Impact of Increasing HEI Graduates on Labor Quality in Japan

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Introduction

College-bound high school graduates have increased dramatically in both absolute and proportional counts in the last few decades in Japan. It is claimed by the community of higher educational institutions (HEIs) that a rapidly increasing number of under-prepared college entrants have been filling up the classrooms of Japanese colleges and universities. This phenomenon has drawn social attention and caused a great deal of concern not only in the higher educational community but also in domestic industries in Japan. Professors today claim that they cannot teach what they used to because of insufficient academic preparation of incoming students. As a result, researchers and educators throughout the community have emphasized the importance of remedial programs for incoming college entrants.[1)] Industry has also voiced concern about the quality of college education, as today's students represent the quality of the future workforce of the country.

The purpose of this paper is to examine the impact of a growing college-entering population on the changing quality of manpower in the Japanese labor markets. Although measuring the changing labor quality is extremely difficult, this paper uses a proxy indicator, the so-called Divisia index calculated in a study by Watanabe (2003), and investigates how, and to what extent, the influx of college graduates has affected the labor quality of the overall Japanese workforce. In doing so, the critical issue of the "quantity-quality" trade-off that has received growing attention is discussed beyond the boundaries of higher educational institutions.

Growing Population of College Entrants in Japan

The number of high school graduates entering 4-year colleges and universities in Japan increased from 449,573 in 1976, which accounted for 33.5 percent of the total high school graduates in that year and reached a higher level in 1998 at 611,841, or equivalently 42.1 percent of the total graduates (*Gakkō Kihon Chōsa*, various years).[2)] Figure 1 shows that the raw count of individuals entering 4-year colleges and universities slowly started to decline thereafter due mainly to the shrinking 18-year-old population.[3)] Nonetheless, the number of college entrants remains at a higher level today relative to those in the late 1970s and the early 1980s.

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There exist numerous studies arguing that rapidly changing economic conditions and technological development require advanced skills and knowledge of today's workforce (*e.g.,* Berryman and Bailey, 1992; Dertouzos *et al.*, 1989; Holzer, 1996; Johnston and Packer, 1987; Osterman *et al.*, 2001; Porter, 1990). These studies assert that a high school diploma no longer guarantees high-paying jobs in today's competitive labor market. From this perspective, the incremental change in the number of college entrants is considered to have been instigated by the stronger labor demand for highly equipped workers with advanced skills.
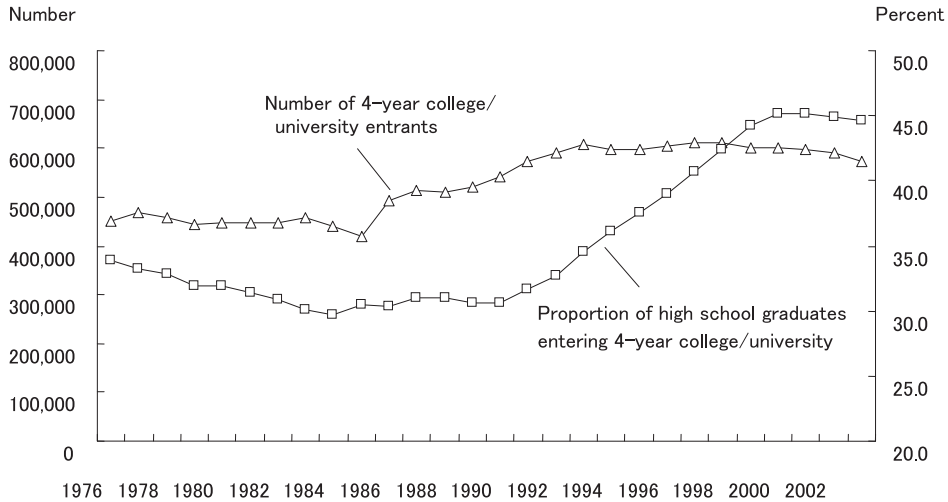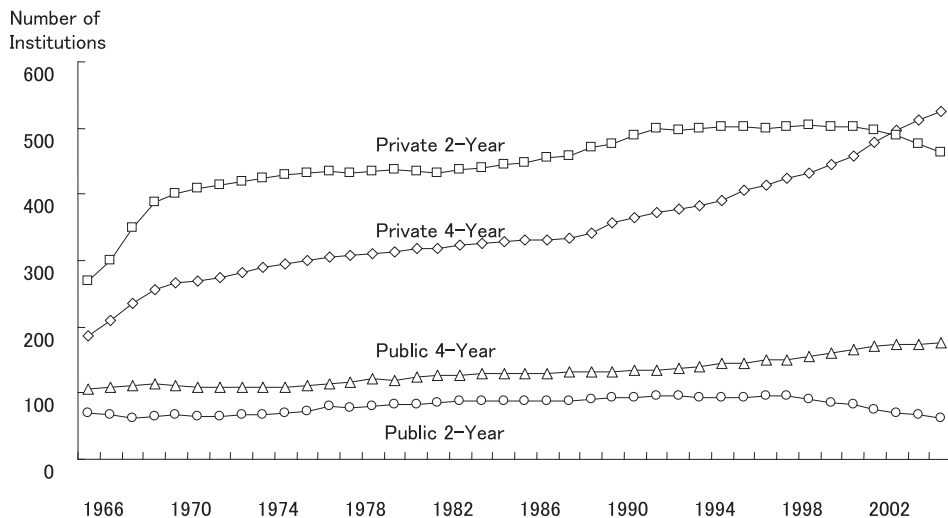
Number   Percent

