Internal Staff Allocation and the Changing Workload of Japanese Professoriate: A Multilevel Statistical Analysis with Simulations

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ABSTRACT

The increasingly competitive and globalizing environment of today's higher education market has compelled many colleges and universities around the world to revamp their academic programs and organizational structures by responsively addressing various contemporary issues raised by internal as well as external stakeholders. It is no exception that Japanese colleges and universities have gone through a period of dramatic transition over the last decade under considerable pressure and influence of the central government's stringent policy mandates. Although the government-led reforms have intended to support the domestic institutions of higher education in gaining a competitive edge and assuring the quality of teaching and research, a series of reform attempts are documented to have increased the workload of Japanese professors tremendously, while shifting their work balance from teaching- and research-oriented activities towards more administrative or service-related tasks. It is a shared concern that the excessive workload of administrative responsibilities on professors deteriorates the quality of student instruction and research productivity delivered by the academic staff. This study focuses on the amount of time spent by the faculty on administrative tasks and examines how their workload is influenced by the organizational scale and composition of supporting staff members as well as faculty colleagues. Our finding suggests that a mere increase of support staff would not necessarily reduce the faculty time spent on administrative or service-related tasks in Japanese universities. An increase in employment of part-time administrative assistants per se could indeed add heavier burdens on professors, due to their growing responsibilities in managing the larger scale of their organizations. Further simulation results demonstrate that the faculty workload in administrative tasks would most effectively be alleviated with the support from research assistants, provided that the same budgetary constraint is assigned to the organizational unit.

Higher education institutions (HEIs) in Japan, particularly those in the public sector, have undergone a series of drastic government-led reforms over the last decade. One important factor behind the desperate reforming efforts by the central government as well as individual colleges and universities is a rapidly shrinking 18-year-old bracket population of the nation, which has made access to higher education wider than ever for the potential applicants which may include traditionally non-college bound high school students.[1] As Japanese colleges and universities intensely compete for the shrinking population of college-aged youths by reaching out with lowered admittance standards, the issues of quality assurance and the academic preparation of new enrollees as well as remedial education for ill-prepared students have raised serious public concerns and have become important agendas in the recent formation of domestic higher education policies.

At the graduate-level of education programs, the new scheme of professional graduate schools was inaugurated in 2003 by the central government, in order to *"respond to the social needs for the training of professionals with advanced specialized skills and the ability to fulfill a leading role in the various areas of social economy …"* (Ministry of Education, Culture, Sports, Science and Technology: MEXT). The expansion of graduate education programs to cover professional occupational arenas such as law, business and accounting, and public policy and public health, was initially hailed by the community of Japanese HEIs as the new

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professional schools scheme would certainly provide many institutions with an opportunity to rebuild financial strength by reinforcing shrinking undergraduate revenues with the new stream of non-traditional graduate enrollments. However, an oversupply of graduate-school trained specialists has caused unemployment and underemployment of recent graduates in the already saturated professional job markets, and many graduate-level professional schools in the country are on the verge of closing their programs due to the lack of robust demand from potential employers (Watanabe 2012).[2]

Perhaps most importantly in the history of modern Japanese higher education, corporatization of the national universities in 2004 especially triggered a sense of severe competition among all levels of, *i.e.*, national, prefectural, municipal, and private, colleges and universities in the country. The corporatizing effort was principally aimed at enhancing quality assurance and gaining a competitive edge for the domestic HEIs in the globalizing market, while reducing the hefty public spending on higher education through downsizing the scale of full-time employment in public institutions. In addition, the corporatized management structure with stronger leadership of the president as well as the board of directors has been designed to allow each institution to develop a distinctively unique identity in an increasingly competitive higher education market, rather than strictly regulated by the central government's sovereign controls with regard to each institution's internal affairs and management.

As a result of a decade of significant reforming attempts, however, the workload of Japanese professoriate has been documented to have increased dramatically, creating tremendous stress and anxiety among the country's academics (Fukudome 2008; MEXT 2003, 2009a; Watanabe 2011). It is a shared concern for both the university community and the MEXT that the growing workload of academic staff may deteriorate in the long term the quality of student instruction as well as research productivity delivered by these professors.[3]

This study focuses on this very issue of changing faculty workload and explores, through applications of a multilevel statistical analysis method and simulations, the optimal scale and composition of an organizational unit which effectively alleviate the growing workload of Japanese professors in administrative and management tasks. Our main finding suggests that a mere increase of support staff would not necessarily reduce the faculty time spent on service and administrative responsibilities. In fact, we find that an increase in employment of part-time support staff per se could add heavier burdens on professors, at least temporarily until organizational "economy of scale" is reached, due to their growing responsibilities in managing the larger scale of organizational units. Finally, a further simulation result suggests that the support provided by research assistants would most effectively lessen the administrative workload of professors in Japan.

