He defined the value-added as the difference between the observed records of accounting examination and the estimated scores. Spetz (2002) focused on the value-added for nursing education and showed that students chose higher education because of the advantages conferred by working positions or personal endowments.

In the present paper, we build upon the accumulated empirical results by proposing an economic model to measure the value-added of universities for each student and by conducting an empirical research. We use medical school tuition fees and data on school characteristics as independent variables to explain the difficulty level of the college. We consider that the difficulty level of the university reflects the student's effort level. Benjamin and Hersh (2002) mentioned that college rankings do not report the college value-added because the variety of output by universities creates ambiguities. However, in this paper, we avoid this ambiguity regarding outputs by focusing on medical school. Almost all students attend the medical school to become medical doctors.

The model clarifies the relationship between the difficulty level and the value-added of the medical schools, and formulates an estimable equation with observable data. The empirical result allows us to evaluate not only the value-added of the medical schools for each student, but also the total value-added of the school. Using the estimated value-added, we made a comparison of the public and private schools. This estimated relationship is useful for conducting a simulation study of the process of privatization of public schools. This simulation provides interesting information about the effects of university system reform in Japan. In 2004, all the national universities had an institutional change from directly managed entities to agencies that entrusted a university education.

This paper is organized as follows. Section 2 presents the model, section 3 describes the data set, and section 4 describes the results of the estimation and the simulation. Finally, section 5 concludes the paper.

2. The Model

Consider the model about a student's behavior toward the entrance examinations of a university. Suppose that a student has a utility function as follows:

$$U = H(w) - F(e). \qquad (1)$$

The function describes his or her utility from the consumption of ordinary goods and services H(w) minus the disutility F(e) arising from the effort to enter the medical school. The ideal combination of goods is represented by a quantity of w and a price of q. In addition, we incorporate all the costs incurred to pass the entrance examination of the medical school, including the cost of a preparation school and the time and effort involved in preparing for the examination. We refer to these as the "effort level", denoted by e. We assume that H(w) has a positive first order differentiation and a negative second order derivative. F(e) is assumed to have a positive first order derivative and a positive second order derivative. We assume that the probability of passing the entrance examination, p(e), depends on the student's effort level and that it is strictly increasing, $p' > 0, p'' < 0$. We assume that the student will earn a fundamental income, M, whether she attends the medical school or not. When he or she goes to medical school, an additional income, G, will be obtained, which we refer to as "value-added" in this paper. For example, a high quality education or the development of a human network with the graduates of the medical school will increase the student's wages. In other words, G represents the wage differences between the graduates of medical school and those of high school. Then, the student's budget constraint can be described as follows:

$$qw + p(e)C = M + p(e)G. \qquad (2)$$

Here, the school tuition fee is C.[1] The school tuition fee and the additional income G must be zero when the student does not enter the college. Solving (2) with w and substituting it into (1), we obtain the first order condition with e as follows:

$$\frac{H'(w)}{q}(G - C)p'(e) - F'(e) = 0\,. \qquad (3)$$

(3) can be rewritten as $\frac{H'(w)}{q}(G - C) = \frac{F'(e)}{p'(e)}$. Then, using the monotonicity of p'(e) and F'(e), there exists some value of e to satisfy the equation. We derive an equation of the effort level as follows:

$$e = h\left[\frac{H'(w)}{q}(G - C)\right]. \qquad (4)$$

The inverse function of $e = h[w, G - C]$ is equal to $\frac{F'(e)}{p'(e)}$. Taking this equation with the budget constraint (2), we find that:

$$p\left[h\left\{\frac{H'(w)}{q}(G - C)\right\}\right](G - C) + M = qw. \qquad (5)$$

The left-hand side of equation (5) is a strictly decreasing function of w. If M is a positive value, then there is one solution for w with a given $(G - C)$. By contrast, if the left-side of (5) is a strictly increasing function of $(G - C)$, then the consumption level w is described as a function of the value-added of the school and the school tuition fees,

[1] We can make the constraint with inequality. However, if the constraint does not bind, the student can enjoy an extra marginal unit of consumption goods, so we assume that the relationship holds with equality.

$w = W(G - C)$. Eliminating w from equation (4) of effort level, we obtain the reduced form of the effort level:

$$e = k(G - C). \qquad (6)$$

Then, the effort level e can be represented as a function of G and C. This means that the student effort level correlates positively with the value-added and negatively with the school tuition fees. In other words, when the value-added of the medical school is given, the student faces a trade-off between his or her effort level and the tuition fee.[2]

Now, let the difficulty level of the ith medical school, L_i, be a function of the student's effort level, so we set $L_i=L(e_i)$. The relation between the difficulty level and the student's effort is positive, because students have to study hard to enter a difficult school. Substituting (6) into $L(e_i)$, we obtain:

$$L_i = L\left[e(G_i - C_i)\right] = L(G_i - C_i). \qquad (7)$$

Then, we can see that the difficulty level is a function of the additional value of the school minus the school tuition fees. The added-value will increase the difficulty level while the school tuition fees decrease the difficulty level. We approximate (7) by a linear function:

$$L_i = \alpha + \beta(G_i - C_i) + \delta X_i, \qquad (8)$$

where α represents the minimum difficulty level. The differences in difficulty levels arise because of the gap between the value-added and the school tuition fees, converted by the parameter, β. The parameter β denotes the conversion factor from the cash based variables to the difficulty level. Other factors, like location or