Source: *Gakkō Kihon Chōsa*, various years, Ministry of Education, Culture, Sports, Science and Technology-Japan.

**Figure 1. Actual numbers and proportions of high school graduates
entering 4-year colleges and universities: 1976 to 2003**

Figure 1 also reveals that the *proportion* of high school graduates who opted to invest in 4-year college education remained at a lower level prior to and during the 1980s, followed by a dramatic upsurge in the 1990s. The proportional increase appears to have lost its momentum at the turn of the century however, showing a slightly decreasing trend in recent years. The remarkable increase observed for the 1990s can be attributed to synchronized incidents of multiple factors. For instance, Japanese HEIs experienced phenomenal economic and social changes in the last two decades. The historically unprecedented euphoria of the "bubble economy" ended in the early 1990s. Long lasting economic downturns thereafter provided young individuals and their parents with incentives to invest in higher education in a countercyclical manner.[4] Perhaps more significantly however, a rapidly diminishing 18-year-old population has hit many Japanese colleges and universities propelling them into severe competition for acquisition of students, particularly with an increasing number of domestic HEIs.

Figure 2 shows that the total numbers of private 4-year and 2-year institutions have been approximately 4 to 5 times more than those of their public counterparts. The numbers of public institutions, both 2-year and

4-year, were relatively stable between 1964 and 2003. In contrast, private 4-year institutions increased dramatically during the same period surpassing the number of private 2-year colleges for the first time in 2001. Figure 2 indicates that the private institutions have played an important role in enrolling a growing proportion of high school graduates in the post-war modern era of Japan. Furthermore, given a shrinking 18-year-old population, the rising number of HEIs implies that the entrance door to postsecondary higher education has become wider and more accessible for Japanese youth, particularly in the last two decades.

Source: *Gakkō Kihon Chōsa*, various years, Ministry of Education, Culture, Sports, Science and Technology-Japan.

Figure 2. Number of colleges and universities in Japan: 1964 to 2003

As a rising proportion of high school graduates exploit the opportunity of higher education, a growing concern has emerged that ill-equipped students are crowding the classrooms of Japanese colleges and universities today. The declining quality of our youth as students is likely to affect the future productivity of the country's workforce in coming years. In this view, this paper attempts to shed light on the extent to which the recent expansion of HEIs has caused qualitative changes in the Japanese workforce. In doing so, the study quantitatively examines the impact of a growing population of HEI graduates on the qualitative changes in the labor force by using a proxy quantitative measure for manpower.

Data

The proxy measures of labor quality-adjusted volume of manpower in the Japanese workforce are provided in Watanabe (2003), where the labor quality-adjusted Divisia index is calculated separately for 4-year college/university graduates, technical and junior college graduates, high school graduates and those

with no high school diploma.[5] The Divisia index is recognized as a modern economic application which relates a continuous-time index to an underlying economic structure via potential functions (Hulten, 2008). This paper takes full advantage of the Divisia measures calculated by Watanabe (2003). The quality-adjusted index measures for 4-year college/university graduates and technical/junior college graduates are used as the dependent variables in our multiple regression analysis.[6]

　　Other variables used in this paper are drawn from *Gakkō Kihon Chōsa* collected and distributed by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of Japan. In particular, the variables used in the statistical analysis in the following section are the *proportion of high school graduates entering colleges and universities* and the *number of college/university entrants*. Inclusion of both the number and proportion makes it possible for us to find their differentiated effects on the changing quality of workforce. In addition, the ratio of average starting salary of high school graduates to that of college graduates from the Labor Force Survey (*Rōdōryoku Chōsa*), which is distributed by the Statistics Bureau of the Ministry of Internal Affairs and Communications, is used as an independent variable in the regression analysis. The salary ratio is considered to capture the effect of potential return on investment in higher education.

