# 大学ランキングと進学動向：
# 女子の高等教育参加に関する統計分析

**University Ranking and Enrollment Patterns: A Statistical Analysis on Female Participation in Japanese Higher Education**

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## 1.　**Introduction**

University ranking has increased its significance and this relatively new phenomenon in higher education is internationally recognized. Among scholars, initial impressions on university ranking tend to be almost always negative due to its commercialized aspects, profit-making intentions, oversimplification of quality and ambiguity or bias in methodology etc. Yet there is no doubt that, for better or worse, university ranking has gathered vast international attentions, and the system and surrounding issues have become substantial public agenda. In addition to parents' serious concerns on the reputation of their children's universities and colleges, ranking has severe impacts on institutional revenues and employment  practice, public policies and even international trading service and immigration issues; it is no longer a private matter.

What about in Japan? Like other countries[1], the official use of rankings in Japan became well known when the governmental initiative Top Global University program set

[1]  e.g., the Project 5-100 for Russian academic excellence was launched in 2013 slated to last for 8 years, aiming at, at least 5 universities to get into the top 100 of major world rankings, at least 15% of international student body in each selected universities' enrollment, and at least 10% of international faculty members. Source: http://5top100.com/about/more-about/

its goal for the enhancement of international competitiveness based on the world university ranking measurement. Within the program involving total 37 universities, the ranking measurement is applied to the selected top 13 universities (Type A), aiming at being ranked in the top 100 in the world. The total 10-year investment of tax money in trust of the world ranking measurement is a serious governmental implication, and in fact, it is a rare case in Japan.

While the adoption of world university ranking is a new phenomenon in Japan, university hierarchy has existed based on a different form of ranking measurement. The hierarchy of Japanese universities has been determined by *hensachi* (deviation value) that stands for how difficult to enter into the program. This hierarchal system is sometimes notorious in the shadow of "highly educated society (kou gakureki shakai)" when it is linked to excessive competition or as known as *exam hell*. Teichler (2011) describes the Japanese "over- competition" as a highly vertically stratified higher education system. In the 1970's, he has already observed the Japanese educational scene and the society as:

> "an [Japanese] educational meritocracy, i.e., an increasing belief that education open to everybody and crucial in determining future societal, professional and life chances, leads to a fierce competition for small distinctions of education attainment because modern societies keep inequalities of status (it was called – as an ironic response to the concepts of manpower demands – "demands for social inequality")" (p.56).

Since the universalization of Japanese higher education based on the increased advancement rate entering to higher education institutions, *exams hell* seems to be the legacy of the past. Yet there are certainly severe competitions and social stratifications based on various causes throughout the system.

Together with the fierce competition and a sense of social inequality around university ranking, female enrollment is selected to be examined due to the recent social demands in Japan. Gender equality is an increasingly sensitive issue and it is required in the needs of more skilled labor force and the increasing awareness on social fairness. As such, higher education is the most "coveted" subdivision for the social reproduction and change in education division (Stromquist, 1996). In the case of Japan, Amano (1997) pointed out in the 1990's that even though the total female enrollment in postsecondary education has increased, the institutions and majors that Japanese women belong to are generally considered as less prestigious than these of the majority of male students enroll. Therefore, as one of the issues around higher education, university ranking and female enrollment patterns are selected as the primary constructs to be tested in this paper.

The principal question that is statistically pursued throughout this research is; *what is the relationship between the prestige of 4-year universities and female enrollment patterns?* For the research question, I hypothesize that *although the Japanese higher education clearly accommodates more females than in the past, the female enrollment is more concentrated in the low ranking, less prestigious (meaning "private" in this context) institutions.* This hypothesis was supported by past studies conducted by international scholars who found out various types of gender distinctions in higher education. A major challenge of this study is intended to apply some statistical

methodologies in order to find out statistical significance in correlations among the key variables around the relationship between university ranking and female enrollment.

## 2. Literature Review

Despite researchers' skepticism on dealing seriously with ranking, some studies focus on how to devise better ranking system and its better use. Shin and Toutkoushian (2011) point out that the recent impacts of rankings have seen in changing hiring practice of faculty members based on the ranking criteria (e.g., authors of high impact journals), internationalization of universities based on ranking indicators (e.g., increase of English-medium courses) and decision making process of students (and parents). Especially, there is a finding that families with high-income and high-achievment take serious consideration on the rankings in their college choices. The sensitivity is stronger in Asian countries (Dill and Soo, 2005).