Related Literature and Indigenous Factors

Preceding studies and recent survey results find that the composition of the workload among Japanese professoriate changed dramatically in the last two decades (Arimoto 1995; Fujimura 1996; Fukudome 2008; Kobayashi and Kato 1996; MEXT 2003, 2009a; Morgan 1996). These studies all document that the work content of Japanese professors has shifted considerably from teaching- and research-oriented activities towards more administrative and service-related tasks. Watanabe (2011), based on the account of individual interviews conducted as part of a research project commissioned by the MEXT, attributes this critical shift in the nature of academic work to a rapidly transforming environment of higher education market in the country. Similar international comparative studies, documented in the *Changing Academic Profession* report, also find that the amount of time spent by academic staff on teaching-related activities decreased significantly between the early 1990s and 2007 in the U.K. (Locke 2008) and Germany (Teichler 2008).

In Hong Kong, however, no significant change was found in this regard during the same period, though teaching-related activities increased at all ranks between 1993 and 2007 (Postiglione and Tang, 2008). It is commonly conceived that professors today are increasingly deprived of the time, which used to be devoted to preparation of classroom instructions, student advising and guidance as well as fulfilling research activities, as their responsibilities in internal management and administration disproportionately continue to swell.

In order to further facilitate accurate understanding of the analytical framework of this study as well as its validity for our non-Japanese audiences, it seems particularly helpful and important to spare some space for a brief description of a typical academic and research unit which distinctively characterizes the organizational structure of Japanese institutions of higher education. The so-called "*kenkyū-shitsu*" (a "research laboratory") is perhaps the smallest academic organizational unit found in Japanese colleges and universities, each of which often consists of multiple teaching and non-teaching staff members. The translated term of "laboratory" or "lab" is not necessarily used to mean a physical space equipped for scientific experimentation or research. Instead, the term is used to mean a basic unit of various activities for every faculty member regardless of one's expertise, nature and style of research, *i.e.*, professors in all fields including arts, humanities, social sciences, as well as medical and STEM (science, technology, engineering, and mathematics) disciplines. A rough image of this basic academic unit or "research lab" is depicted in Figure 1 below.

A typical research lab is composed of a single or multiple academic staff, *i.e.*, senior and/or junior faculty member(s) sharing a common research expertise, with the most senior professor representing the research unit as a leader of the team. The lab may have supporting researchers such as research associate(s) or fellow(s), as well as full- and part-time administrative staff members. The resources provided by the administrative staff may be shared with the research labs headed by other professors of different expertise in the same department or school. The employment of the full-time administrative staff, however, is normally conducted as a human resources matter of the overall institutional management, apart from and independent of the authority of the faculty. Therefore, the university management determines the assignment of the full-time administrative staff, and the staff members are subject to institution-wide job rotation or reassignment of affiliated department or division every few years. Part-time assistants, in contrast, are more likely to be hired upon request from the academic staff or privately hired by individual professors. Research assistants (RAs) are customarily employed from a small pool of doctoral students for the purpose of assisting professors' research activities.

The organizational scale of research labs in medical and STEM fields are typically larger, reflecting the nature of their research activities often requiring experimentation with equipment operated by a large group of members, than the scale of labs in humanities and social sciences which may be consisting only of a single professor with perhaps a privately hired part-time assistant. These independently standing research labs constitute an academic department, and student instruction and thesis guidance are also provided by these groups as educational units that are separately categorized according to their specific discipline or subject. Accordingly, various activities of teaching, research, and administrative and service tasks are carried out by the members of a "*kenkyū- shitsu*" or research lab as a team in most Japanese colleges and universities.