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2 Research by Epple et al. (2004) supports this result. These authors constructed a theoretical and empirical model about student and school behavior, and then concluded that there was a negative correlation between school tuition fees and student ability.

environment effects, are included as δX_i.[3] In addition, we assume that the college difficulty level is zero when the benefits and costs of the school are equal and the environmental effects are zero. No student will expend any effort for zero additional income. Hence, the minimum difficulty level, α, becomes zero.

Next, we consider the value-added term, βG_i. We separate this term into two parts, an observable and an unobservable part. First, we represent βG_i as:

$$\beta G_i = \gamma_0 + \sum_{j=1}^{J} \gamma_j Z_{ij} + \varepsilon_i. \tag{9}$$

The term, $\sum_{j=1}^{J} \gamma_j Z_{ij}$, which is a linear combination of the observable factors of the value-added of the university i is observable, as is the constant term, γ_0. The other term ε_i, which is assumed to be an error term, represents the unobservable part. In the present paper, we assume that the error term, ε_i, has a normal distribution with a zero mean and a σ^2 variance.[4] Substituting (9) into (8), we obtain the equation below:

$$L_i = \gamma_0 - \beta C_i + \sum_{j=1}^{J} \gamma_j Z_{ij} + \delta X_i + \varepsilon_i. \tag{10}$$

Our assumptions about ε_i make the ordinary least squares method appropriate in the estimation of equation (10).

Finally, we estimate the value-added of the university, according to the estimated result of equation (10):

$$L_i = \hat{\gamma}_0 - \hat{\beta} C_i + \sum_{j=1}^{J} \hat{\gamma}_j Z_{ij} + \hat{\delta} X_i + e_i. \tag{11}$$

$\hat{\beta}$, $\hat{\delta}$, and $\hat{\gamma}_j$ (j=0,1,…J) are the estimated parameters of β, δ, and γ_j, respectively.

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[3] Strictly speaking, δX_i consists of several components. In our empirical analysis, we set $\delta X_i = \theta_0 + \sum_j \theta_j Y_{ij}$, where Y_{ij} is jth environmental factor of the ith school, for example the population of its district.

[4] It is not important to assume its mean zero because the constant term γ_0 adjusts the deviation of the mean from zero.

The residual of the estimation is represented as e_i. Substituting these estimated parameters into (9) and then considering an equation (8), we can derive:

$$\begin{aligned}\hat{\beta}G_i &= \hat{\gamma}_0 + \sum_{j=1}^{J} \hat{\gamma}_j Z_{ij} + e_i \\ &= L_i + \hat{\beta}C_i - \hat{\delta}X_i.\end{aligned} \tag{12}$$

Recalling that $\hat{\beta}$ is the conversion factor from the cash base unit to the difficulty level, we find the cash-based value-added of the college using the inverse of $\hat{\beta}$ from (12);

$$G_i = \frac{L_i + \hat{\beta}C_i - \hat{\delta}X_i}{\hat{\beta}}. \tag{13}$$

The denominator of (13) represents the modified difficulty level of the college where the school tuition fees and the environment effects are controlled. Measuring (13) allows us to compare the values between universities.

3. Data

In Japan, almost every student faces severe competition when attempting to enter a university.[5] It is especially difficult to enter medical school, more so than any other department. A student who was unfortunate enough to fail his or her entry exam must face preparing the exam the following year. It is not a rare phenomenon that a student will spend three or four years attempting to enter the university of his or her choice.

The only way for a student to become a medical doctor is to enter a medical school. According to the overview of the 2003 entrance exam, the highest competition rate for medical schools was about 40.0; that is, there is one successful candidate for every 39 failed students.[6] Because medical doctors get high incomes, students rush to take the

[5] This kind of phenomenon is observed in South Korea, China, and other Asian countries.
[6] The average competition rate for medical schools was about 12.1, and the lowest was

entrance examinations in medical schools. This high competition rate shows that excess demand exists for medical school.[7]

There are 79 medical schools in Japan, including public and private universities. Table 1 reports the summary statistics of our data. The degree of difficulty of entrance exams to medical schools was obtained from the *College Guide 2005,* a guidebook for colleges and entrance examinations in Japan. The data was based on the survey by *Sundai Preparatory School*, one of the most famous preparatory schools in Japan. Figure 1 compares the difficulty levels of medical schools. The highest difficulty level for a medical school entrance exam was for The University of Tokyo, which reached 71. The lowest level was 55 for Kawasaki Medical School. National universities were in the top ranks of the lists, with private universities following. Among the national universities, the previous imperial schools were ranked relatively higher. Of the private schools, two long-established schools, Keio University and Nippon Medical School, have higher difficulty levels.