Largely depending on the accessibility of selective – or highly ranked – institutions and prestigious specializations for women, gender segregation allows for the understanding of the economic forces that impact gender equality. Those who achieved good higher educational attainments have higher tendencies to participate in the labor force and more likely to be employed. In other words, the lower their education attainments are, the higher unemployment rates reach (OECD, 2005). Less access to education as well as resources and time is a crucial element that causes women to encounter segregation in employment and promotion (Korinek, 2005). Especially in developing countries, females who do not own resources to invest in their higher education have the least chance at gaining stable employments (Lopez-Claros and Zahidi,

2005). Moreover, the gender distribution of field of study illustrates horizontal segregation in the choice of prospective professions, and it causes gender gap, thereby resulting in inequality (Kearney 1996).

In a historical point of view, the significance of women's education in Japan was recognized from the early years of the Meiji era (1868- 1912)[2] to the present time (Harrington, 2001). This is especially true for elementary and secondary education, but when higher education is considered, gender inequality and repression become evident. Often represented by Tsuda Umeko[3] as a "pioneer" of Japanese women's higher education, most females who had opportunities to pursue higher education for career goals were usually from prestigious families and, therefore, were not seen as role models for other women (Rose, 1992). Subsequently, Fujimura-Fanselow (1985) discussed that the gender gap existed even after the postwar reforms[4]; not only has the overall female enrollment in higher education remained behind that of male, but also female patterns of participation were restricted in various types and levels of higher institutions.

Several researches of Japanese women in higher education have found that female students tend to choose particular fields of study (UNESCO, 1998). Limited fields of study pursued create strong patterns of proper gender roles in the society. However, Amano (1997) reported that this trend might be shifting as women are starting to explore

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[2]  Before World War II, the social status of women in Japanese society was very low. The Constitution at that time did not guarantee the equality of the sexes e.g. women had neither the right to vote nor the right to be elected (Harrington, 2001).

[3]  The founder of Tsuda College, the first private women's college in Japan established in 1900, which still remains as a prestigious women's college, re-established in 1948, with 2,930 enrollments in Academic Year 2017.

[4]  After the War, the new Constitution that was promulgated in 1946 guaranteed for the first time the equality of men and women under the law. The Constitution of Japan, as promulgated, comprised the right of equality and concomitant freedom from discrimination in political and social relations on the basis of "race, creed, sex, social status of family origin" (article 14); academic freedom (article 23); the right to equal education (article 26) (Haley, 1998).

male-dominated areas of study such as, Social Science, Engineering, Natural Science, Agriculture and Medicine.

The history of higher education and educated women in Japan cannot be fully understood without a discussion of the function of the private sector in higher education. The strength of private sector is generally its diverse programs and specializations in certain areas of study, promptly absorbing social demands. Junior Colleges[5]and Women's Colleges are more associated with the private sector, and some private schools are prestigious for its entrepreneurial training, especially within the business sector (Fujimura-Fanselow, 1985). At the same time, the private sector as for women's education is traditionally rooted in the "gender track," which was often also deemed as "training schools to be skilled house-makers." Renn (2017) found out the contribution of women's-only institutions for the expansion of access for women to enter into highly selective urban institution. At the same time, she recognized that it generally comes with the *second-choice* characteristics of women's institutions, in which their students would have chosen to attend other coeducation urban elite universities if they did not experience the academic cut in national examinations or other selection process. According to her research, it is a common phenomenon among the students of women's institutions in the countries like China, Japan, India, South Korea and Kenya.

Amano (1997) portrayed Japanese higher education in the 1990's serving with two dimensions: one is general education and the other is professional education. First, general education for women aims at obtaining knowledge and attitudes relevant to the gender roles expected for women. Through higher education, women's learning

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[5] Junior Colleges aim to conduct teaching and research in specialized subjects and to develop student abilities by requiring courses that target vocational and practical life skills. Junior colleges offer two- or three- year programs in different fields of study, leading to the title of associate.   (MEXT, 2003)

emphasizes the particular culture of the middle class, in which they are traditionally expected to be a good wife and wise mother. Such orientation is clearly reflected by women's selection of the field of studies, such as Home Science and Humanities and the low number of women in professional courses. Therefore, these general educations serve small number of women as the promising candidates for advanced education. Second, the aspect of professional education for women seems limited. Even when they enroll in professional fields, most of women tend to have occupations as child care workers, elementary and secondary school teachers, health and welfare related technicians, dieticians or secretaries. In other words, they concentrated in areas that are essentially extensions of the role of mother and wife. In contrast to women being oriented to the private domain, men's roles are oriented toward the public domain (Amano, 1997).