Figure 1. An image of "*kenkyū-shitsu*" (research lab) in Japanese universities
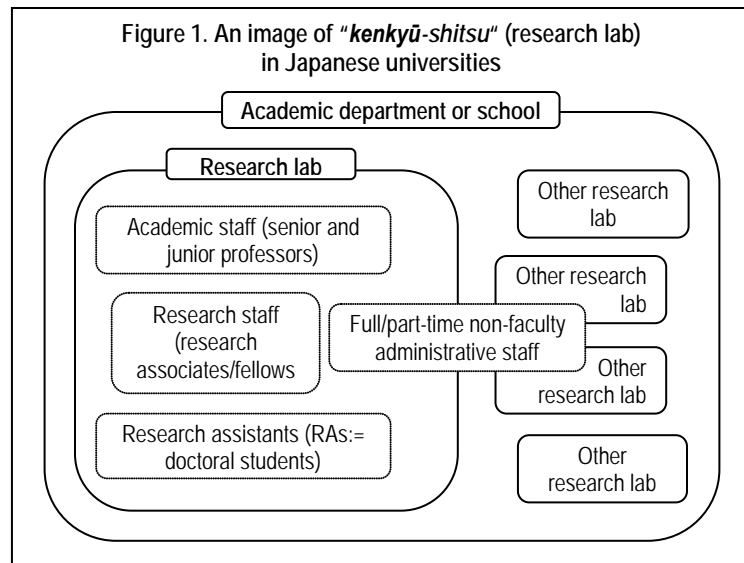
The aim of this study is placed on examining how and to what extent the composition and scale, *i.e.*, the number of supporting staff and faculty colleagues, of these research labs affects the workload of a professor who belongs to such an organizational unit. Some related studies exist in the economics literature on the relationship between institutional scale as well as scope and the research productivity of university faculties (Dundar and Lewis 1995; Hashimoto and Cohn 1997; Koshal and Koshal 1999). In contrast, the analytical focus of our study is uniquely placed on the amount of time spent by faculty on administrative or service-related tasks as it represents without doubt a single crucial factor that indirectly affects the productivity of academic staff in both teaching and research activities. Based on our estimation result, albeit preliminary at this stage, an attempt is also made to demonstrate by simulation how the changing numbers of faculty colleagues, full- and part-time administrative staff as well as research assistants in the same unit shape the administrative workload of professors under varying assumptions of budgetary constraints. The ultimate goal of our analysis is to present a clear picture of cost-effectively allocated human resources in HEIs, in hope that our finding helps many colleges and universities design academic units which enable the faculties to achieve a well-balanced distribution of workload among teaching, research, and service duties in today's high pressured institutional environment.

Data Source and Methods

The authors collected the data used for the analysis in 2010 as part of a research project commissioned by the National Institute of Science and Technology Policy (NISTEP) of the MEXT from 2010 through 2011. The data set contains a cross-sectional record of 1,511 full-time individual professors of various ranks (full, associate, assistant professors, and lecturers, regardless of a tenured status) drawn from a sample of 118 graduate schools in both public and private universities in the country. Owing to the initial aim of the NISTEP/MEXT project which primarily focused on exploring changing workload of professors responsible for graduate school instruction in large research universities, the original sample was drawn from professors affiliated with graduate schools rather than those affiliated only with undergraduate departments.[4] Moreover, in order to capture varying effects of different styles and formats of teaching, research and administrative practices in different academic disciplines, the questionnaire was distributed to the faculties of (1) literature; (2) economics and commerce; (3) physics; (4) mechanical engineering; and (5) medicine and dentistry. Therefore, the data naturally consists of multilevel or hierarchical units with individual observations

nested within the higher level units (*i.e.*, graduate schools), which in turn are nested within the higher level clusters (*i.e.*, institutions).

Table 1 shows the summary statistics on the number of hours spent per week for various activities by the sampled professors. The distribution in the table reveals that the largest amount of work time is devoted on average to research activities (17.1 hours per week), followed by student instruction and thesis guidance (13.7 hours). An average of 6.6 hours was spent by Japanese professors on internal management and administrative tasks per week, and a similar amount of consolidated time was devoted to external social service (3.1 hours) which may include serving as a reviewer for academic journals, a board member of professional and academic

Table 1. Time (hours) per week spent by Japanese professors, by category of activities				
	Mean	Median	Max	Min
Student instruction/guidance	13.7	10.0	80.0	0.0
Research activities	17.1	15.0	100.0	0.0
Internal/administrative work	6.6	5.0	50.0	0.0
External/social service	3.1	2.0	80.0	0.0
Other	3.4	1.0	40.0	0.0
Total	51.2	50.0	128.0	0.0

$N = 1{,}511$. The questionnaire also inquired about the number of hours spent per week for general practice in University Hospital for medical staff (not shown in the above table), for which the mean was 12.0 hours per week with the maximum of 100 hours.

associations, government committees, etc., and other activities not categorized above (3.4 hours). Overall, the mean and median hours worked per week by the sample of Japanese professors were found to be 51.2 and 50.0 hours, respectively, which is consistent with the previous findings by the MEXT (2009a).

It is important to remember that the daily student instruction and research activities in Japanese colleges and universities are normally conducted by a relatively large group of faculty colleagues and researchers in the same lab, particularly in medical and STEM fields, with more or less support from full- and part-time administrative staff and RAs, as discussed in the previous section. In short, these internal members carry out teaching and research as well as the related administrative tasks as a team of the same research lab. Table 2 below provides the summary statistics on the makeup of these research units, calculated based on our sample. The table indicates that the average number of academic staff in a research lab is 4.8 with the median of 3.0 professors. The average numbers of full- and part-time administrative support staff and RAs in a lab are 1.5, 1.3, and 0.7, respectively. However, the smaller medians indicate that the majority of research labs have no such formal support staff, and the averages are perhaps inflated by the numbers reported by the respondents in relatively large research labs, presumably in medical and STEM disciplines.