School tuition fees were based on *Obunsha's Keisetsu Jidai*, which is a college guide in Japan. In Japan, medical schools have six-year courses, so we derive the school tuition fees as the sum of the admission charge and the course fees for six years. The admission charge is needed when a student enters university, whereas the course fee covers lecture fees and facilities expenses. There is no difference in tuition fees among the national schools; it costs 3,406,800 yen, which is the lower than the fees of private schools. Turning to the private schools, Kyorin University charges the highest tuition fees of 51,808,400 yen. The average fee among private schools is about 29

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about 4.8.

[7] The demand function has been observed in the US, originally by Sloan (1971) and recently by Quinn and Price (1998).

million yen.

The variables representing the medical school value-added are the pass rate of the national examination for medical practitioners, the year of establishment, the quota of the school, the dummy for previous imperial universities, the dummy for previous medical colleges, and the dummy for previous medical academies. It is important for students to pass the national exam for medical practitioners, so its pass rate indicates the quality of the school's education. The highest rate is 100% for Nagasaki University and Jichi Medical School. The lowest score is 78% for Dokkyo University's School of Medicine. The average pass-rate is about 91%. The establishment year represents the effect of school tradition. A school that has been established for some time will have accumulated well-organized curriculums, teaching materials, and human networks. These factors are beneficial for students. The quota of the college also affects the difficulty level, but its impact may be ambiguous. A smaller quota can have a positive aspect as it means students have fewer classmates and greater access to instruction from their professors. On the other hand, smaller quotas can have a negative effect as they mean that fewer alumni exist.

Dummy variables reflect the status of the medical schools before World War II. The status of medical schools is explained in Table 2. There were seven previous imperial universities, 10 previous medical colleges, and 29 previous medical academies before World War II in Japan. While all the previous imperial universities have become national universities, the previous medical colleges and academies have become both national and private schools. The dummy variables take a value of one for these schools and zero for other schools.

The previous imperial universities have a long history and have maintained their positions as headquarters of research and education since their foundation. Medical schools in Japan are strongly connected with hospital personnel. A school with a longer history has greater power over personnel issues than does a school with a shorter history. The students who graduate from the former type of schools obtain a relatively broad human network.

A previous medical college has an advantage for graduates because the medical colleges act as centers of medicine in their local areas. They are strongly connected not only to schools, but also to hospitals in the district. Therefore, a student who graduates from a previous medical college will find it easy to obtain a position.

The local population affects the difficulty of a school's exams because a student from an area with a high population faces stronger competition from rivals than do students in other areas. The data source on local population is the National Census from 2000. Tokyo has the maximum population and Tottori has the minimum.

4. Empirical results

4.1. Results of the estimation

The estimated results of equation (9) are shown in Table 3. First, we use all the candidates of the explanatory variables in the estimation. We call this model the "full model". Subsequently, we drop some variables that are statistically insignificant. We call this the "selected model". Despite of the cross-section data, our models are well fitted since the adjusted R^2 exceeds 0.800 in both of models. In the remaining sections, we discuss the implications arising from the selected model.

The coefficient of school tuition fees was -0.132 with 1% statistical significance. This results support our assumption that a student's effort level is negatively correlated with school tuition fees. The student makes a great effort to enter a school with low tuition fees. There are positive signs for dummy variables. Every coefficient of the dummy is statistically significant at 1%. The dummy for previous imperial schools is estimated to be 4.969 with a 1% level of significance. A rich tradition, a high standard of education, and a strong human network on a nationwide scale add value to students in previous imperial universities. The dummy for previous medical colleges has a positive sign. The difficulty level is raised 2.75 points by the medical college's status. The graduates will receive benefits from the medical college. The benefits are not only a high quality teaching system but also the human networks developed. It is observed that the difficulty level and the dummy for previous medical academies have a positive correlation. It is increased about 1.36 points. Its historical performance and education level are assessed but their influences are less than the previous imperial schools or the previous medical colleges.

The coefficient of the pass rate of the national examination for medical practitioners is estimated to be positive and significant. Because the pass rate of the national exam reflects the quality of the curriculum, a student whose school achieves a higher pass rate can accumulate greater human capital during his or her school days. The student is willing to make a greater effort and pay more to enter the school.

We estimate the coefficient of population as an environment factor. It is estimated to be positive with a 5% significant level. The results show that a school located in a larger population area has a higher difficulty level. This supports our assumption that congestion causes serious competition and raises the difficulty level.

4.2. Comparing value-added

Using the estimation results above, the value-added of a medical school can be measured by calculating equation (13). This formula is used to obtain the value-added in order to remove the effect of school tuition fees and the environmental influence from the difficulty level, and to adjust with the coefficient of school tuition fees. Figure 2 reports the results of value-added per student. The bars of national schools are colored gray while those of private school are colored black. The range of value-added is from about 430 million yen to 530 million yen. These values exceed the measurements of the lifetime wages of a hospital doctor by Arai (1998), who reported that the average wage was about 240 million yen. However, our results represent the average lifetime income of private practitioners, who earn much more than do hospital doctors.