The review of literature above shed lights on the linkage among the following elements: 1) rankings play influential roles to establish the prestige of institutions, 2) good attainments in higher education lead to economic stability and higher social status, and 3) Japanese private higher education has had certain *gendered* functions that affected on the choice of profession and specialization.

Accordingly, the research design has been developed its significance at several points. First, given the changing times since the initial participation of females into higher education, empirical evidences are accumulated from the relatively new data sources. Second, in order to simplify the range of samples, the data are focused on specific fields of study: Law, Business, Commerce, and Economics. In Japan, these areas of studies are usually so-called *bunkei* (i.e., humanities and social sciences). Third, the

enrollment of elite and non-elite institutions is another focal point for the gender contrast; thus the categories are highest and lowest (top 30 institutions and bottom 30 institutions) in the ranking. Fourth, what is not known by the prior literatures is the comparison on functions between private sector and public sector; the focus is more placed on the private-public distinction in higher education so that the roles of private and public sectors are to be clarified in terms of gender issues.

3. **Methodology**

**3.1 Samples**

The samples of this research are female enrollment (n = 65,395) in 120 programs that consist of Law, Business, Economics, and Commerce in the Japanese co-educational 4-year universities as of 2003. Japanese universities (4 years or more) require the completion of upper secondary schooling or its equivalent for admission, and they offer courses of at least four years leading to a bachelor's degree. These institutions are categorized in private and public, and high (top 30) and low ranking (bottom 30) as shown in the following table.

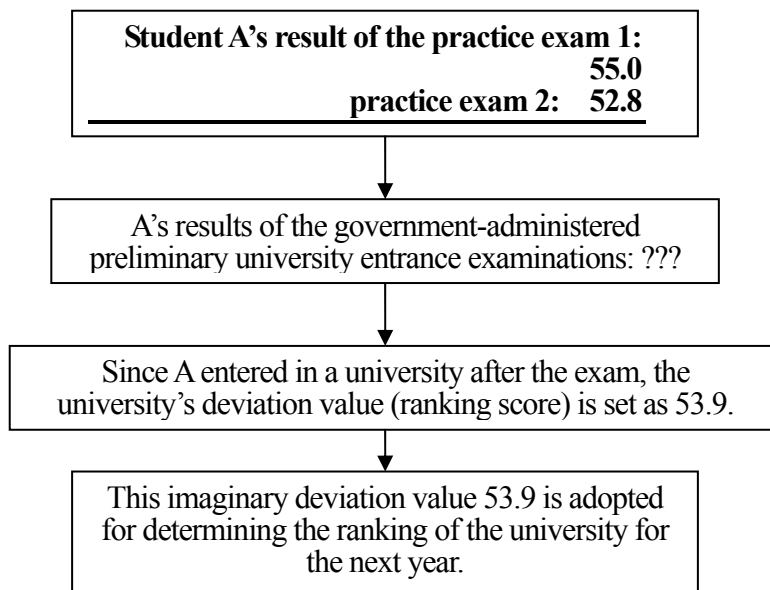|  | Programs in Public 4-year Universities | Programs in Private 4-year Universities |
|---|---|---|
| High ranking | 30 | 30 |
| Low ranking | 30 | 30 |

**3.2 Definitions**

**3.2.1 Enrollment**

Enrollment is a fundamental aspect in understanding the sociology of education. According to Prichard (1973), he discussed the significance of enrollment in terms of the need to study the demographics and social relationship between one group and another within a population. He emphasizes how population size is of sociological significance as well as measuring distribution, composition and density. Forest and Kinser (2002) noted that enrollment is an organizational concept that describes the fundamental institutional aptitude to maintain its effective dynamics (e.g. amount of revenue, administrative abilities, and political power). Enrollment is thus not just a tool for tracking the demographic transformation from prospective students to those enrolled within the institution and who attain graduation (Forest and Kinser, 2002). Rather enrollment has become a global tendency in which government policies utilize this as a means to allocate funding and devising universities and colleges' budgets. Tuition revenue is an important part of providing higher education institutions to increase their own funding for its institutional management. As the result of accelerated competition over tuition revenue, administrative bodies at all levels (governmental, institutional at national, municipal, and local levels) are escalating the awareness of significance and the strategic management for enrollment.

In this paper, female enrollment is defined as the number of females enrolled in law, business, economics, and commerce fields within the top 30 and bottom 30 ranked public and private programs in Japan's universities in the Academic Year 2003.