Table 2. Average staff members in a research lab				
	Mean	Median [†]	Max	Min
Professors	4.8	3.0	50.0	1.0
Full-time administrative staff	1.5	0.0	50.0	0.0
Part-time administrative staff	1.3	0.8	35.0	0.0
Research assistants (RAs)	0.7	0.0	17.0	0.0

$N = 1{,}511$.
[†] The median number was provided by each respondent after converting the part-time staff to the full-time equivalent, based on the number of hours worked per week.

In order to accommodate the hierarchical design of the original data, a multilevel statistical method is employed for estimating the amount of time spent by professors on internal management and administrative responsibilities. The generalized linear mixed model (GLMM) represents a class of regression models arising in almost all areas of statistical application with a hierarchical data structure (Bryk and Raudenbush 1992, Gelman and Hill 2007, Goldstein 1995, Hox 2002). It is particularly suitable for the purpose of our analysis with the possible cluster effects at different levels (*i.e.*, professors in 105 graduate schools nested in 69 institutions, with valid responses for all the necessary variables used in our analysis) with the additional categorical blocks (*i.e.*, 5 academic disciplines) that naturally exist in the sampled data. These multilevel effects can be properly controlled in the GLMM estimation with the potential random effects, which may be specified as

$$y_{ijkl} = x_{ijkl}\,\beta + \xi_j + \xi_{jk} + \xi_l + u_{ijkl},$$

$$\begin{cases} i = \text{individual professors,} \\ j = \text{institutions,} \\ k = \text{graduate schools,} \\ l = \text{academic disciplines} \end{cases}$$

where y_{ijkl} represents the number of hours spent on administrative work by an individual faculty member i, affiliated with a graduate school j, which is nested in an institution k, and self-identifying in an academic discipline l; x_{ijkl} being covariates with a corresponding vector of fixed-effect coefficients β. The next group of variables, ξ_j, ξ_{jk}, and ξ_l, capture the random effect at

multiple levels, *i.e.*, unobserved heterogeneities at institution- and graduate school-levels, as well as for the categorical blocks with five academic fields, respectively. The last term, u_{ijkl}, is defined as the disturbance that is not necessarily normally distributed. Moreover, based on the exploratory analysis of the raw data, which reveals a positively skewed distribution of the number of hours spent by individual professors on administrative work, the Poisson link is chosen as the appropriate link function for the maximum likelihood estimation of the above model. Thus, our base estimation model may be considered as the log-linear or Poisson mixed regression model with the random multilevel cluster and block effects. The estimation result of the above model with the sample of Japanese professors is discussed in the following section with some implications, followed by the simulation results in the subsequent section.

Estimation Results

The preliminary result of the GLMM estimation with the full sample is presented in Table 3. It is noteworthy that all three random effects at the levels of institutions and graduate schools as well as academic disciplines are found highly significant, justifying the validity of our random effect specification. The significant variance estimates for three random intercepts indicate that it is essential to control the unobserved heterogeneities among institutions, graduate schools, and academic disciplines.

Table 3. GLMM estimation of time spent on administration by Japanese professors			
Variable name	Coefficient	Standard error	Sig.
Constant	1.637	(0.152)	***
Number of professors	-0.047	(0.015)	**
Number of professors_squared/100	0.094	(0.113)	
Number of professors_cubed/1,000	0.005	(0.021)	
Number of full-time admin staff	0.044	(0.015)	**
Number of full-time admin staff_squared/100	-0.602	(0.153)	***
Number of full-time admin staff_cubed/1,000	0.121	(0.035)	***
Number of part-time admin staff	0.060	(0.021)	***
Number of part-time admin staff_squared/100	0.156	(0.202)	
Number of part-time admin staff_cubed/1,000	-0.115	(0.051)	+
Number of RAs	-0.069	(0.030)	*
Number of RAs_squared/100	1.700	(0.868)	+
Number of RAs_cubed/1,000	-1.027	(0.548)	+
Term (years) of employment at current institution	0.007	(0.011)	
Hours spent on student instruction per week	0.002	(0.001)	*
Hours spent on research activities per week	-0.013	(0.001)	***
Hours spent on social service per week	0.024	(0.002)	***
Fixed-term employment (yes = 1)	0.096	(0.039)	*
Style of activities (group-oriented vs. individual-driven):			
Style of research	-0.001	(0.014)	
Style of teaching	0.075	(0.014)	***
Style of administration	-0.120	(0.017)	***
Style of social service	-0.008	(0.018)	
Rank (omitted = Assistant professor):			
Lecturer	-0.108	(0.060)	+
Associate Professor	0.088	(0.046)	+
Professor	0.401	(0.046)	***
Random effects:			
$\sigma_{institution}$	0.147	†	***
σ_{school}	0.275	†	***
$\sigma_{discipline}$	0.213	†	***

N = 1,150. Other variables included in the GLMM estimation are the number of research fellows and its squared and cubed values, the number of TAs and its squared and cubed values, the number of undergraduate, masters, and doctoral students in the school/department, dummies for gender, private institution, and former imperial universities, none of which showed significant results. + significant at the 0.1 level; * significant at the 0.05 level; ** significant at the 0.01 level; *** significant at the 0.001 level.

