

A Time Allocation Study of University Faculty*

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Abstract

Previous time allocation studies have assumed that work was a homogeneous activity. All relevant tradeoffs were thus made between work and either leisure or household activity. This paper investigates the at-work allocation of time among teaching, research, and broadly-defined service by university faculty, scientists and engineers in particular. We focus on the impact of tenure on this allocation of time, and we find in general that tenure does not affect the percentage of faculty time devoted to teaching; rather tenure decreases the percentage of faculty time devoted to research and grant writings in favor of university service. We find that, on average,

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I. Introduction

Absent from the extensive review of the time allocation literature by Juster and Stafford (1991) are economic studies about the time allocation among work-related activities. This was a justifiable omission because no such studies had then been conducted. There were, we believe, at least two reasons for this void in the literature. The first reason is that the extant literature had assumed that work was a homogenous activity, and the time not spent working was used for either leisure or household production.¹ The second reason is related to the first; no public domain databases contained information on heterogeneous at-work activities.² The absence of at-work allocation studies during the intervening 15 years is due to these same reasons.³

In this paper we investigate the at-work allocation of time among teaching, research, and broadly-defined service by university faculty, scientists and engineers in particular. We focus on the impact of tenure on the at-work allocation of time. Some studies have looked at the impact of tenure on other university-related activities such as licensing and have found, theoretically, that less licensing is done by non-tenured faculty; other studies have found that tenure does not affect the quality of publications.⁴ Also, the confirmation of tenure related changes the relative price of faculty activity, research in particular at a research university, although empirical research to date has not quantified this price effect.

¹ This assumption is even present in the recent American Time Use Survey (Frazis and Stewart (2004); Hammermesh et al. 2005).

² Juster and Stafford (1991, p. 513) noted the need for time diaries “to disaggregate a work period into subcomponents of different activities and different work intensities.” Relatedly, there is a rich literature related to reporting biases associated with time diaries. See, for example, Thomas et al. (2003).

³ The education literature related to how faculty allocate their time has generally been conducted at the aggregate (e.g., cross university) level. For a review of this literature, see Milem et al. (2000) and the references therein.

⁴ See, for example, Thursby et al. (2005) and Goldfarb et al. (2003).

Understanding how faculty allocate their time, and the determinants of that allocation, falls broadly under what may be called public accountability.⁵ From a funding sense, all universities are public; stakeholders have a right to know about resource allocations, and universities have a responsibility to be forthcoming. For example, in 2003, 55.9 percent of research support at public institutions came from the federal government compared to 74.2 percent at private institutions.^{6, 7} Similarly, time allocations send signals to university administrators about how faculty view the price of alternative time-related responsibilities, and how that price changes with tenure. Such information is critical to implementing efficient incentive systems. Finally, to the extent that the time allocation of faculty is related to subsequent academic success, understanding such issues especially among women has policy implications toward balancing the representation of women in science and engineering.⁸

The remainder of the paper is outlined as follows. In Section II, we describe the database that we used for this study and our statistical findings, and then in Section III we discuss, in an exploratory manner, the implications of our findings.

II. The Empirical Analysis

The Dataset

The data for this study come from the National Science Foundation / Department of Energy Survey of Academic Researchers. This database was constructed by Bozeman and Link under the sponsorship of these agencies within the Research Value Mapping Program at Georgia Tech for the purpose of understanding the teaching, research, and grant experiences of university scientists and engineers and their career trajectories.

⁵ See Link and Scott (2003) for a broad-based discussion of this topic.

⁶ These percentages have remained fairly constant for several decades. See National Science Board (2006, appendix table 5-10).

⁷ Relatedly, federal funding agencies are subject to the Government Performance and Results Act (GPRA) of 1993 (P.L. 103-62), which, among other things, holds federal funding agencies accountable to measuring the performance of their allocated research dollars, and one dimension of such performance is the time allocation of recipients. As well, the sentiment of GPRA has already begun to trickle down to states and thus to their allocation strategies (e.g., post-tenure review procedures).

⁸ The under representation of women in science and engineering first gained the national spotlight with the publication of the 1989 White House Report, *Changing America: The New Face of Science and Technology*.

Survey data were collected from a sample of university scientists and engineers with the Ph.D. at the 150 Carnegie Extensive Doctoral/Research Universities during the time period spring 2004 to spring 2005.⁹ The sample of researchers selected to receive the survey is stratified by academic field and gender.¹⁰ We construct sample weights so that the sample is representative of the population of academic scientists and engineers. These weights are used in the analysis.