### 3.2.2 Ranking

In order to indicate the ranking of the programs in Japan, we must clarify that it is different from conventional understanding of "ranking" in the world. In Japan, deviation values so-called *hensachi* (usually the range of about 25-80) are traditionally and widely adopted. This score usually stands for how difficult or how competitive to enter into the program. For instance, based on the 2018 prediction created by one of the major clam schools Kawai-juku[6], Waseda University's Department of Literature has the highest score of 67.5 among humanities and social science programs in Japanese private universities. Deviation value originally signifies a position of a student among the other entire test takers based on their average points of the test results. For better understanding on how to determine the score, see the following table as an example.

**Process for Creating Ranking Scores Based on Deviation Value in Japan**

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┌─────────────────────────────────────────────┐
│  Student A's result of the practice exam 1:  │
│                                      55.0    │
│           practice exam 2:     52.8          │
└─────────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────────┐
│   A's results of the government-administered │
│  preliminary university entrance examinations: ??? │
└─────────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────────┐
│   Since A entered in a university after the exam, the │
│  university's deviation value (ranking score) is set as 53.9. │
└─────────────────────────────────────────────┘
                     │
                     ▼
┌─────────────────────────────────────────────┐
│   This imaginary deviation value 53.9 is adopted │
│  for determining the ranking of the university for │
│                 the next year.                │
└─────────────────────────────────────────────┘
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[6] http://www.keinet.ne.jp/rank/18/ks01.pdf : referred in January 2017.

In order to determine the programs' ranking, first, private test-preparation companies analyze (1) practice test results (deviation value) of students; it is privately operated, but nationwide practice examinations. Then, (2) the true national standardized entrance examination is run by the quasi-governmental organization once a year under supervision of MEXT, i.e., Ministry of Education, Culture, Sports, Science and Technology. Following this, based on the match between students' results on (1) and which universities these students enter eventually, these companies estimate the required deviation value of universities for the admission of next year. It is because the result of (2) is confidential and not accessible as public resource. Therefore, the estimated deviation values earned by students based on the practice exams in the previous year determine the qualification for admission; this is generally and traditionally considered as the ranking of universities in Japan. That is, the measurement of how hard to get into the program.

### 3.2.3 Type of Institutions

Type of institution is defined in this study as either a public or private institution. According to Kitamura (1985), public higher education (national and municipal) has lower tuition, and offers generally better conditions in terms of student-teacher ratio, floor space per student, and available books per student. But the enrollment of public higher education accepts only a quarter of the entire higher education entrants. Thus, the education system is forcing the majority of young people attends the more costly, but in general, educationally disadvantaged and concentrated in private universities (Kitamura,

1985). The government and policies have traditionally been apt to provide intense resources with the public sector in order to preserve academic quality. Another purpose of the allocation for the public sector is to satisfy essential demands for the nation while private institutions grow more flexibly according to changing popular needs with less qualitative enhancement by the government.

Nevertheless, McVeigh (1998) indicates on the education bureaucracy[7]by the ministry that influences on both private and public educations: the task of guiding, managing and promoting education, moral development, cultural activities, scientific progress, and even religious matters. The ministry can provide private institutions with guidance and advice on academic matters (e.g. the curriculum, staffing, physical facilities and equipment, financial matters, and management) (Kitamura, 1985). When new institutions are established, the institutions must be built with regard to the ministry's University Establishment Standard. Although private institutions receive revenues from several sources, most of them are heavily depending on student tuition (Kitamura, 1985; Kobayashi, 1992).

In comparison to OECD countries, Japan's national funding spent on its higher education is the lowest in ratios to GDP as shown in the OECD data below.

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[7] The education bureaucracy occurs first at the strategic level consist of the Ministry of Education's Secretariat and advisory councils, especially the Central Council of Education. The policies of these organs are shaped by economic nationalism, but more specifically, particular business interests and ideological pressures stemming from the favor of the Diet (McVeigh, 1998).