† In order to estimate the generalized linear mixed model (GLMM), the "glmer" function included in a package "lme4" in R is run for this study. However, significance of the random effects may not be assessed as the "lmer" and "glmer" functions do not return the corresponding standard errors of the estimates of variance components. Therefore, in order to assess the significance of the random effects in "glmer", the likelihood ratio (LR) tests between four models, *i.e.*, model 1 with only fixed effects GLM versus model 2 with fixed effects with an institution-level random intercept; model 2 versus model 3 with fixed effects with institution- and school-level random intercepts; model 3 versus model 4 with fixed effects with institution-, school- and discipline-level random intercepts, were executed.

As for the effects of the co-working members in the research lab, the existence of faculty colleagues in the same unit significantly reduces the time spent by a professor on administrative work, although its squared (divided by 100) and cubed (divided by 1,000) effects show no significance. Support provided by the full-time administrative staff indeed has a positive impact on the number of hours spent by professors per week on administrative tasks, along with a significantly negative squared effect and a positive cubed effect. Because of these higher-order effects, it is predicted that the growing workload of a professor will eventually be overturned for larger scales of the full-time staff employment, causing a decline in the faculty time spent on administrative and service-related tasks. Our estimation result also reveals that increasing employment of part-time support staff does not alleviate administrative workload of professors though the significantly negative cubic effect could eventually overturn the result, given that employment of a sufficiently large number of part-time assistants are allowed. Support from RAs, in contrast, reduces the faculty workload in administration significantly. Although the quadratic effect of RAs is significantly positive, it is anticipated that the negative cubic effect may well upset the former effect for a larger scale of organizational units.

The estimated effects of varying staff compositions on faculty workload are graphically summarized in the form of predicted values in Figure 2 below. A prediction of faculty time spent on administrative duties as the number of co-workers in the lab varies is computed based on the GLMM estimation result presented in Table 3. More specifically, the predicted values may be obtained by changing the number of support staff of interest while holding the numerical values of other staff members and covariates constant. Figure 2 plots the result of such predictions, separately made for faculty colleagues, full-time administrative staff, part-time staff assistants, and RAs. Most notably in the figure, a professor's administrative workload would immediately begin to decline with additional employment of faculty colleagues in the research lab, from the baseline of 5.1 hours per week assuming no other existing support staff or colleagues.

The result is consistent with the finding in the raw questionnaire responses with nearly two-thirds of the professors requesting an expansion of faculty employment in order to alleviate their growing workload, whereas only one-third of professors favored increased employment of administrative and support staff (NISTEP 2011). Moreover, the finding may be reflecting that Japanese professors prefer to continue managing the academic and internal affairs as a shared responsibility with other professor colleagues rather than collaboratively working with administrative staff, which is an organizational issue critically pointed out by Yamamoto (2002, 2006).

Also notable in Figure 2 is the finding that a continuing employment of part-time administrative assistants per se would indeed increase the faculty workload in administration immensely, up to over 8 hours even with employment of over 13 full-time equivalent assisting individuals, after which the time spent by a professor finally begins to decline. While employing such a large number of part-time assistants may be unrealistic for most research labs, though not totally so as Table 2 shows (*e.g.*, there exists a research lab employing 30 part-time administrative assistants), the result clearly indicates that the mere increase in part-time staff employment rather creates a rising complexity for professors in managing a rapidly growing research lab, at least until the economy of scale is reached by an organizational unit with a sufficiently large group of part-time staff members.

Figure 2. Change in the amount of time spent on administrative work by Japanese professors
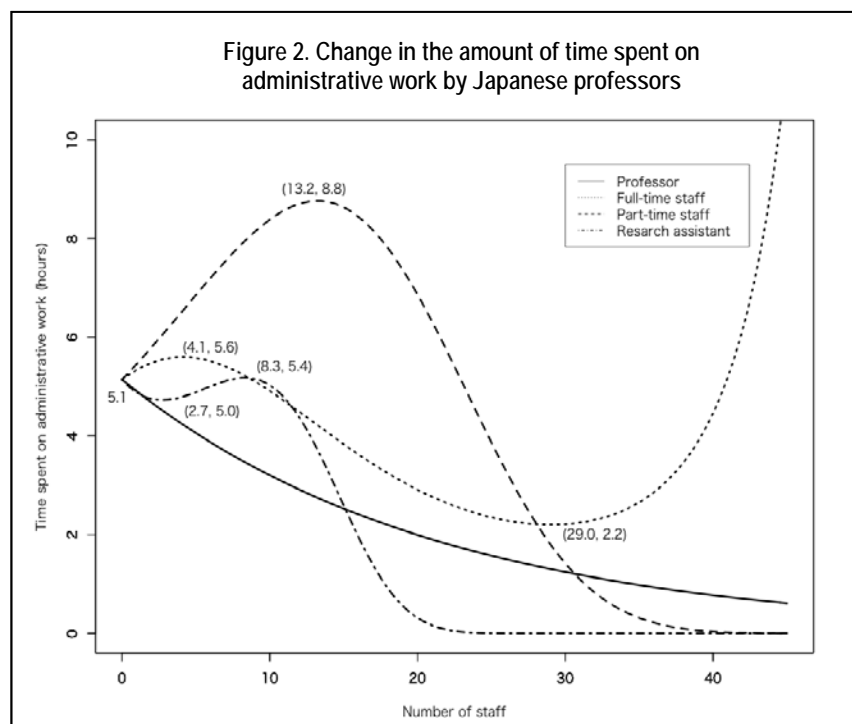
In contrast to the growing workload due to expansion of part-time support staff, increased employment of full-time administrative staff reduces the faculty time spent on administration relatively quickly after employment of four or more full-time individuals. However, as we discuss in the following section, the support from the full-time staff would not cost-effectively ease the faculty workload due to their higher compensation levels relative to part-time administrative and research assistants. Finally, support

