The Impact of Learning and Living Environment of Colleges on Dropout Rates: A
Study Using Panel Data

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Abstract

This paper attempts to analyze how the learning and living environment of college affects the control of students' withdrawal and graduation within standard academic years, using panel data. The panel data analysis reveals the possibility that the conditions of the learning environment, such as the convenience of libraries provided by colleges and the ratio of instructors to students, have a certain effect on the control of dropout rates in addition to students' academic skills before college entry. This result suggests that there are differences in dropout rates and graduation rates between those colleges that have an environment to encourage motivation for learning and those that do not, even if their deviation scores are the same.

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Abstract

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1. Introduction

The percentage of high-school graduates advancing to higher education in Japan has increased dramatically in recent years. By 2009, more than 50% of new graduates had entered undergraduate programs, and the age of "one in two is a college student" had begun. The School Basic Survey of the Ministry of Education, Culture, Sports, Science and Technology (MEXT) reveals that the percentage of high-school graduates entering undergraduate programs in 2011 reached 56.7% (Fig. 1). As of August 2011, a total of approximately three million students were attending colleges.

An increase in the percentage of students entering higher education is a common tendency in many developed countries including the U.S. and U.K, which reflects increasingly important roles of higher education institutions in each country as education and research facilities amid globalization. In addition to providing technical knowledge and extensive education, universities are expected to develop skilled human resources capable of broad social, economic, and cultural interaction with a diverse mix of individuals in the international community while maintaining the culture of their own countries as the backbone.

Despite the growing expectations of society of higher education, however, various problems in ensuring the quality of higher education have recently been addressed in Japan, including students withdrawing from college and the extreme financial decline of universities attributable to enrollment falling.

The survey "*Daigaku No Jitsuryoku* ("The Capability of Universities" survey)" conducted in 2008 by the Yomiuri Shimbun was the first extensive study to ask nationwide public and private colleges about their student dropout rates, student graduation rates within the standard number of academic years, and other questions. The report indicated an average dropout rate of 2.5% and average graduation rate of 84.6% (The survey targeted 725 colleges in Japan excluding those that have only graduate schools, of which 499 colleges responded). [1] The Yomiuri Shimbun has been conducting the same survey annually since 2008. The average dropout rate during the four college years increased, although slightly, from 7.7% to 8.2% between the first survey in 2008 and the third survey in 2010.

Students leave college before completion for passive and involuntary reasons such as "financial difficulties" and "loss of motivation for education" in addition to positive and voluntary reasons such as "seeking overseas education" and "transfer to another college." The Basic Survey of School Corporations conducted by the Promotion and Mutual Aid Corporation for Private Schools of Japan in 2006 reported that 55,497 students had withdrawn from private colleges in 2005, comprising 2.9% of all college students. The reasons for their withdrawal included "change of academic path or

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[1] The Capability of Universities survey has been conducted by the Yomiuri Shimbun every year since 2008. In the fourth Capability of Universities survey in 2011, the number of respondents was 623 colleges and the response rate was 85%, both of which had increased from the previous year.

transfer to another college (21.0%)," followed by "financial difficulties (18.6%)," and "loss of motivation for education (14.2%)." In other words, in addition to economic reasons such as "heavy personal burden of education on households," "a gap separating the needs of students and the undergraduate education provided by colleges," exemplified by the poor connection between the educational curricula of high schools and colleges, has been indicated as a factor underlying the survey results above.[2]

These results suggest that the issue of dropouts involves problems of policies for equal educational opportunities and the governance of higher education institutions. Higher education institutions are expected to play important roles in preventing, to the highest possible extent, passive and involuntary withdrawal before completing a college curriculum and maximizing the intellectual activities and creativity of individual students. Consequently, the conditions of withdrawal in the past and their contributing factors must be examined based on reliable data.

According to the OECD (2010), the average dropout rate at higher education institutions—to be precise, the percentage of students who failed to earn the first academic qualification (e.g. a bachelor's degree) offered at higher education institutions within the standard academic years—in OECD countries in 2008 was 31%, whereas it was approximately 10% in Japan, a low level similar to the respective rates in Denmark and Belgium. This result contrasts to the high rates in the U.S. and New Zealand, which are 54.0% and 47.1%, respectively.[3]

The number of dropouts nonetheless has been increasing even in Japan in recent years. Chronologically following the result of subtraction of "the number of graduates after four years from the number of freshmen at four-year colleges" based on the School Basic Survey of each year to understand an approximate number of dropouts at higher education institutions reveals a substantial increase in the absolute number from approximately 25,000 of the 1990 freshmen to approximately 50,000 of the 2005 freshmen.

This increase is attributable in part to the drastic deregulation of college establishment in 1991, which markedly increased the number of colleges and students. Meanwhile, the considerable growth in the absolute number of dropouts between the 1990s and the latter half of the 2000s is an important issue, suggesting that Japan must seriously address such a trend. Approaches to the improvement of college education and research systems must also be considered.

Although some preceding studies of the causes of students' withdrawal and efforts to solve the problem have been developed in the U.S. and Europe, such research remains rarely reported in Japan. Particularly, an analysis using panel data of individual colleges over multiple years has yet to be

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[2] Obunsha Educational Information Center provides an overview of this survey in its 2005 report on the status of students' withdrawal from private colleges.
http://eic.obunsha.co.jp/resource/topics/0705/0503.pdf
[3] The Act Policy Report of Lotkowski et al. (2004) reported the analysis of the conditions and causes of students' withdrawal from colleges in the U.S in 1990s.

reported.