**Percentage of Public Expenditure on Higher Education among OECD Countries**
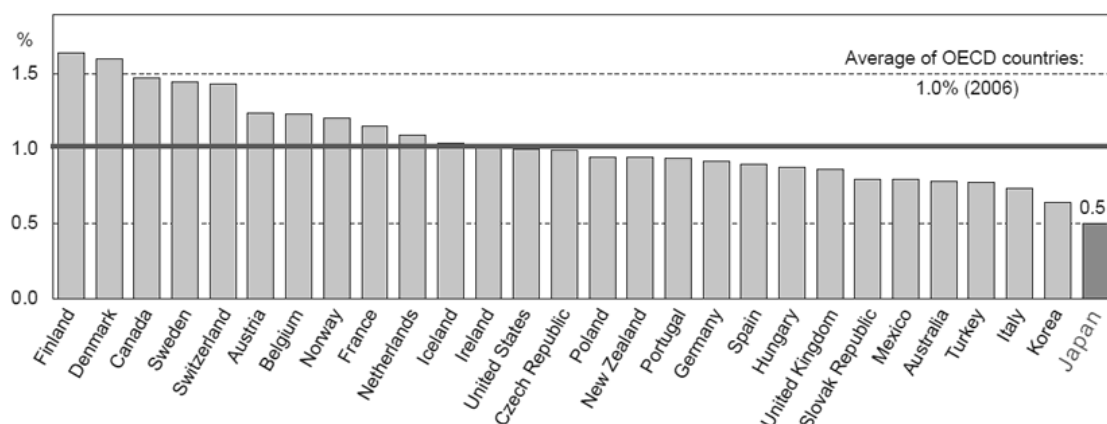


Source: Based on OECD Education at a Glance, 2009

There is a clear distinction between private and public institutions within Japan. On average, private 4-year universities receive 10% of their revenues from public subsidies as of 2016 while public universities are mainly supported by various public funds. It is still considered that the purpose of most private institutions is to support mass higher education at low public expense accommodating 80% of the entire enrollment. A limited number of prestigious elite universities exist in big cities such as Tokyo or the Kansai area, and even these elite private institutions rely heavily on tuition fees (Yonezawa, 2003).

Junior Colleges and women's colleges are probably a typical way to distinguish to some extent between the private versus public sector of institutions in Japanese case. For instance, as of 2017, 95.0% of Junior Colleges are privately owned and 88.7% of the enrollment was shared by females. Enrollment of private Junior Colleges shares 94.6% of the overall enrollment of Junior College (MEXT, 2017). Also, the national and public

(municipal) women's colleges are only 9 institutions[8] whereas the private sector possesses 82 institutions (90.1%) (MEXT, 2003); it'd be fair to say that Junior Colleges are higher education institutions for women and the private-dominated area together with the women's colleges.

Even though numerous reforms for quality and innovation enhancement have been implemented by the private sector with various public supports, traditionally speaking, Japanese private sector receives low public funding and high dependency on tuition revenue. It provides mass education with distinctive and specialized characteristics, and more female concentration compared with the public sector.

## 4.　Research Design

In order to develop a statistical analysis on the relationship between university ranking and enrollment patterns, a correlational methodology is implemented to test the hypothesis that *female enrollment is more concentrated in low ranking private institutions*.　In this study, a secondary data analysis is adopted.　The data is analyzed through two approaches, 2x2 ANOVA and regression analysis. The results of these two quantitative methods are reported and compared. Finally, a discussion of possible errors of inference from the conclusion and possible ways for better approaches are discussed.

### 4.1 Secondary Analysis

As a technique for gathering data to test the hypothesis in this study, Secondary (Statistical) Analysis is utilized. Existing statistics research is highly suitable for this

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[8]  Further breakdowns: 2 national: Ochanomizu Women's College and Nara Women's College, and 7 public (municipal) women's colleges. Additionally, men's colleges do not exist in Japan since College of Marine Mercantile started accepting female students in 1980.

macro analysis design, as requiring vast information that is gathered by large organizations (e.g. international agencies, governments, ministries) (Neuman, 2004). Because of the existing data, however, there are some major cautions for the use. First, it is hardly suitable to some specific research design that may require very narrow focus on research questions as its targets and the data. Second, the secondary sources should be re-examined the similarities and discrepancies with regard to its primary use by considering units in the data (e.g. time, place, type of institution, people) before adopting the sources (Neuman, 2004). Third, quoting statistics may cause misinterpretations without knowing details of the subjects that may lead readers to false impressions.

Although there are some concerns for the use of secondary data, existing statistics is apt to this research design that involves hypotheses testing based on several variables that are often dealt by official agencies for examining social, economic and political issues. They are then applicable to my research design whose constructs are gender stratification based on ranking of institutions in Japanese higher education.

As to analysis of these two secondary sources, the number of female enrollments is highly reliable since all institutions publicly expose the number. Yet, the institution rankings based on deviation value is questionable. It is the ranking of how difficult to enroll into institutions with regard to the practice test results as the mere resource; not the quality of institutions per se. Therefore, the correlation between these scores gained by students and the quality of institutions is weak. However, with the operational perspective, this method for the "ranking" is relatively credible and nationally accepted. Also, it is fair

to mention that there is no other means that can substitute for measuring the ranking in Japan especially in terms of time and cost efficiency[9].