　　The duration of the study period for the focus of this paper is from 1985 to 2000, and thus our sample size is extremely small with only 16 observations available in the dataset. However, it is expected that the analysis would show a significant result if the model is accurately specified with the necessary variables. The analytical framework and the resulting estimation outputs are discussed in the following section. The descriptive statistics of the variables are provided in Table 1 below. The average manpower index (quality-adjusted) for 4-year college/university graduates is higher (104.9) than that of 2-year college graduates (86.1). During the studied period of 1985-2000, an average of 528,741 high school graduates entered colleges/universities. The descriptive statistics also indicate that the average proportion of high school graduates entering colleges and universities was 35.3 percent, and the average salary of high school graduates was 80 percent of that of college/university graduates.

Table 1. Descriptive statistics: means and standard deviations

	Mean	S.D.	Min.	Max.
Labor quality-adjusted manpower index for 4-year college graduates	104.9	2.5	100.0	107.7
Labor quality-adjusted manpower index for 2-year college graduates	86.1	12.9	63.1	100.2
Proportion of high school graduates entering colleges and universities	35.3	5.5	29.6	45.1
Total number of high school graduates entering colleges and universities	528,741	70,017	418,952	611,841
Ratio of high school to college graduates average starting salaries	79.9	1.1	78.1	81.5
Sample size	16			

Sources: *Gakkō Kihon Chōsa*, 1985-2000, Ministry of Education, Culture, Sports, Science and Technology and Watanabe (2003).

Statistical Model

This paper attempts to examine the effects of a rapidly growing population of higher educated workers on the manpower quality in the Japanese labor market. The impact of growing college entrants on the changing quality in the workforce is estimated by a simple linear regression model with the ordinary least squares (OLS) method of the following specification:

$$quality\_index_t = \beta_0 + (proportion\_enter_t)\beta_1$$
$$+ (number\_enter_t)\beta_2 + (salary\_ratio_t)\beta_3 + \varepsilon_t \qquad (1)$$

where the dependent variable, $quality\_index_t$ is the labor quality-adjusted index for manpower calculated by Watanabe (2003) for the period covering 1985 through 2000. Three independent variables included in the estimation are the proportion of high school graduates entering colleges and universities ($proportion\_enter_t$), the raw head-count of college and university entrants ($number\_enter_t$), and the ratio of average starting salary of high school graduates to that of college-bound counterparts ($salary\_ratio_t$). The associated vector of intercept and coefficients β_0, β_1, β_2, and β_3 are the parameters of our interest and reveal the effects of the included variables on the labor quality, and ε_t is assumed to be an independently and identically distributed (iid) error term. The subscript t indicates the observational time points.

Furthermore, the time-series nature of the data suggests a potential autoregressive process in the error term in OLS equation (1), for which the process can typically be described as $\varepsilon_t = \rho\varepsilon_{t-1} + u_t$ with u_t being assumed to have the standard iid property with mean 0. As with the regular argument of heteroscedasticity, it is well-known that the OLS produces unbiased consistent but inefficient estimators if autocorrelation exists in the error term. Therefore, the Durbin-Watson d-statistic is computed as $d = \sum_{t=2}^{T}(\varepsilon_t - \varepsilon_{t-1})^2 \Big/ \sum_{t=1}^{T}\varepsilon_t^2$ and is presented for each estimation result to test for an AR (1) process. The generalized least squares (GLS) estimation results are also provided by the method of Prais-Winsten iterations, along with the standard OLS estimation results.[7]

Estimation Result

The empirical result is presented by different educational groups in Table 2. The first column, *i.e.,* (1) OLS, presents the OLS estimation of the change in the volume of quality-adjusted labor force for 4-year college/university graduates. The result shows that the increase in the total number of college/university entrants raised the overall labor quality of 4-year college/university graduates in the Japanese labor market. The proportional increase in the college/university entrants also raises the overall labor quality, but it does so with marginal significance at the .10 level. The labor quality of the 4-year college/university educated workforce declines as the average salary of high school graduates increases relative to that of college

graduates. This implies that the higher pay level for high school graduates may be absorbing some of the potential college-bound individuals who could have raised the quality of 4-year college/university labor force.