The previous imperial schools have a high rank. The University of Tokyo, which has the number one ranking has been the center of research and education in Japan. A student improves his or her abilities by obtaining a high quality education in the school.

The previous medical colleges and academies form the group with the second highest ranking. As these schools were established before World War II, their long history is a major source of value-added for graduates. In contrast, a college established after World War II is given a lower scores than another public university because graduates from these new medical schools face a shortage of job opportunities because of their lack of human networks.

In addition, a student working in a hospital has an advantage because when he or she is faced with an obstinate disease patient, the student is allowed to transfer the patient to the related university hospital. The university hospitals of previous imperial schools and previous medical colleges have relatively greater facilities than other hospitals, a student who graduates these schools have more opportunities to cure disease than other student. This strongly connects to lifetime income for medical doctor.

Focusing now on the comparison between private and public schools, some private schools, like Keio University or Nippon Medical School, can offer a value-added that is very close to that of the previous imperial schools. These schools are the previous medical colleges with a long history. In addition, although Jichi Medical School was established relatively recently, it obtains a high ranking because its national examination pass rate is high. Although some schools have relatively high rankings, most of the private schools obtain relatively low rankings. The reason for this result is their expensive school tuition fees.

The aggregated value-added of medical schools is reported in Figure 3. The aggregated value-added is calculated as the product of the value-added per student and the quota of school. This value could be one benchmark that represents the contribution of the school in a year. The highest value is about 60 billion yen for Tokyo Medical College and the second highest is about 55 billion yen for Showa University. Both of these are private schools. Although these schools do not have a relatively higher student value-added, their quotas are higher than those of other schools. On the other hand, Kyoto University and the University of Tokyo follow the former private schools in terms of the aggregated value-added. From the point of view of the value of medical schools, the difference between public and private schools is smaller than the differences between value-added for students.

4.3. Simulation: Competition between national and private schools

In 2004, all the national universities changed their institutional system. Before the reform, they were directly founded and operated by the country. Subsequently, they became agencies entrusted with Japan’s university education. Under this system, the government has power to guide their tuition fees using subsidy policy. However, in the near future, it is expected that the universities will behave as private universities do, including setting the level of their tuition fees independently. Under the current institutional reforms, the national universities will not become private universities in the near future. However, as an extreme case, we should simulate the case where all the public schools are privatized. This simulation is important because it will shed light on the need for public schools in medical education. The value-added figures that were calculated in the previous section have important roles in this simulation. National schools will need to raise their tuition fees when the privatization occurs. Given our student behavior model in section 2, such a reform will cause the difficulty level of public schools to fall because of increasing tuition fees. The difficulty level of post-privatization schools is re-calculated in the following simulation. We assume that the public schools are required to increase their tuition fees to the average level of private school tuition fees when privatization occurs. The average private school tuition fee is 29,049,900 yen. In addition, we assume that all schools keep their value-added level before and after privatization.

The difficulty levels of post-privatization medical schools are reported in Figure 4. Following privatization, the highest difficulty level is achieved by Keio University, which is a private school. Because the student effort level decreases as the national school tuition fees are increased, the difficulty level of the national school decreases. Then, the private schools, especially Keio University, Nippon Medical School, and Jichi University are ranked in the upper levels. Further, the other private schools catch up with the national schools. Therefore, it seems that privatization will mean the difficulty levels of private and public universities will be equalized. For example, the rank-sum statistics for Figures 1 to 4 are 0.055, 0.027, -0.023, and 0.016, respectively. The absolute values of these statistics are close to zero, which means that the distribution of public and private schools is less biased. This shows that there are no advantages for the public schools after the privatization. In other words, the public schools will face more competitive student markets. At that time, their traditions are not so important, but their educational standard becomes more important.

5. Conclusion

This paper constructs a model that explains students' efforts to pass an entrance examination and then derives the value-added of medical schools using the estimated results of the model. This model shows a negative correlation between the difficulty level and the school tuition fees because students do not study hard to enter a school with high tuition fees. This prediction is supported by our empirical result that a student faces a trade-off between paying high tuition fees or a high effort level. The estimated value-added of medical school is consistent with Arai's (1998) estimation because, in contrast to Arai, our results include the income of private practitioner.

Comparing the estimated value-added of each school, we initially find that a student who belongs to a national school obtains a higher value-added than does a private school student. The long experience of the medical schools that were established before World War II give a higher value-added to their students.

A simulation for evaluating the privatization of national schools shows that a private school will achieve the highest post-reform value and that the difficulty level of private schools will be much closer to those of public schools. These results imply that the school tradition is still meaningful, but the quality of education is also important.

Finally, directions for future research should be noted. It would be possible to use our approach to evaluate colleges in other countries, such as South Korea and East Asian countries, where college entrance is based on an examination system similar to the Japanese system. Because of strong competition among students, the difficulty level of the entrance exam may represent the value of schools. Another possibility is the application of our approach to countries that do not have difficult entrance examinations, but do require hard study for graduation. In such a case, we could evaluate the difficulty level for graduation when applying our method of analysis.