## 4.2 Correlational research

The data are analyzed through a correlational methodology. This type of research is common within social research, in which many of the constructs are studied especially within Education. Samples usually cannot be manipulated or controlled. For example, when studying educational opportunity, it is not possible or it is simply unethical to place students in groups where some students have educational opportunity and others do not. Another example is characteristics that individuals possess, e.g., gender, age, and race. These characteristics are impossible to manipulate by the experimenter. Therefore, with constructs like these, correlational designs are more appropriate (Crano and Brewer, 2002).

Another characteristic of correlational research is that variables are allowed to vary freely, suggesting that changes in one are related to changes of another (not implying causality). As in experimental designs, information is usually lost regarding the degree of the variable due to the controlled manipulation. However, as in a correlation, more information can be gained from understanding the variation of the variable. For example, in case a variable is test results, an experimental design may simply note if the

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[9] Times Higher Education announced Japanese University Ranking in March 2017 based on an internationally conventional methodology for world rankings that are used by major ranking companies and organization like Times Higher Education, QS World University Rankings, U.S. News Best Global Universities, ARWU (Academic Ranking of World universities). It consists of four pillars, instead of mere measurement by deviation value (hensachi): Resources (finance per students, faculty per students, bibliometric calculation, mock exam, competitive funding,): 38%; Engagement (high-school survey: global talent, high-school survey: developing ability): 26%; Outcomes (employer reputation, researcher reputation): 20%; Environment (international student, international staff): 16%. In this ranking, the results are different from the Japanese traditional deviation value ranking.

student(s) passed or failed whereas in correlational research can examine the full range of scores and how close or how far away the student was from passing of failing the test (Crano and Brewer, 2002).

The correlation of two variables can be determined with exact degree by computing a correlation coefficient. This helps to test the significance of the research and be able to compare to other studies that examine similar relationships. Therefore, if multiple studies examine the relationship of female enrollment and the prestige of a university and they all find a high (.70) relationship between these variables, this can increase the generalizability of the research results. A correlational design is also capable of handling more than two variables at a time. For the reason, a researcher can investigate various combinations of several different variables at one time to see how this relates to a particular measure.

A disadvantage of a correlational design is that it cannot account for cause and effect relationships. Since it is not usually able to partake in random assignment (although sometimes it can), manipulating and controlling the independent variables generalizability of the causality is tentative. Specifically, this type of research cannot rule out a possible third source that may be accidentally or causally linked with one of the observed variables. For example, in my study of female student enrollment and the ranking of the private sector, there may be other confounding variables that contribute to the relationship of the female enrollment and the ranking of universities. Perhaps, this relationship is due to the geographical location of the institutions rather than the ranking. Another possibility may be that these females choose private universities to find more

culturally (or economically) comparable peers even though the public institutions are academically more prestigious.

Another potential negative side of the correlation coefficient is that it is sometimes difficult to specify or define what a strong or weak relationship is. Because depending upon the constructs used in the research, the definition of strong and weak correlation may alter. Therefore, correlations cannot be compared between all constructs but only rather to specific areas being studied (Ragin, 1994).

In this study, the data is analyzed through two approaches a 2x2 ANOVA and a regression analysis. The ANOVA organizes the data in terms of comparing the four groups (i.e. private high ranking, public high ranking, private low ranking, and public low ranking). The regression analysis will examine the data by using the general linear model to compute a correlation coefficient to provide the direction and strength of the relationship between the independent and dependent variables. The following sections explain the details of these analysis techniques.

## 4.2.1 2x2 ANOVA

ANOVA (Analysis of Variables) model is an effective way to determine whether the means of more than two samples are significantly different from one another and that it is not simply a factor of a sampling error. In my particular analysis, a 2x2 ANOVA is utilized as one approach to analyze the data. Therefore, I have 2 categorical independent variables each with two levels and one continuous dependent variable. Accordingly, my independent variable, ranking of universities consists of two levels labeled as low or high ranking, the other independent variable type of institution consists of two levels labeled

as private or public institution. The aim of this analysis is to examine the relationship between the means of the independent variable groupings in relationship to the means of the continuous dependent variable, female enrollment. Therefore, the following four groups are compared: private high ranking, public high ranking, private low ranking, and public low ranking. Thus a 2x2 ANOVA analysis is utilized to determine whether the means of these two samples cannot be simply attributed to a sampling error. In other words, it can clarify the answer of the question: Does the patterns of female enrollment significantly differ depending on a high or low ranking of a private university?