This study specifically examines the relationship between their learning and living environments and dropout rates. More specifically, the study examines the potential effects of development and improvement of learning and living environments, including learning and living support provided by colleges, on the reduction of dropouts based on panel data.

This article is structured as follows: First, Section II presents an overview of preceding studies that have analyzed the conditions of students' withdrawal from college and students' satisfaction with higher education and gives a summary of the characteristics of major factors that correlate with such conditions. Section III briefly describes data used for the analysis in this study. Section IV outlines the econometric model and estimated results. Section V concludes the study and presents future prospects.

2. Preceding studies

Some empirical studies of the conditions and causes of students' withdrawal from higher education institutions have already been made in the U.S. The analysis reported by Robbins et al. (2004) is significant for its statistical integration of the outcomes of previous studies using the method called meta-analysis to elucidate the overall tendencies. Rather than the dropout rates, the study specifically examines the college retention rates, which indicate the proportion of students remaining in their college after a certain period of time (often within one year after entering college) and analyzes the causes.

Robbins et al. (2004) points out that a significant correlation exists between the withdrawal of students themselves and the social economic status (SES) of their family. More specifically, students whose parents' income and educational background are high are more unlikely to withdraw from college. As in Japan, the heavy personal burden of higher education on households in the U.S. presumably causes the income of students' parents to affect the continuation of students' college education.[4] The analysis of Ishitani and DesJardins (2002) shows a significantly lower dropout rate of students receiving financial aid (scholarships) from the government or college than other students without financial aid. Development of systems to provide students with economic support is likely to contribute measurably to an increase in the college retention rates and a decrease in the dropout rates also in Japan. The econometric analysis used later shows devotion of attention to the scholarships provided to students as a variable to explain the dropout rates.

Robbins et al. (2004) also examined the effects of academic factors such as the students' academic performance before college, non-academic factors such as the students' campus activities and learning environment of colleges, and other factors, including the students' household income and

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[4] Tinto (2006) points out that a correlation between students' socioeconomic status and withdrawal is evident even at top ranking universities with high graduation rates.

their parents' educational background, on students' withdrawal from college (represented in the study by the college retention rate). The results suggest a tendency of the competence of students before or at the time of entering college represented by the scores of the American College Test (ACT) taken by college applicants, grade point averages (GPA) of freshmen, and other indicators to have a certain negative effect on students' withdrawal.

An interesting finding was that factors such as the students' motivation for learning, confidence in learning, habit of studying, and academic goals that would affect their learning process had a stronger negative correlation with students' withdrawal than their academic performance before and after entering college (Tinto (2006) reported similar analytical results).

Such importance of learning habits and motivation has also been indicated in Japan in an analysis performed by Yano (2009). Yano (2009) presented a hypothesis called "the effect of learning habits" and used the method of path analysis to verify the possibility that students' learning and reading experience during college years improve their learning and reading abilities in the workplace to affect their income positively. Colleges' efforts to help students develop their learning habits by improving their campus life environment and improving learning and living support are likely to have a significant effect on the reducing dropout rates.

In connection with the development of learning habits explained above, increasing students' satisfaction with campus life and education is an important measure. Oshio (2003) argued that, in addition to the aspect of investment as exemplified by human capital theory, education involves an aspect of consumption and suggested the potential of education as consumption to enrich life itself. In Australia, Athiyaman (1997) regarded students as "the consumers of educational services" and investigated the relation between the quality of educational services and students' satisfaction through factor analysis from the perspective of marketing. A major finding was the correlation of variables representing the quality of campus public infrastructure, including libraries, computer rooms, and recreation facilities, with student satisfaction.

This study also conducts analysis while particularly addressing variables considered in the series of preceding studies as factors to explain the dropout rates.

3. Data
3.1 Variables to be used

To perform an analysis that specifically examines the relation between the learning environment of colleges and their students' dropout rates, this study primarily uses data from yearly issues of the

Capability of Universities survey from the education reporting team of the Yomiuri Shimbun and the yearly issues of the *University Ranking* of Asahi Shimbun Publications.[5]

Table 1 presents definitions of variables used in the analysis the sources of data. In addition to the dropout rate of each college, a range of variables related to living and learning support are employed. Particularly because the availability of an environment that allows students to increase their motivation for learning is likely to have a certain correlation with dropout rates as indicated by Willcoxson (2010), variables such as "the number of instructors per student" and "the number of books borrowed per student" that are considered closely connected to the students' campus learning environment are used in the analysis.

Furthermore, the analysis has adopted variables related to "grants-in-aid obtained for scientific research" as the research level of a college is regarded as a factor to increase motivation for learning activities there.

As for living support, this study uses the colleges' own scholarships and loans or the percentage of students granted tuition discounts among all students as variables indicating the level of living support in response to the 2009 survey of the Yomiuri Shimbun, which asked respondents about scholarships and tuition discounts that had been adopted at the discretion of the colleges.