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Table 1

Definition and summary statistics of variables

Variables (unit)	Obs.	Mean	S. D.	Max	Min
Difficulty level of entrance exam by Sundai Prep. Schc	79	63.84	3.41	71	55
School tuition fees (million yen)	79	12.93	13.27	51.80	3.41
Pass rate of national medical doctor examination (%)	79	0.93	0.04	1.00	0.78
Year of foundation (A.D.)	79	1961	11.50	1981	1949
Quota of school (person)	79	94.11	9.60	120	60
Population (Million person)	79	5.069	4.203	0.613	12.06

Note: Obs. means observations and S.D. means standard deviation.

Table 2

Types of medical colleges

The previous imperial universities	The previous medical colleges	The previous medical academies	The schools established after WWII
Hokkaido Univ.	Chiba Univ.	Sapporo Medi. Univ.	Asahikawa Medi. Coll.
Tohoku Univ.	Niigata Univ.	Hirosaki Univ.	Akita Univ.
The Univ. of Tokyo	Kanazawa Univ.	Fukushima Medi. Coll.	Yamagata Univ.
Nagoya Univ.	Kyoto Prefectural Univ. of Medicine	Gunma Univ.	Univ. of Tsukuba
Kyoto Univ.	Okayama Univ.	Tokyo Medi. and Dent. Univ.	Toyama Medi. and Pharm. Univ.
Osaka Univ.	Nagasaki Univ.	Yokohama City Univ.	Fukui Univ.
Kyushu Univ.	Kumamoto Univ.	Shinshu Univ.	Yamanashi Univ.
	Keio Univ.	Gifu Univ.	Hamamatsu Univ.
	The Jikei Univ.	Nagoya City Univ.	Shiga Univ.
	Nippon Medi. School	Mie Univ.	Shimane Univ.
		Osaka City Univ.	Kagawa Univ.
		Kobe Univ.	Ehime Univ.
		Nara Medi. Univ.	Kochi Univ.
		Wakayama Medi. Univ.	Saga Univ.
		Tottori Univ.	Oita Univ.
		Hiroshima Univ.	Miyazaki Univ.
		Yamaguchi Univ.	Univ. of The Ryukyus
		The Univ. of Tokushima	**Jichi Medi. School**
		Kagoshima Univ.	**Dokkyo Univ.**
		Iwate Medi. Univ.	**Saitama Medi. School**
		Juntendo Univ.	**Kitasato Univ.**
		Showa Univ.	**Kyorin Univ.**
		Tokyo Medi. Coll.	**Teikyo Univ.**
		Tokyo Women's Medi. Coll.	**Tokai Univ.**
		Toho Univ.	**St. Marianna Univ.**
		Nihon Univ.	**Kanazawa Medi. Univ.**
		Osaka Medi. Coll.	**Aichi Medi. Univ.**
		Kansai Medi. Univ.	**Fujita Health Univ.**
		Kurume Univ.	**Kinki Univ.**
			Hyogo Coll. of Medicine
			Kawasaki Medi. School
			Univ. of O.E.H.J.
			Fukuoka Univ.

Note: Private schools are written in **bold**.

Table 3

Estimation results for difficulty level of medical school with OLS

Estimation method	full model	selected model
School tuition	-0.131***	-0.132***
	(-6.226)	(-6.589)
Dummy for the imperial univ.	5.791***	4.969***
	(4.032)	(6.930)
Dummy for the medical college	3.533***	2.746***
	(2.665)	(4.706)
Dummy for the medical academy	2.063*	1.360***
	(1.901)	(3.220)
Passrate of national exam for medical practitioners	0.234***	0.236***
	(5.162)	(5.410)
Year of foundation	0.033	
	(0.683)	
Quota of university	0.004	
	(0.164)	
Population	0.135**	0.133**
	(2.222)	(2.234)
Constant	-23.809	41.582***
	(-0.251)	(10.186)
Observations	79	79
Adjusted R-squared	0.800	0.804

Note: t-ratios are in parentheses.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