### 4.2.2 Regression

The second way in which the data are analyzed is a regression analysis. Compared to ANOVA, a regression analysis provides information regarding the degree and type of the relationship between the independent and dependent variables. For instance, a regression analysis is used to determine the extents the relationship between the variables are linear, meaning that the relationship between the variables is predictable. For example, as one of the independent variables increases the dependent variable increases or if one variable increases the other variable decreases.

On the other hand, a non-linear or curvilinear relationship occurs when a prediction cannot be made between the independent and dependent variables. In this case, sometimes the independent variables predict the direction of the dependent variables and sometimes it does not. If the relationships between the variables are linear, then a Pearson product-moment correlation coefficient can be calculated, which gives an estimate of the proportion of shared variation between the independent variables being

measured. This means that the value of the correlation coefficient provides the proportion by which variation in the dependent variable (i.e. female enrollment) would be reduced if the independent variables were held constant (i.e. rank and type of institution).   This correlation indicates the direction and magnitude of the relationship, which ranges from $-1.00$ to $+1.00$.

The sign of the correlation indicates the direction of the relationship.   The positive sign indicating either a positive relationship when one variable increases, the other variable increases or when one variable decreases, the other variable decreases.   The negative sign indicates that as one variable increases the other variable decreases. The given number determines the strength of the relationship. The number 1 depicts a perfect relationship between the variables, therefore the closer the correlation is to 1 the stronger there relationship and the further away the relationship is from 1 the weaker the relationship.

## 5.  **Data Analysis**

A univariate analysis of variance was run to calculate the significance between the variables.   The fixed categorical independent variables were ranking of institution, which consisted of two levels (low and high), and type of institution, which consisted of two levels (private and public).   The random continuous variable, female enrollment constituted for the dependent variable.   Presented in Table 1 are the means and standard deviations for each cell.

Table. 1 Descriptive Statistics

|  | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| RANKINGS | 120 | .00 | 1.00 | .5000 | .5021 |
| TYPE | 120 | .00 | 1.00 | .5000 | .5021 |
| FEENROLL | 120 | 87.00 | 1910.00 | 545.0333 | 377.6532 |
| INTERACT | 120 | .00 | 1.00 | .2500 | .4348 |
| Valid N (listwise) | 120 |  |  |  |  |

The univariate analysis of variance results are presented in Table 2. Examination of the univariate analysis of variance indicated that the female enrollment is significantly different depending upon the private and public institution as well as between the high and low ranking ($F = 20. 446$, df =1, $p < .01$). A review of the univariate F's indicated that both the ranking and type of institution ($F = 18.325$, df=1 $p < .01$) were significant contributors to the outcome variable, female enrollment. Also, the interaction of the independent variables (the ranking and the type) was computed, and it is significant ($F = 85.156$, df=1, $p < .01$). Results are exhibited in Graph.1

Table.2 Tests of Between-Subjects Effects

Dependent Variable: FEENROLL

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 8766350.467 | 3 | 2922116.822 | 41.309 | .000 |
| Intercept | 35647360.133 | 1 | 35647360.133 | 503.932 | .000 |
| RANKINGS | 1446285.633 | 1 | 1446285.633 | 20.446 | .000 |
| TYPE | 1296256.533 | 1 | 1296256.533 | 18.325 | .000 |
| RANKINGS * TYPE | 6023808.300 | 1 | 6023808.300 | 85.156 | .000 |
| Error | 8205663.400 | 116 | 70738.478 | | |
| Total | 52619374.000 | 120 | | | |
| Corrected Total | 16972013.867 | 119 | | | |

a R Squared = .517 (Adjusted R Squared = .504)