In addition, to the variable of "the number of instructors per student" above, a variable expressing the level of learning support provided to the students by the colleges is also developed. Although variables for learning support might be designed in numerous ways, this study is conducted particularly to assess the adequacy of curricula that might facilitate exchange with instructors and other students and encourage motivation for learning. For this reason, the questions related to learning support asked in the 2010 survey are used in the study. More specifically, the 2010 survey includes such questions as the following: 1 whether problem-based learning (PBL) or fieldwork-based classes are offered; 2 whether all senior students are required to attend seminars/laboratory classes; 3 whether a place for students' group study or discussion is available; and 4 whether classes to allow students' group study are offered. These questions are answered on a scale of four levels, from "implemented throughout the entire college", to "not implemented." This study accordingly converts the four-level assessment of each question into 0–3 points for a total learning support score of 0–12 points and studies the relation with dropout rates.

In addition, the study devotes attention to questions such as whether the college is public or private, whether it is an established institution founded before World War II or a new college, and

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[5] Colleges responding to the Capability of Universities survey of the Yomiuri Shimbun increased every year during 2008–2010. Of 725 institutions, 499 participated in the 2008 survey. Therefore, the response rate was 68.8%. In 2009, 529 colleges responded. In 2010, 592 colleges joined the survey.

whether a difference in standard scores makes a difference in dropout rates. Aside from the dropout rate indicator, the relations of the rate of standard year graduation that indicates the percentage of students who graduate within the standard academic years (basically four years for four-year colleges) with other indicators are also regarded as necessary.

We prepared our college panel data for three years during 2007–2009 by constructing a dataset of variables based on data presented in Table 1. As Table 1 evidences, however, the variables include three types—those for which data for the three years of 2007–2009 are obtainable, those for which data are available only for a single year, and those such as "the year of foundation" which do not change over time. Because variables such as "learning support scores" (2008) and "living support scores" (2009), for which data are available for only one year, are unlikely to change rapidly during one or two years, they are treated in this study as variables that do not change during 2007–2009 just as in the case of the "established university dummy (universities founded in and before 1950 are 1 and the others are 0)". In other words, the same "learning support score" and "living support score" apply to the same college for the three years during 2007–2009. Changes in the "standard scores" during the three years are also negligible. Therefore, the standard score data of 2009 are used also for the 2007–2008 college data. Meanwhile, panel data of "dropout rates," "the number of instructors per student," and "the number of books borrowed" can be prepared for three years. The panel analysis helps identify the effect of changes in "the number of instructors per student" and "the number of books borrowed" on the dropout rates.

3.2 Descriptive statistics of variables

Table 2 presents descriptive statistics of the variables used for all colleges, public colleges, and private colleges. Data of variables with missing values in Table 1 are excluded, and descriptive statistics are based on a sample of 491 universities and colleges in total. The number of colleges that responded to the *Capability of Universities* survey in all three years (2008–2010) in which it was conducted, however, are 305. This renders the panel data unbalanced, which demands some attention.

Table 2 presents that the respective percentages of dropouts during the freshman year and during the four years are 2.41% and 8.16% in total. Data by institutions of type reveal that the dropout rate for four years is 3.80% at public universities but it is high, 9.99%, at private ones. The rate of standard year graduation is 82.3% overall, and the rate for public universities is higher than that for private universities by an average of 3.8% points.

The number of instructors per 100 students is 7.9 overall. The figure for public universities is 11.8, which is higher than the 6.3 of private universities. The same tendency is shared by variables such as "learning support scores," "the number of books borrowed," and "standard scores." The living support scores represented by the "percentage of students who receive their college's own

scholarships or loans or are granted tuition discounts, however, suggest no significant difference between public and private universities.

College standard scores were made into four dummy variables representing the first to fourth quartiles, and the dropout rate [1 year], dropout rate [four years], and rate of standard year graduation of each quartile were observed. Those colleges for which standard scores are in the lowest 25% had the average dropout rate [four years] of 14.1%, which is more than 10% points higher than 3.7% of those colleges in the highest 25%. The rate of standard year graduation of the colleges shows the same tendency. Students' academic performance at the time of entering college has a significant correlation with their future withdrawal and graduation also in Japan.

Important factors in addition to the performance at the time of entering college are the learning environment of the campus and students' motivation for learning. Figure 2 exhibits, like the above, the dropout rates [1 year], dropout rates [four years], and the rates of standard year graduation of four dummy variables created for the first to fourth quartiles of the quantities of books borrowed per student per year. Those colleges at which the number of books borrowed is in the lowest 25% indicate the average dropout rate [four years] of 12.3%, which is approximately 6 percentage points higher than the 6.1% of the colleges in the highest 25%.

Consequently, colleges at which students frequently use libraries and where the learning environment and students' motivation for learning are seemingly at a high level tend to display low dropout rates and high rates of standard year graduation. These variables also have a positive correlation, although slight, with such indicators as "the number of instructors per 100 students" and "learning support scores." The next section accordingly estimates an econometric model to examine which indicators have significant correlations with dropout rates when these interested variables are incorporated into the explanatory variables of one another.[6]

3.3 Relation between learning environment and dropout/graduation rates

The following specifically examines "the number of instructors per 100 students," "living support score," "learning support score," "standard score," "the number of books borrowed," and "the number of grants-in-aid for scientific research obtained" that were developed in the previous section as variables closely related to campus learning environment and students' motivation for learning. Table 3 helps identify any significant difference in the "dropout rates" and "rates of standard year graduation" between the group with indicator values higher than the average and the group that is lower than the average.