provided by RAs also immediately alleviates the faculty workload in administration down to 5 hours per week with employment of 2.7 full-time equivalents, after which the administrative time rises slightly until starting to drop sharply with 8.3 full-time equivalent RAs. As Figure 2 clearly demonstrates, support provided by staff members and colleagues in the same organizational unit contributes fairly differently to shaping the administrative workload of a faculty member in Japanese universities.

Simulations of Workload-minimizing Staff Allocation

The staff composition of an organizational unit that minimizes the administrative workload of professors is computed under hypothetical settings. The simulations are conducted based on our preliminary GLMM estimation result (*i.e.*, based on the predicted curves in Figure 2), with varying assumptions of budgetary constraints. Moreover, in order to confine the overall organizational spending on human resources, the annual salary of 8 million yen is assumed for the academic staff, along with hypothetical compensations of 4.0, 1.3, and 1.0 million yen assumed for a full-time administrative staff, part-time administrative assistant, and RA, respectively.[5]

The simulation result in Table 4 shows that employment of only RAs should simply be pursued in order to minimize the faculty workload in administration, with no support from any other staff members, when the budget of an organization is restricted within the lower range (less than 9.0 million yen). For instance, with the help of one RA in a research lab operating with a limited budget of 1.0 to 2.0 million yen, a professor's workload in administrative tasks would be minimized at 4.87 hours per week, which is a reduction of a quarter hour per week from 5.14 without any employment of support staff in a unit.

Table 4. Simulation of administrative workload-minimizing staff composition					
Annual Budget (thousand/year)	RA	PT admin. staff	FT admin. staff	Faculty	Hours
Less than ¥1,000	0	0	0	0	5.140
¥1,000 ≤ & < ¥2,000	1	0	0	0	4.874
¥2,000 ≤ & < ¥3,000	2	0	0	0	4.753
¥3,000 ≤ & < ¥9,000	3	0	0	0	4.736
¥9,000 ≤ & < ¥10,000	1	0	0	1	4.651
¥10,000 ≤ & < ¥11,000	2	0	0	1	4.535
¥11,000 ≤ & < ¥12,000	3	0	0	1	4.519
¥12,000 ≤ & < ¥13,000	12	0	0	0	4.403
¥13,000 ≤ & < ¥14,000	13	0	0	0	3.883
¥14,000 ≤ & < ¥15,000	14	0	0	0	3.270
¥15,000 ≤ & < ¥16,000	15	0	0	0	2.614
¥16,000 ≤ & < ¥17,000	16	0	0	0	1.971
¥17,000 ≤ & < ¥18,000	17	0	0	0	1.393
¥18,000 ≤ & < ¥19,000	18	0	0	0	0.917
¥19,000 ≤ & < ¥20,000	19	0	0	0	0.559
¥20,000 ≤ & < ¥21,000	20	0	0	0	0.314
¥21,000 ≤ & < ¥22,000	21	0	0	0	0.161
¥22,000 ≤ & < ¥23,000	22	0	0	0	0.075

Note: The simulation result is based on the following annual salary assumptions: RA = ¥1.0 million per year; part-time administrative staff = ¥1.3 million per year; full-time administrative staff = ¥4.0 million per year; faculty = ¥8.0 million per year.

For further increased employment with three RAs with an expanded annual budget of 3.0 to 9.0 million yen, the administrative workload of a professor is reduced to 4.74 hours per week. However, once the organizational budget expands sufficiently, *i.e.*, over the threshold of 9.0 million up to 12.0 million yen, combined employment of RAs with an additional faculty colleague would enable minimization of administrative workload of a professor. For example, for a hypothetical budget of 11.0 to 12.0 million yen, employment of a faculty colleague along with three RAs would enable a reduction in professor's administrative workload down to 4.52 hours per week. However, with the annual budget over 12 million yen, a monotonic increase in the employment of only RAs with no faculty colleagues would most effectively reduce the administrative workload of a professor in a research lab.