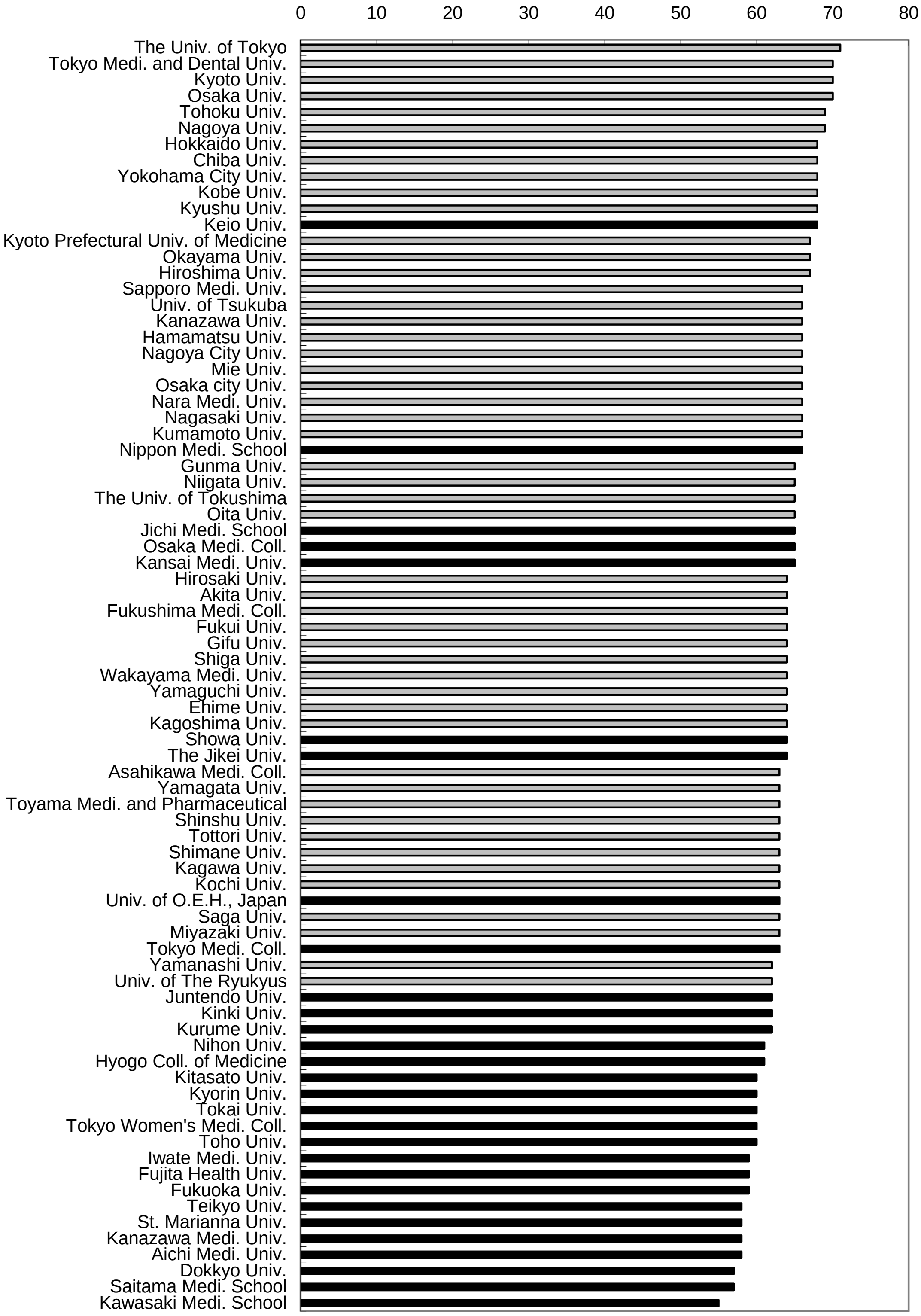

Fig. 1 Difficulty level of medical school

Note: Public schools are colored gray and private schools are colored black.