As shown in Table 3, t-tests suggest correlations of variables, "the number of instructors per 100 students," "learning support score," "standard score," and "the number of books borrowed," with all

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[6] For all colleges, the four-year dropout rate increased from 7.8% to 8.3% and the graduation rate decreased from 84.2% to 81.3% during 2007–2009.

indicators, "dropout rate [1 year]," "dropout rate [four years]," and "rate of standard year graduation." Those colleges for which the "number of instructors per 100 students" is larger than the average, for instance, have a four-year dropout rate of 5.1%. Those colleges having fewer instructors than the average show a higher dropout rate of 9.3%. This difference is significant at the 1% significance level. Those colleges for which the "number of books borrowed" is larger than the average indicate a four-year dropout rate of 4.3%, whereas that of those below the average number of books borrowed is 8.9%, also presenting a significant difference at the 1% level.

Somewhat unexpectedly, the living support scores of colleges with the percentage of students provided with the colleges' own scholarships, loans, or tuition discounts higher than the average revealed the rate of standard year graduation of 81.7%, which is, although only slightly, lower than 82.5% at the colleges for which percentage of students provided with financial assistance is below the average. This difference is significant at the 10% significance level. The dropout rates, however, indicate no clear difference between the group with a high living support score and the group with a low score.

Such trends suggest the ability of those colleges with a high "number of instructors per 100 students," "learning support score," "standard score," "number of books borrowed," and "number of grants-in-aid for scientific research obtained" to limit their students' withdrawal from their education. The next section establishes verification hypotheses and performs panel data analysis to verify the reliability of the effect of these variables.

4. Econometric analysis

4.1 Establishing verification hypotheses

Using the college panel data described above, the relation between the development of learning environment and students' withdrawal is verified through econometric analyses. Four hypotheses are established in this case as specific verification hypotheses.

Hypothesis 1: The higher the academic performance of students is at the time of entering college, the lower the dropout rate.

As stated in earlier studies, students' levels of academic skills at the beginning of their college education are likely to have a strong correlation with their ability required later for the college curriculum. Skills acquired before college also presumably have a positive effect on students' motivation for learning in college. By regarding the "standard scores" as average academic skills of students at the time of college entry, this study confirms the relation of this variable with dropout rates and rates of standard year graduation to determine the validity of the hypothesis presented above.

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Hypothesis 2: The higher the students' motivation for learning is, the lower the dropout rate.

This study uses "the number of books borrowed per year" by students as an indicator of average "motivation for learning" of students on campus. One reason for setting up this hypothesis is an assumption that numerous highly motivated students gathering together would inspire other students to learn, thereby possibly deterring their withdrawal from college. Another conceivable mechanism is that efforts of colleges such as improving the quality of their libraries affect the students' motivation for learning. Results reported by Weiner (2008) demonstrated that the quality of libraries affected students' satisfaction with and evaluation of their campus life, and its relation with dropout rates is expected to be noteworthy.

Hypothesis 3: The better the learning environment is, the lower the dropout rate that can be expected.

Whether colleges actively provide their students with an environment that fosters their learning activities is an important perspective in considering the control of students' withdrawal. Those students who are forced to study at a college at which "each instructor teaches too many students" or where "there are no opportunities to take small classes such as seminars" are less likely to receive adequate learning support than those who are not in such a college, which might drive them to withdraw from college in some cases.

Considering "the number of instructors per 100 students" and the "student support score," this study examines whether high values of these variables are associated with a lower dropout rate by estimating the parameters of an econometric model.

Hypothesis 4: The greater the living support that is provided, the lower the dropout rate.

As exemplified at the beginning of this article by the survey by the Promotion and Mutual Aid Corporation for Private Schools of Japan, approximately 20% of students report "financial difficulties" as a reason for withdrawal from college. In Japan, the heavy personal burden of higher education on households is regarded as a problem, and life support provided to students such as colleges' own scholarships are expected to have a certain effect on the control of dropout rates.

This study incorporates the variable, "living support scores," into explanatory variables and estimates parameters to examine the validity of the hypothesis presented above.

4.2 Econometric model

This study employs the value resulted from Logit transformation of "dropout rates within 1 year (of college entry)" and "rates of standard year graduation" as explained variables to perform econometric analysis. Three models, i.e., a pooled OLS model, fixed effects model, and random effects model, are used as the econometric models, and the F test, Hausman test, and Breusch and Pagan test are performed to identify the most appropriate econometric model. The parameters of the estimation results from such a model will be examined. In addition, the sample will be divided between public and private institutions to confirm the reliability of the estimation results.

4.3 Estimation results

Dropout rates

Table 4 exhibits results of panel data analysis of all colleges, public colleges, and private colleges using "dropout rates within 1 year (of college entry)" as the explained variable. First, an F test was performed after estimating the fixed effects model in all estimation cases, and the test hypothesis that "all coefficients of individual dummy variables are zero" could not be rejected. A Breusch and Pagan test was performed after estimating the random effects model, and the test hypothesis that "the variance of fixed effects is zero" could not be rejected. The result is that a fixed effects model and random effects model are more appropriate than a normal pooled OLS model. Accordingly, the null hypothesis that the fixed effects of individual colleges are uncorrelated with the explanatory variables was tested using a Hausman test. The estimation results of the fixed effects model are presented if the null hypothesis was rejected and the fixed effects model was adopted, and the estimation results of the random effects model are shown if the null hypothesis was not rejected and if the random effects model was employed.