The one-sided test for $H_0: \rho = 0$ against $H_1: \rho > 0$ is carried out by comparing Durbin-Watson's d to values $d_L(16, 3) = .86$ and $d_U(16, 3) = 1.73$ for the 5% significance. The obtained d for the OLS result is 1.075 and lies between $d_L = .86$ and $d_U(16, 2) = 1.73$, which indicates that no conclusion is drawn from this test of autocorrelation. Therefore, an alternative result is obtained by GLS estimation with the Prais-Winsten iteration method. The GLS result is shown in the second column, *i.e.,* (2) GLS. Although the efficient result shows that proportional increase has no significant effect on the labor quality, the actual *number* of college/university entrants on average raises the overall quality of the labor force for 4-year college/university graduates. However, the labor quality of the 4-year college/university educated workforce tends to significantly decline with the salary ratio.

The same specification is estimated for the graduates of technical and junior colleges. The OLS result in the third column shows that the increase in both the absolute count and proportion of these graduates on average reduces the overall quality of technical and junior college educated workforce in the labor market. In particular, the proportional increase significantly reduces the labor quality of the technical/junior college educated workforce. The high school to college graduates' salary ratio shows no evidence of affecting the workforce quality. The Durbin-Watson's d is 1.720 and is smaller than $d_U(16, 3) = 1.73$, which indicates an inconclusive result for the test of serial correlation in the error process. The GLS estimation in the last column, *i.e.*, (4) GLS, with the Prais-Winsten iteration yields nearly identical results to the OLS estimation

Table 2. OLS and GLS estimations of the impact of increasing college and university entrants on labor quality in Japan

	Labor quality-adjusted:						
	4-year college graduates				Technical and junior college graduates		
	(1) OLS		(2) GLS		(3) OLS		(4) GLS	
number_enter (x 1,000)	.007	***	.012	*	-.059	**	-.058	**
	(.010)		(.008)		(.024)		(.024)	
proportion_enter	.405	*	.350		-2.285	***	-2.289	***
	(.188)		(.180)		(.391)		(.397)	
salary_ratio	-1.513	***	-1.140	***	-89.03		-88.98	
	(.405)		(.383)		(80.34)		(81.73)	
Constant	208.4	***	178.1	***	306.9	**	306.5	***
	(32.0)		(30.5)		(101.9)		(103.7)	
Durbin-Watson (autocorrelation)	1.075 (Inconcl.)		1.613 (Inconcl.)		1.720 (Inconcl.)		1.948 (No)	
$\hat{\rho}$	---		.521		---		.137	
Adjusted R^2	.879		.992		.964		.964	

Sources: *Gakkō Kihon Chōsa*, Ministry of Education, Culture, Sports, Science and Technology and Watanabe (2003).
Notes: The numbers in parentheses are standard errors. *** indicates that the coefficient estimates are significant at the .01 level, ** significant at the .05 level, and * significant at the .10 level.

with significantly negative effects on both the head count and the proportion. Unlike the 4-year college/university educated workforce, the salary ratio is not a significant factor for the labor quality of the 2-year college graduate workforce.

Conclusions

As the 18-year-old population has peaked, higher educational institutions have no choice other than enrolling an increasing *proportion* of high school graduates in order to survive in the higher education market. As shown in Figure 1, the proportion of high school graduates entering colleges and universities dramatically increased during the 1990s, resulting in the debate on the academic readiness of those students working towards college degrees. This paper estimated the impact of the growing population of college-entering high school graduates on the qualitative change in the labor force by education group, *i.e.*, 4-year college/university graduates and technical/junior college graduates.

Evidence obtained shows that the proportional increase in college-bound high school students has significantly reduced the quality of the workforce for technical/junior college graduates. In contrast, the increase in the total number of college entrants raised the overall quality of the 4-year college educated workforce in the Japanese labor market. The result suggests that the increase in the number of college entrants does not necessarily mean that the 4-year college educated workforce suffers a "quantity-quality" trade-off. However, the result also implies that excessive enrollment of students into technical and junior colleges has produced graduates prematurely for job markets, weakening on average their overall labor quality. From this perspective, it is suggested that the quality assurance of technical and junior college education, which has historically received less attention relative to 4-year colleges and universities, needs to be discussed further.

Notes

1）For instance, the Japan Association for Developmental Education was established in 2005 in this pursuit.

2）These figures are calculated based on the matriculation of students, which includes those graduating from the regular as well as correspondence high school programs, entering 4-year national and local public and private universities.

3）The sharp drop in the number of college entrants for 1985 in Figure 1 is not coincidental. The dip observed in Figure 1 is caused by a smaller graduating population of students born in the year of "*Hinoe-uma*" which reduced the number of children born in 1966, owing to the ancient superstition associated with that year.