As observed in Figure 2, owing to the relative inefficiencies of full- and part- time administrative and support staff in alleviating the faculty workload, the simulation result in Table 4 does not recommend any involvement or roles played by these administrative staff in minimizing the hours spent by professors on administrative and service-related tasks. Nonetheless, an exceedingly large number of RAs may not present a realistic picture as the number of RAs is directly linked to the available pool of doctoral students currently enrolled in specific areas of study. Thus, an alternative result is pursued under a more likely scenario by restricting the number of RAs in a research lab up to five individuals. The restricted result of simulations is provided in Table 5 below.

With the restricted employment of RAs capped at the maximum of five, which is perhaps a more likely assumption reflecting a limited number of available doctoral students in specific areas of study, the simulation result recommends hiring one to three RAs for nearly all ranges of organizational budgets, in conjunction with an increased employment of academic staff in most cases. For

a given budget of 11.0 to 17.0 million yen, for example, an additional faculty colleague and three RAs would reduce a professor's administrative workload to the minimized value of 4.52, which is the same result obtained without the restriction (see Table 4). Once the organizational budget exceeds 17.0 million yen, however, the simulation recommends hiring two faculty colleagues and an RA, which reduces the administrative time further to 4.44 hours per week. With an additional and small budgetary increment to the next higher bracket of 18.0-19.0 million yen, employment of two additional faculty colleagues with two RAs in a research lab could reduce the faculty workload to the minimum of 4.33 hours. Furthermore, if an abundant resource allocation is made possible for an organizational unit, e.*g.*, an annual budget of 25.0-26.0 million yen, then the combined employment of three faculty colleagues with one RA is suggested by the simulation as an optimal point of staff allocation in terms of achieving the minimization of administrative workload for a professor. Once the budgetary capacity grows over 32.5 million yen, however, a substantially large number (25-26) of part-time assistants, with no other support staff and faculty colleagues, most efficiently alleviate the administrative workload to less than four hours per week.

An increasing involvement of academic staff, along with flexible employment of research assistants, particularly when an organization is granted with abundant resources, is easily understood from their predicted impacts presented in Figure 2 and is explained by their effectiveness as co-workers handling administrative and management tasks as shared duties among themselves. However, an obstacle exists in realizing this expansion of academic appointments in Japanese universities, other than the obviously limited budgets constraining organizational recruitment practices.

The number of academic staff appointed as tenure-track or tenured as well as non-tenured (terminal or contract) professors

Table 5. Simulation of administrative workload-minimizing staff composition (The maximum number of RAs is set to 5 or less)					
Budget (thousand/year)	RA	PT admin. staff	FT admin. staff	Faculty	Hours
Less than ¥1,000	0	0	0	0	5.140
¥1,000 ≤ & < ¥2,000	1	0	0	0	4.874
¥2,000 ≤ & < ¥3,000	2	0	0	0	4.753
¥3,000 ≤ & < ¥9,000	3	0	0	0	4.736
¥9,000 ≤ & < ¥10,000	1	0	0	1	4.651
¥10,000 ≤ & < ¥11,000	2	0	0	1	4.535
¥11,000 ≤ & < ¥17,000	3	0	0	1	4.519
¥17,000 ≤ & < ¥18,000	1	0	0	2	4.437
¥18,000 ≤ & < ¥19,000	2	0	0	2	4.327
¥19,000 ≤ & < ¥25,000	3	0	0	2	4.311
¥25,000 ≤ & < ¥26,000	1	0	0	3	4.233
¥26,000 ≤ & < ¥27,000	2	0	0	3	4.128
¥27,000 ≤ & < ¥32,500	3	0	0	3	4.114
¥32,500 ≤ & < ¥33,500	0	25	0	0	3.820
¥33,500 ≤ & < ¥33,800	1	25	0	0	3.622
¥33,800 ≤ & < ¥34,800	0	26	0	0	3.241
¥34,800 ≤ & < ¥35,100	1	26	0	0	3.073

Note: The simulation result is based on the following annual salary assumptions: RA = ¥1.0 million per year; part-time administrative staff = ¥1.3 million per year; full-time administrative staff = ¥4.0 million per year; faculty = ¥8.0 million per year.

in public institutions have been strictly controlled by the government in Japan. For instance, the number of faculty positions in national universities has been historically overseen by the MEXT, and individual universities were not allowed to make academic appointments beyond the capacity assigned by the MEXT with their own internal discretion or resources.