Table 4 reveals the following findings. First, overall, "the number of instructors per 100 students," "the number of books borrowed," and "grants-in-aid for scientific research dummy" were negatively significant at a 1% significance level. In other words, colleges with high scores of these indicators that are regarded as affecting students' motivation for learning have the tendency that the dropout rate is low even when other variables are controlled. Consequently, positive significance at 1% level of the "standard score first quartile dummy" and "standard score second quartile dummy" and their connection with students' academic skills before and within one year from college entry were confirmed.

Secondly, the estimation results with separation of public and private colleges were observed. The estimation for public colleges indicate, like the overall estimation result, negative significance of "the number of instructors per 100 students," "number of books borrowed," and "grants-in-aid for scientific research dummy" whereas the dummy variable for "standard score" was not significant. In the estimation for private colleges, however, certain explanatory variables were removed throughout the points in time because a fixed effects model was adopted, and "the number of instructors per 100

students" and "grants-in-aid for scientific research dummy" were negative and significant. Consequently, the possibility that the quality of education and research environment engenders control of dropout rates was suggested in cases of both public and private colleges.

Thirdly, such variables as "living support score" and "student support score" did not have a significant effect on dropout rates. Regarding life support, students benefiting from their colleges' own scholarships, loans, and tuition discounts are limited to slightly less than 10% in both public and private colleges in this study's data, which implies that the level of support is not necessarily adequate. Although no significant correlation between the level of scholarship systems and dropout rates is evident as of now, various efforts of colleges to support their students' campus life are expected to have a controlling effect on their dropout rates. Their policies must therefore be monitored from now on.

Herein, we provide an overview of major estimation results, which validate Hypotheses 1 and 2 and a part of Hypothesis 3 of the verification hypotheses in the preceding section. Particularly the possibility that variables such as "the number of books borrowed" and "ratio of instructors to students" that change over time affect the control of dropout rates should be emphasized. Studies in the U.S. and Europe such as those of Cragg (2009) and Weiner (2008) demonstrated a positive effect of the variables, "the number of books borrowed" and "ratio of instructors to students," on college retention rates. In Japan, too, the importance of improving campus learning environments has been suggested. These variables are related to the degree to which "learning opportunities" that students themselves find in their campus life exist. Experiencing the joy of learning conceivably increases the satisfaction of individual students with their campus life and education, leading to lower dropout rates of the entire college.

Rate of standard year graduation

The results of panel data analysis regarding the rate of standard year graduation are presented in Table 5. Because a random effects model was selected in all cases of overall, public, and private colleges based on Hausman tests, the estimation results of the model are presented.

Table 5 presents negative significance at the 1% level of "the number of instructors per 100 students" and "the number of books borrowed" in the overall sample. It is particularly interesting however, that the "grants-in-aid for scientific research dummy" caused negative significance at 1% level, implying a tendency of those colleges that, for being more research-oriented than others, have the number of grants-in-aid for scientific research higher than the median have a lower percentage of students graduating within standard academic years. This tendency persists even when the sample is divided between public and private colleges.

Considering that the "grants-in-aid for scientific research dummy" is negatively significant in the estimation of dropout rates, research-oriented institutions might tend to have more students than

other colleges who repeat a year but who graduate without dropping out. Although exactly how such a tendency should be evaluated poses a difficult question, the authors consider that controlling dropout rates should be prioritized over raising the rates of standard year graduation. Therefore, the characteristics of research-oriented universities described above should not necessarily be regarded as an alarming matter.

The "standard score first quartile dummy" was significant at the 1% level only in the case of private colleges. This suggests the possibility that standard scores do not affect dropout rates and the rates of standard year graduation in public colleges, in contrast to the case of private colleges.

5. Conclusion

This study has specifically addressed the issue of the increasing number of dropouts in higher education and examined, using panel data, how the learning and living environment of college affects the control of students' withdrawal and graduation within standard academic years.

The estimation results of econometric analysis reveal that "deviation scores" used as the proxy indicator of students' academic skills at the time of college entry have a strong effect on the dropout rates. Students who have been targeting entrance exams notice after entry that "learning" in college differs from their prior education. Students who have been studying continuously in elementary school and junior and high schools are most likely more adaptive to the academic settings of the college than those who have not. More importantly, however, the analysis in this study has indicated the possibility that the conditions of learning environment provided by colleges have a certain effect on the control of dropout rates in addition to the academic skills before college entry.

The negative correlation of such variables as "the number of books borrowed" and "ratio of instructors to students" that illustrate the students' motivation for learning and the quality of campus learning environment with dropout rates even when other variables are controlled suggests that the opinion that "students who withdraw from college without learning are already determined based on their academic skills at the time of entry" is a simplistic idea.

Finally, we describe the challenges in this study. First, whereas the data on "the number of instructors per 100 students" and "the number of books borrowed per year" were used as variables to explain the learning environment, there are other variables that are considered important in describing the college learning environment. Therefore, continuous efforts to identify factors that are effective in controlling dropout rates from a range of perspectives are necessary.