Graph. 1



Estimated Marginal Means of FEENROLL
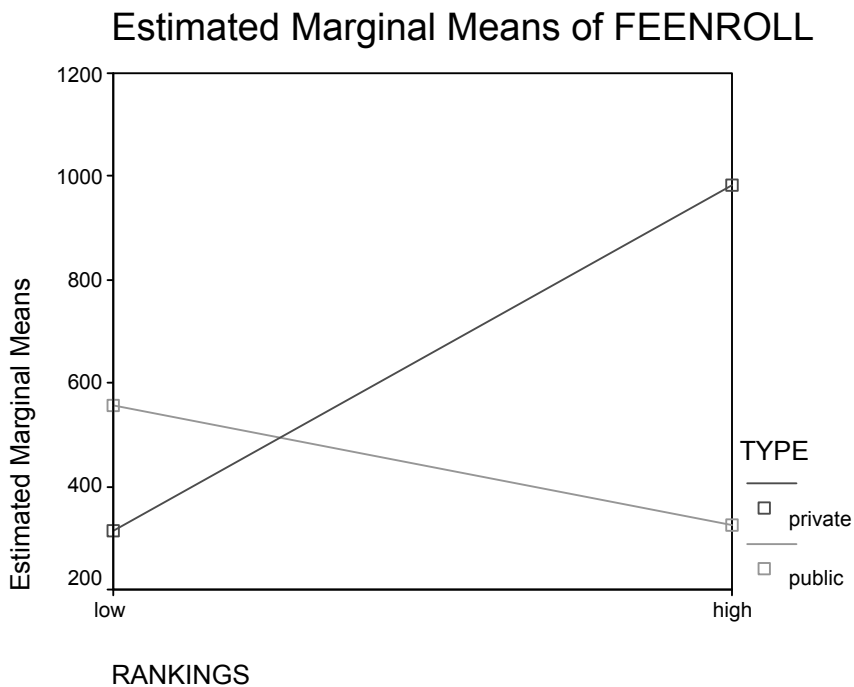
Multiple Regression was the second method used to analyze the data. The outcome variable was female enrollment; the predictor variables were type of institution and rank of institution. The overall result of the regression model is statistically significant. See Table 3 for a summary of the multiple regression analysis. Examination of Table 4 indicates that the prediction formula was significant ($F=41.31$, $df = 3$, $p < .01$). Additionally, Table.5 indicates that the two independent variables made significant contributions – rank of institution (b= .88) and type of institution (b = .32).

Table.3 Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .719 | .517 | .504 | 265.9671 |

a    Predictors: (Constant), INTERACT, TYPE, RANKINGS

Table. 4 ANOVA

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 8766350.467 | 3 | 2922116.822 | 41.309 | .000 |
| | Residual | 8205663.400 | 116 | 70738.478 | | |
| | Total | 16972013.867 | 119 | | | |

a    Predictors: (Constant), INTERACT, TYPE, RANKINGS
b    Dependent Variable: FEENROLL

Table.5 Coefficients

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 315.133 | 48.559 | | 6.490 | .000 |
| | RANKINGS | 667.667 | 68.672 | .888 | 9.722 | .000 |
| | TYPE | 240.233 | 68.672 | .319 | 3.498 | .001 |
| | INTERACT | -896.200 | 97.117 | -1.032 | -9.228 | .000 |

a    Dependent Variable: FEENROLL

6. **Limitations**

Overall when interpreting the results of these analyses, other limitations need to be considered. First, these methods do not capture the breadth of possible causes that may contribute to explain female enrollment within the various higher education institutions. For instance if more qualitative methodologies were included such as a case analysis, other possible causes for this relationship may have been identified; however, this was not included in the use of the quantitative methodologies. For example, through a case analysis, political and economical causes may have shown to contribute to the current gender stratification for Japanese women. Second, other limitations are related to the external validity of the research methodology. For instance, the sample was not randomly selected, specifically in terms of the field of studies. These were chosen in matter of convenience through available data categories. Therefore, the results can only be generalized to Japanese women studying only in these *bunkei* fields (i.e. Law, Business, Economics, and Commerce).

In regards to internal validity, the institution rankings based on deviation value is point to question. It is the ranking of how difficult to enroll into institutions with regard to the test results as the mere resource; not the quality of institutions per se. However, again, with the operational perspective, this method for the ranking is credible and nationally accepted. Therefore, the adoption of deviation value (*hensachi)* for the ranking is reasonable for the characteristics of this research design.

7. **Conclusion**

In summary, when both ANOVA and regression analysis are compared both methods indicated that the independent variables were significantly related to the dependent variable.   Therefore, the results reject the presented hypotheses stating that *female enrollment is more concentrated in low ranking private institutions*.   Both analyses reveal that *female enrollment is most concentrated in high-ranking programs of private institutions* as presented in the Graph 1.   The univariate analysis demonstrated this by analyzing the group means, whereas the regression analysis demonstrated this through the calculation accounting for the shared variances of the independent variables toward the dependent variable.

As for further development of methodology in this type of analysis, there are various limitations to this research design. There are several assumptions are needed to conduct this analysis (e.g. homogeneity, third factor variable and linear relationship).   For instance, one common problem in regression analysis is that of multicollinearity as it is likely that there is some correlation between the independent variables thus likely making the correlations appear stronger then they may be in reality.   Although there are fewer assumptions needed when conducting an ANOVA design, the results only tell us if the independent variables are related to the dependent variables. Thus, if the regression analysis met the required assumptions, this can tell us more details regarding the relationship between the variables.

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