A similar condition has been imposed on prefectural and municipal colleges and universities by the corresponding local governments. The public control has been modified to allow these institutions to more or less flexibly determine the optimal number of academic staff after the corporatization of the national universities in 2004.[6] However, the flexibly appointed academic positions are typically given to junior faculty employed based on terminal (3-7 years) contracts, and the tenure-track or tenured faculty positions in Japan's public institutions are still overseen by the central or local government authorities. Therefore, flexible appointment of academic staff in public institutions is still rather an unrealistic scenario in Japan.[7]

Finally, it is worth emphasizing that our result by no means is intended to underrate or eliminate various important roles played by administrative and support staff in Japanese colleges and universities. The aim of this study was set to demonstrate by simulation the optimal staff composition under hypothetical settings from the perspective of only minimizing the administrative workload of academic staff. This approach was pursued in hope that the alleviated workload in administrative or management tasks of Japanese professors could be turned into their enhanced productivities in teaching and research. Apparently, there exist numerous tasks that could only be carried out by full-time administrators, and it would be overly unrealistic to imagine any institutions without such professional individuals. Underrepresented roles of the administrative and support staff found in this study may be attributed to a clear separation of administrative responsibilities presumed or pre-assigned between the academic and administrative staff in Japanese HEIs.

Conclusions and Future Agendas

This study, using a small sample of Japanese university professors collected as part of a research project commissioned by the National Institute of Science and Technology Policy of the MEXT, focused on the amount of time devoted to non-teaching, non-research activities by academic staff and examined the extent to which faculty workload in administration is influenced by varying compositions of administrative and support staff as well as academic colleagues working in the same organizational unit. Our finding suggests that a mere increase of support staff would not necessarily reduce the faculty time spent on administrative or service-related tasks in Japanese universities. An increase in employment of part-time support staff could indeed add heavier burdens on professors, due to their growing responsibilities in managing the larger scale of their organizations. Further simulation results demonstrate that the faculty workload in administrative tasks would most effectively be minimized with the support from research assistants, in conjunction with additionally employed faculty colleagues provided that sufficiently large financial resources are allocated to the organizational unit. Although our preliminary findings from the multilevel statistical analysis with simulations present important implications on the issue, the results also raise some vital future research agendas.

Firstly, our preliminary result is based on an estimation with the full sample of professors in all academic disciplines, which include professors in (1) literature, (2) economics and commerce, (3) mechanical engineering, (4) physics, and (5) medicine and dentistry. Although the GLMM estimation captures the potential random effects existing among different academic fields, the structure of collaboration within each organizational unit may vary significantly by academic field. Thus, it may be ideal to conduct further analyses with sub-samples that are separated according to the academic disciplines. Furthermore, since the number of faculty positions in private institutions is not subject to the governmental control, it is anticipated that the employment of necessary academic colleagues in a research lab may be more efficiently conducted. The resultant differences between public and private institutions are worth investigating.

Secondly, employment practices, as well as the assignment of full-time administrative staff, are beyond the authority of faculty members. Therefore, the variable on full-time administrative staff may perhaps be treated exogenously rather than using it as one of the controlling variables in our simulations. Thirdly, and perhaps most critically, the interactions among different categories of staff members may generate synergetic effects on the faculty workload. Thus, further model estimation with the suitable interaction terms among the related staff categories is necessary to allow the synergetic effects in our simulation results.

Finally, even if the faculty workload in administrative and service tasks is reduced as a result of efficient management of human resources in the organization, whether the extra hours borne from such efforts would be turned into productivity enhancement in teaching and research remains to be carefully examined.

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ENDNOTES

1. The advancement rate of Japanese high school graduates to postsecondary institutions, which include 2-year junior colleges and 4-year universities, rose from 37 percent in 1990 to 58 percent in 2010 (MEXT 1991, 2011). Moreover, 81 percent of high school graduates in the country entered some form of higher learning programs in 2010 (MEXT 2011).
2. Overall, 187 professional graduate schools or programs were established in Japan within a short span of 2003-2011 years, of which 111 were launched in private institutions. However, as of April 2012, four private universities have determined to shut down their law schools by 2013, and one private university has already closed its public policy school.
3. It is also worth noting that teaching workload for Japanese professors is on average much greater than that of US colleagues. For example, statistics by the MEXT (2009b) shows that professors at national universities teach an average of 6.1 classes per week, while private university professors teach an average of 7.6 classes per week, for which the calculation is based on one course being equivalent of 90 minutes and offered for 15 weeks.
4. Graduate school-affiliated professors in Japanese universities are normally responsible for instruction and guidance of both undergraduate and graduate students, while the undergraduate department-affiliated faculty provide instructions for undergraduate students only.
5. Our simulation result is fairly robust to the change in these assumptions of staff compensation; that is, altering these assumed values of salaries did not affect our basic findings.
6. Prefectural and municipal colleges and universities in Japan followed the corporatizing efforts of national universities which took place in 2004, transforming themselves into corporatized entities with an organizational structure under stronger leadership of president with the board of directors.
7. Private colleges and universities, of course, are not subject to this governmental contol.

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