In the analytical results presented this time, the variables for "life support" and "learning support" showed no significant correlation with "dropout rates" and "rates of standard year graduation." As demonstrated by prior foreign studies, effective "life support" and "student support" are nonetheless likely to increase students' motivation for learning and to reduce dropout rates substantially. *The Capability of Universities* survey of the Yomiuri Shimbun and *the University Ranking* of Asahi

Shimbun used for this study assess the "life support" and "learning support" of each college and university from diverse perspective*s* ever year. Using different approaches to analyze the quality of these indicators carefully might therefore produce results that differ from those obtained from this study. The study in this respect remains as a future task for the authors.

Reference

Athiyaman, A. (1997) "Linking student satisfaction and service quality perceptions: The case of university education," *European Journal of Marketing*, Vol.31, No.7, pp.528–540.

Cragg, K. M. (2009) "Influencing the Probability for Graduation at Four-Year Institutions: A Multi-Model Analysis," *Research Higher Education*, Vol.50, pp.394–413.

Dey, E. L and Astin, A. W. (1993) "Statistical Alternatives for Studying College Student Retention: A comparative Analysis of Logit, Probit, and Linear Regression," *Research in Higher Education*, Vol.34, No.5, pp.569–581.

Hartog, J. and Oosterbeek, H. (1998) "Health, Wealth and Happiness: Why Pursue a Higher Education?" *Economics of Education Review*, Vol.17, No.3, pp.245–256

Ishitani, T. T. and DesJardins, S. L. (2002) "A Longitudinal Investigation of Dropout from College in the United States," *Journal of College Student Retention*, Vol.4, No.4, pp.173–201.

Lotkowski, V. A., Robbins, S. B. and Noeth, R. J. (2004) "The Role of Academic and Non-Academic Factors in Improving College Retention," ACT POLICY REPORT, pp.1–31.

Michalos, A. C. (2008) "Education, Happiness and Wellbeing," *Social Indicators Research*, Vol.87, No.3, pp.347–366.

Noddings, N. (2003) *Happiness and Education*, Cambridge University Press.

OECD (2007) *Understanding the Social Outcomes of Learning* OECD Publishing.

OECD (2010) *Education at a Glance*, OECD Publishing.

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., and Carlstrom, A. (2004) "Do psychosocial and study skill factors predict college outcomes? A meta-analysis," *Psychological Bulletin,* Vol.130, No.2, pp.261–288.

Oshio, T. (2003) "*Kyouiku Wo Keizaigaku De Kangaeru* (Consideration of education in terms of Economics)." Nippon Hyoron Sha. (Japanese)

Tinto, V. (2006) "Research and Practice of Student Retention: What Next?," *Journal of College Student Retention*, Vol. 8, No.1, pp.1–19.

Weiner, S. (2008), "The Contribution of the Library to the Reputation of a University," *The Journal of Academic Librarianship*, Vol.35, No.1, pp.3–13.

Willcoxson, L. (2010) "Factors affecting intention to leave in the first, second and third year of university studies: a semester-by-semester investigation," *Higher Education Research & Development*, Vol.29, No.6, pp.623–639.

Yano, M. (2009) "Education, Labor and Society" *The Japanese Journal of Labor Studies* No. 556. 5–15 (Japanese)

Figure 1: Changes in the percentage of high school graduates going to college

(Note) Figures include high school graduates in past years
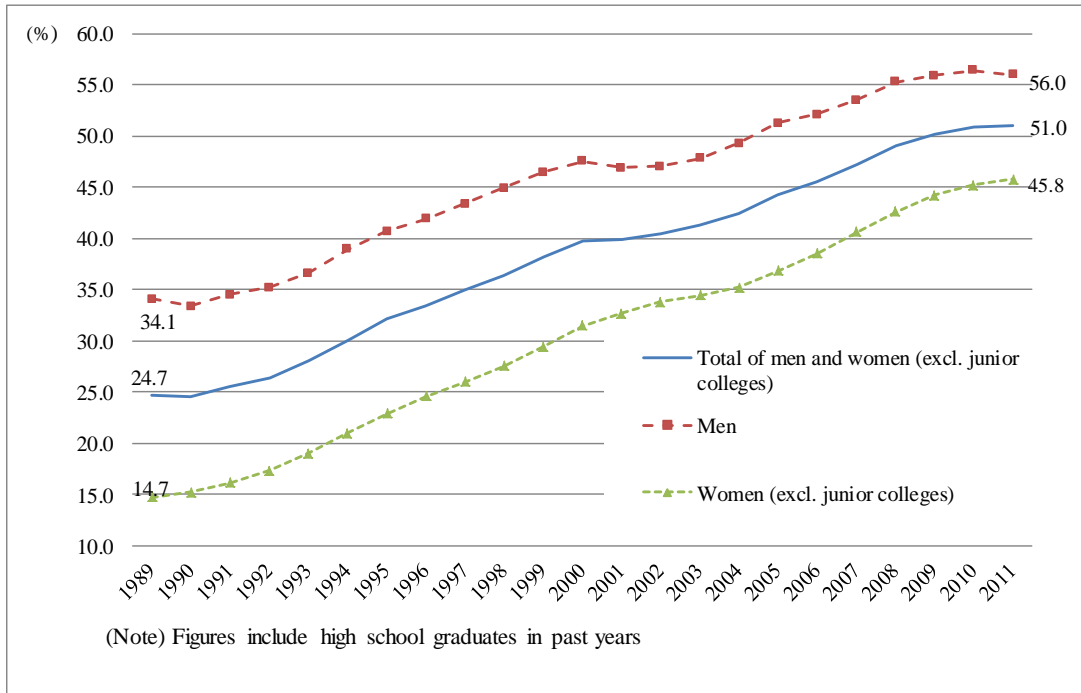
(Source)   MEXT, School Basic Survey