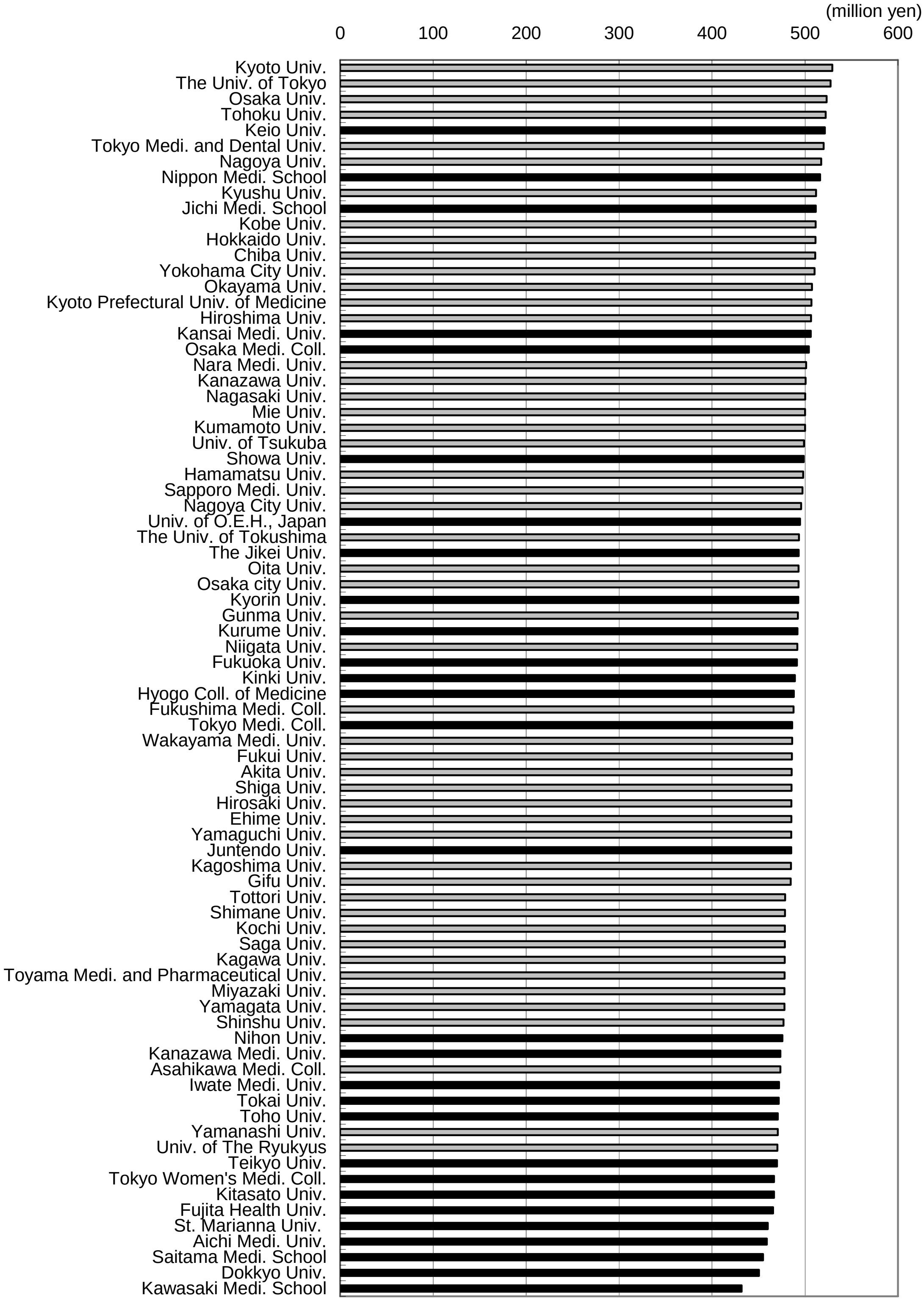

Fig. 2 Added-Value of medical schools per student

Note: Public schools are colored gray and private schools are colored black.