4）For instance, Watanabe (2006) shows that enrollment in school is countercyclical to economic conditions.

5）In Watanabe (2003) the index of labor quality is computed for each education group $j=\{1, 2, 3, 4\}$ by

$$\dot{L}^j = \sum_i^2 \sum_k^9 \sum_l^{12} \rho_{ijkl} \dot{\lambda}_{ijkl}$$ where the growth of labor quality is measured with changes in cross-categorized worker characteristics, namely by gender (i), education (j), tenure (k), and age (l).

$$\rho_{ijkl} = \frac{\omega_{ijkl}\lambda_{ijkl}}{\sum_i^2 \sum_k^{12} \sum_l^9 \omega_{ijkl}\lambda_{ijkl}}$$ is the value share, which is the proportion of the total scheduled salaries paid

to the $ijkl$ th group of individuals to the aggregate total salaries paid to all workers and λ_{ijkl} is interpreted as the proportion of the $ijkl$ th workers to the total workers. For a detailed discussion of the index calculation, please refer to Watanabe (2003).

6）Please see Appendix table for the computed index for 4-year college graduates and 2-year college graduates.

7）Therefore, the efficient estimates are obtained by transforming the data as $y_* = \begin{bmatrix} \sqrt{1-\rho^2}y_1 \\ y_2 - \rho y_1 \\ \vdots \\ y_T - \rho y_{T-1} \end{bmatrix}$ and

$X_* = \begin{bmatrix} \sqrt{1-\rho^2}x_1 \\ y_2 - \rho x_1 \\ \vdots \\ y_T - \rho x_{T-1} \end{bmatrix}$, where ρ is estimated by $\hat{\rho}$ from the residual regression of $\hat{\varepsilon}_t = \rho\hat{\varepsilon}_{t-1} + u_t$, and

running the OLS until the convergence is attained. Please refer to the standard econometrics textbooks such as Greene (2008) and Johnston and DiNardo (1997) for a detailed discussion of the treatment of an AR(1) process.

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Appendix table. Changes in labor quality-adjusted full-time working population in Japan by level of education (1985=100.0)

Year	Labor quality-adjusted: 4-year college graduates	Technical/junior college graduates	High school graduates
1985	100.0	100.0	100.0
1986	100.5	100.2	100.0
1987	101.2	100.2	100.9
1988	102.9	99.4	105.5
1989	103.8	98.1	106.2
1990	104.5	95.8	107.4
1991	105.2	93.0	109.1
1992	105.3	88.9	108.3
1993	105.9	84.9	109.9
1994	105.8	85.9	107.4
1995	106.8	76.9	110.3
1996	106.9	79.1	109.2
1997	107.2	75.0	108.9
1998	107.2	68.6	108.4
1999	107.4	68.0	106.8
2000	107.7	63.1	106.2

Source: Watanabe's (2003) calculations based on *Basic Surveys on Wage Structure 1985 to 2000*, Ministry of Health, Labour and Welfare of Japan.

わが国の高等教育進学者数と労働力の
質的変化に関する定量分析

渡　邉　　聡＊

　高等教育進学者数の急激な増加に伴い，わが国の大学・短期大学では入学者の深刻な基礎学力不足が指摘されている。大学・短期大学進学者の学力低下は卒業後の技能・スキル不足，延いてはわが国の労働市場におけるマス（Mass）労働力の長期的な生産性低下に繋がることが危惧される。本稿は，わが国の四年制大学・短期大学卒業者の労働力の質的変化とその要因について，時系列データをもちいて明らかにすることを目的とする。また本稿においては重回帰分析を進めるうえで，大学・短期大学への「進学者総数」と大学・短期大学進学者が高等学校卒業者総数に占める「割合」の推移を区分して定量分析をおこなう。

　経済生産性に係る議論および理論研究において有効な指数とされるディビジア（Divisia）指数を応用した本研究の分析結果によれば，近年，特に短期大学卒業者の労働市場におけるマス労働力の質的変化に著しい減少傾向が確認できる。またこれらの労働力の質的低下は，大学・短期大学に進学する高等学校卒業者数と進学者が占める割合の急増に起因することが分かる。これに対して高等教育進学者数の増加は，わが国の労働市場における四年制大学卒業者のマス労働力の質に僅かではあるが向上効果をもたらしている。これらの分析結果は，わが国の高等教育機関における学生・教育の質保証問題が特に短期大学において深刻な課題であり，大学教育の質保証が四年制大学を対象とした学生やカリキュラムにおいてだけでなく，短期大学も含め十分な議論がなされなければならないことを示唆している。

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