Table 1: Definitions of variables used and sources of data

Variable Name	Definition	Year	Source
Dropout Rate (1 yr)	% of dropouts within 1 year from entry	2007-2009	*Capability of Universities* 2008 - 2011, Yomiuri Shimbun,
Dropout Rate (4 yr)	% of dropouts within 4 years from entry	2007-2009	Id.
Rate of Standard Year Graduation	% of students graduated in 4 years	2007-2009	Id.
# of Instructors per 100 Students	# of full-time instructors/# of students	2007-2009	*Capability of Universities* 2008 - 2011, Yomiuri Shimbun
Living Support Score	(# of students provided with college's own scholarships, loans, or tuition discounts)/# of all students	2008	Id.
Learning Support Score	Assessed each of (1) PBL, (2) seminars/labs, (3) place for group study, and (4) group study classes on a scale of 0–3	2009	Id.
Deviation Score (Quartile Dummy)	Average deviation score of all faculties and departments. Prepared 4 dummy variables (1st quartile dummy to fourth quartile dummy) depending on the value	2009	Sundai preparatory school, *2010 Target Line for Success*
# of Books Borrowed	# books borrowed by students per year/# of students	2007-2009	Asahi Shimbun, *University Ranking* (yearly issues)
Grants-in-aid for Scientific Research Dummy	Colleges with the number of new/continued MEXT grants-in-aid for scientific research higher than the median are 1; the rest are 0	2007-2009	Id.
Year of College Foundation[1]	Year of establishment as a college/university based on government approval	/	*Capability of Universities* 2011, Yomiuri Shimbun,
Established University Dummy	Universities founded in and before 1950 are 1; the rest are 0	/	Id.
New College Dummy	Universities founded in and after 2001 are 1; the rest are 0	/	Id.
Public College Dummy	Public colleges are 1; the rest are 0	/	Id.
Private College Dummy	Private colleges are 1; the rest are 0	/	Id.

(Note) For colleges that have been merged, the survey asked the year of merger.

Table 2: Descriptive statistics of variables used (2007–2009)

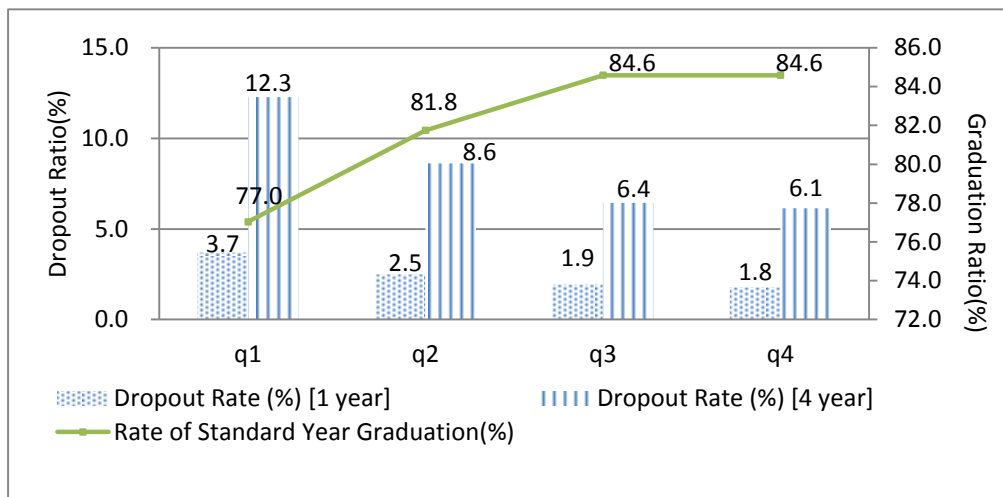|	Overall (491 colleges: N×T=1244)				Public College (136 colleges: N×T=367)		Private College (355 colleges: N×T=877)	
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Mean	Std. Dev.
Dropout Rate (%) [1 year]	2.41	2.11	0.01	15	0.79	0.66	3.08	2.14
Dropout Rate (%) [4 years]	8.16	5.52	0.5	41.1	3.80	1.88	9.99	5.52
Rate of Standard Year Graduation (%)	82.26	8.21	41.5	98.5	84.94	7.42	81.14	8.27
No. of Instructors per 100 Students	7.90	11.18	1.94	161.29	11.76	7.73	6.29	11.99
Living Support Score	0.08	0.12	0	2.14	0.09	0.14	0.08	0.11
Learning Support Score	9.43	2.34	0	12	10.32	1.70	9.05	2.47
Deviation Score Quartile Dummy (I)	25.0%	0.42	0	1	0.0%	0.00	31.9%	0.47
Deviation Score Quartile Dummy (II)	25.0%	0.44	0	1	3.0%	0.17	35.0%	0.48
Deviation Score Quartile Dummy (III)	25.0%	0.44	0	1	42.0%	0.49	19.7%	0.40
Deviation Score Quartile Dummy (IV)	25.0%	0.44	0	1	55.0%	0.50	13.3%	0.34
Number of Books Borrowed	10.46	25.52	0	535	12.90	28.12	9.44	24.30
Grants-in-aid for Scientific Research Dummy (%)	42.7%	0.49	0	1	61.6%	0.49	34.8%	0.48
Established University Dummy (%)	32.1%	0.47	0	1	48.0%	0.50	25.4%	0.44
New College Dummy (%)	11.6%	0.32	0	1	16.1%	0.37	9.7%	0.30