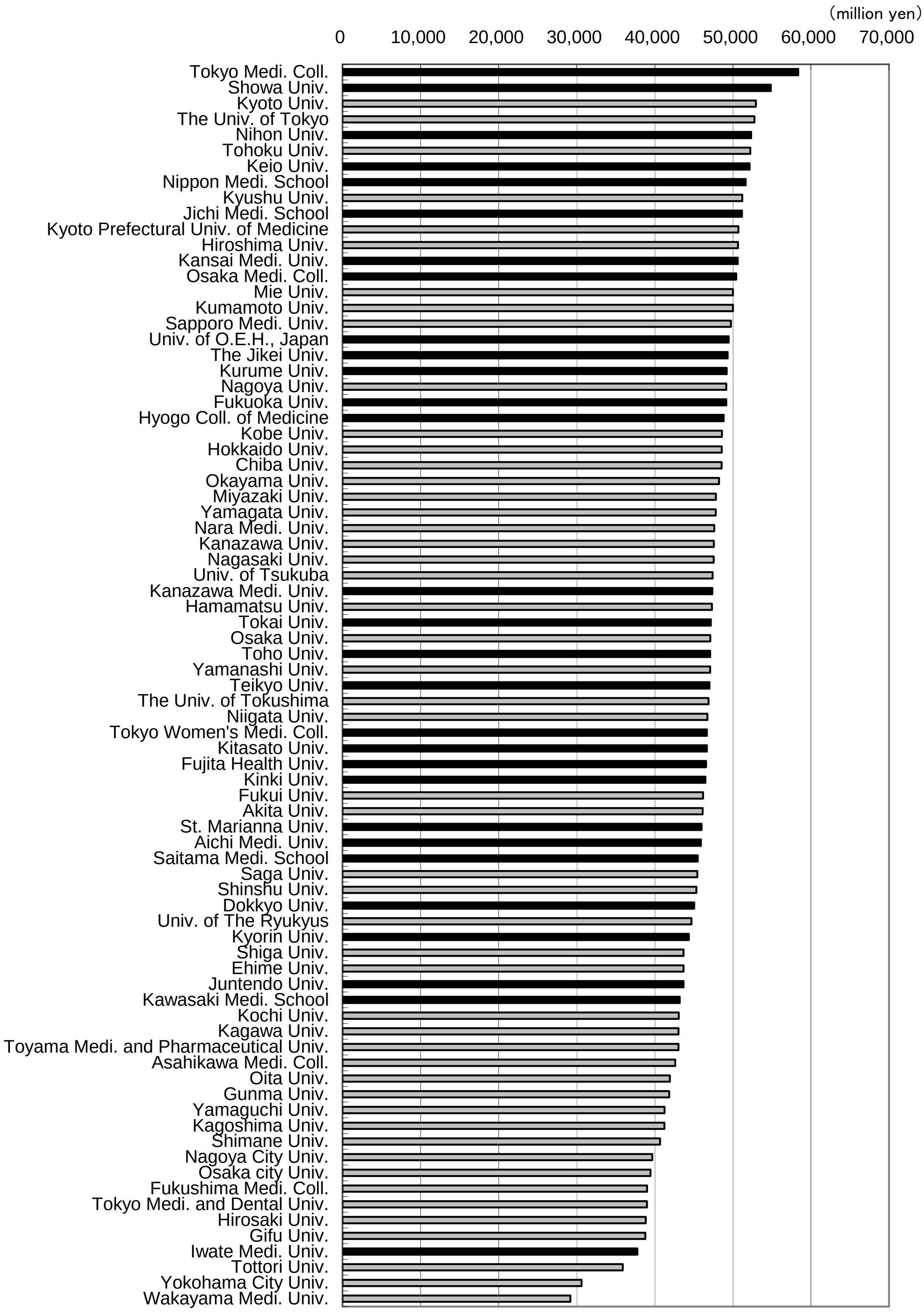

Fig. 3 Total Added-value of medical school

Note: Public schools are colored gray and private schools are colored black.

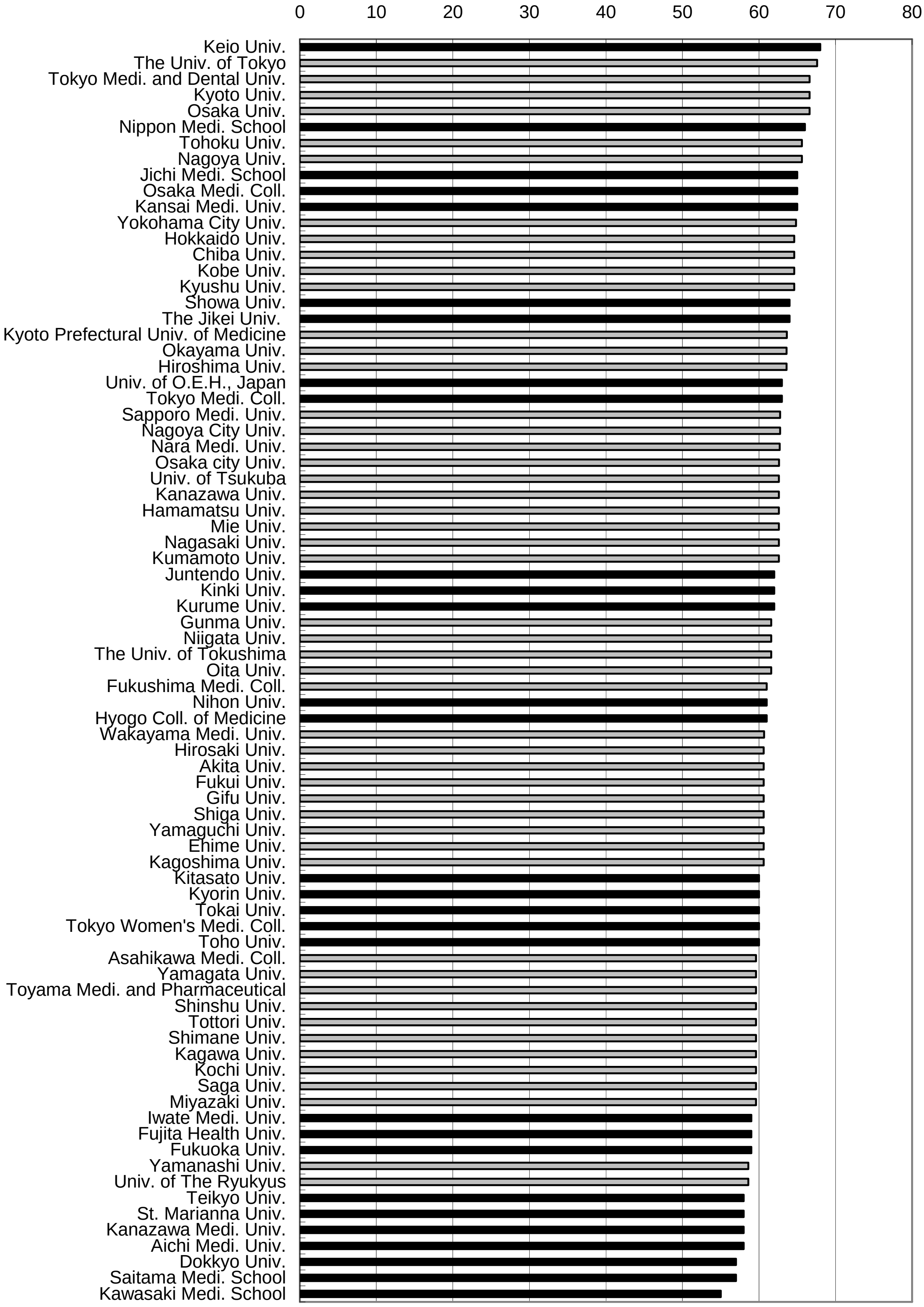

Fig. 4 Comparison of difficulty level of medical school after privatization: a simulation

Note: Public schools are colored gray and private schools are colored black.