Table 3: Results of t-tests of differences in dropout/graduation rates based on variables

	Dropout Rate (%) [1 year]				Dropout Rate (%) [4 year]				Rate of Standard Year Graduation (%)			
	High	Low	t-value		High	Low	t-value		High	Low	t-value	
# of Instructors per 100 Students	1.4	2.8	-10.9	**	5.1	9.3	-12.8	**	84.7	81.3	6.7	**
Living Support Score	2.4	2.4	0.4		8.3	8.1	0.7		81.7	82.5	-1.7	+
Learning Support Score	2.2	2.6	-2.8	**	7.6	8.7	-3.7	**	82.7	81.8	1.9	+
Standard Deviation	1.2	3.6	-25.9	**	4.6	11.7	-29.5	**	84.6	79.9	10.6	**
# of Books Borrowed	1.9	2.6	-5.8	**	6.2	8.9	-7.8	**	84.5	81.4	6.1	**
# Grants-in-aid for Scientific Research Obtained	1.1	2.7	-10.5	**	4.3	8.9	-11.4	**	81.9	82.3	-0.6	

(Note) Each group average was calculated by assuming that the value of each variable above the mean was "high"
and below the mean was "low."
The signs **, **, and + respectively indicate that the differences in mean values are significant at 1%, 5%, and
10% levels.

Figure 2: Relation between the number of books borrowed per college student and
dropout/graduation rates

(Source) Prepared by the authors based on the data of Table 1

Table 4: Factors of dropout rate: panel data analysis (2007–2009)

	Overall (491 colleges: n=1244)			Public college (136 colleges: n=367)			Private college (355 colleges: n=877)		
	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.	
# of Instructors per 100 Students	-0.021	0.00	**	-0.043	0.01	**	-0.154	0.04	**
Learning Support Score	-0.006	0.02		0.055	0.07		╱	╱	
Living Support Score	-0.204	0.47		1.498	1.25		╱	╱	
Standard Score (1st Quartile)	1.582	0.18	**	╱	╱		╱	╱	
Standard Score (2nd Quartile)	1.251	0.16	**	0.744	0.71		╱	╱	
Standard Score (3rd Quartile)	0.121	0.15		-0.350	0.26		╱	╱	
# of Books Borrowed	-0.020	0.01	**	-0.047	0.01	**	-0.002	0.009	
Grants-in-aid for Scientific Research Dummy	-0.191	0.07	**	-0.307	0.16	+	-0.121	0.062	+
Established University Dummy	0.001	0.13		0.131	0.26		╱	╱	
	rho = 0.264			rho = 0.264			rho = 0.929		
	Adj.R^2 = 0.339			Adj.R^2 = 0.147			Adj.R^2 = 0.047		
[Hausman test statistics]	5.37			2.61			16.2		
[Adopted model]	Random Effects Model			Random Effects Model			Fixed Effects Model		

Table 5: Factors of rate of standard year graduation: panel data analysis (2007–2009)

	Overall (491 colleges: n=1244)			Public college (136 colleges: n=367)			Private college (355 colleges: n=877)		
	Coef.	S.E.		Coef.	S.E.		Coef.	S.E.	
# of Instructors per 100 Students	0.008	0.00	**	0.020	0.01	**	0.006	0.00	*
Learning Support Score	0.007	0.01		-0.016	0.03		0.012	0.01	
Living Support Score	-0.356	0.25		0.194	0.51		-0.534	0.29	+
Standard Score (1st Quartile)	-0.541	0.09	**	╱	╱		-0.451	0.12	**
Standard Score (2nd Quartile)	-0.205	0.08	**	0.050	0.28		-0.144	0.11	
Standard Score (3rd Quartile)	0.026	0.08		-0.032	0.10		0.077	0.12	
# of Books Borrowed	0.006	0.00	**	0.015	0.01	**	0.003	0.00	
Grants-in-aid for Scientific Research Dummy	-0.255	0.03	**	-0.304	0.05	**	-0.217	0.03	**
Established University Dummy	0.035	0.07		-0.043	0.10		0.105	0.08	
	rho = 0.683			rho = 0.511			rho = 0.761		
	Adj.R^2 = 0.203			Adj.R^2 = 0.224			Adj.R^2 = 0.18		
[Hausman test statistics]	5.37			7.44			3.67		
[Adopted model]	Random Effects Model			Random Effects Model			Random Effects Model		