The variable of interest in this paper is the allocation of faculty time. Individuals were asked to estimate over the past full academic term the percent of time per week devoted to ten different activities such as research related to grants, non-grant research, teaching, advising students, and departmental service. We combine these categories into research, grant writing, teaching, and service. Descriptive statistics for these four activities are listed in Table 1.

Table 2 reports mean percentage of time allocated to teaching, research, grant writing, and service for faculty with tenure and for faculty without tenure.¹¹ Clearly, there is little difference between tenured and non-tenured faculty in the percentage of time allocated to teaching. Non-tenured faculty spend relatively more time on research and grant writing compared to tenured faculty, who spend relatively more time on service. Also, among tenured faculty, rank seems to matter. Full professors, compared to associate professors, allocated slightly more time to research and service and slightly less time to teaching.

⁹ See, <http://www.carnegiefoundation.org/Classification/index.htm>.

¹⁰ The target sample was 200 men and 200 women from each of the 12 National Science Foundation science and technology disciplines: biology, computer science, mathematics, physics, earth and atmospheric science, chemistry, agriculture, chemical engineering, civil engineering, electrical engineering, mechanical engineering, and materials engineering (<http://www.nsf.gov/sbe/srs/nsf03310/start.htm>). Sampling proportions are available upon request from the authors, as is the survey instrument.

¹¹ In constructing the estimation sample, we deleted 16 faculty who are assistant professors with tenure, and we deleted 42 associate and full professors who do not hold tenure in order to calculate the means in Table 2.

The Survey of Academic Researchers also contains information on a number of professional variables. As seen in Table 2, we have information on rank and tenure status. We also observe the number of years in the current rank as well as information about the career paths of associate and full professors. Lastly, the survey includes data on demographic characteristics such as gender, race/ethnicity, and citizenship status. Table 3 presents descriptive statistics for these variables.

The Empirical Models and Results

Because our dependent variables are fractions that are bounded between zero and one, we cannot use standard regression techniques. Instead, we use a quasi-likelihood model as suggested by Papke and Wooldridge (1996).

We begin with two parsimonious specifications.¹² The first of these builds on the results in Table 2 by including an indicator for tenure as the only explanatory variable. The second specification replaces the tenure indicator variable with years of since receiving tenure. Table 4 present marginal effects and robust standard errors.¹³ Neither tenure nor years with tenure affects the percentage of time that faculty allocate to teaching (as anticipated from Table 2). However, non-tenured faculty devote more time to research and to grant writing than do tenured faculty.¹⁴ Tenured faculty devote more time to university service.

The results in Table 5 include gender as an additional independent variable. In either specification, gender does not affect the time allocation toward teaching; males are more research intensive; and males devote less time to university service. When tenure is measured dichotomously, males are less inclined toward grant writing and university service.

¹² All models include indicator variables for academic field.

¹³ Complete regression results for all specifications are available from the authors on request.

¹⁴ The Thursby et al. (2005) model of faculty behavior concludes that untenured faculty are more intensely involved in basic research as opposed to applied research.

The results in Table 6 consider an expanded specification of tenure/rank, with and without gender effects. This specification includes years as an assistant professor, an indicator for associate, years as an associate professor, an indicator for full professor, and years as a full professor.¹⁵ Again, males allocate about the same proportion of their time to teaching and grant writing as do females, relatively more of their time toward research, and relatively less of their time toward service. Time in rank as an assistant professor has no effect on the allocation of time among teaching, research, and grant writing, but over time assistant professors accept more service responsibilities.¹⁶ Regarding rank intercept terms, associate professors allocate relatively less time in grant writing than do either assistant professors or full professors; full professors allocate relatively more time to service than assistant professors or associate professors. Full professors also allocate relatively less time to research than do assistant professors or associate professors. Regarding time-in-rank among tenured associate and full professors, the longer a faculty members remains an associate professor, the greater the percentage of time he/she allocates to teaching and the less the percentage of time he/she allocated to research and grant writing. For full professors, time-in-rank manifests itself primarily in the area of less grant writing.

Figure 1 shows the predicted fractions of time spent on each of the four activities using the results of columns 1, 3, 5, and 7 from Table 6. The assumption is that the person is an assistant professor from year 0 through year 7, becomes an associate professor in year 8, and becomes a full professor in year 19. As shown in Figure 1, we estimate that new assistant professors spend the greatest fraction of time on research and grant writing. Compared to an assistant professor with several years of experience, newly tenured associate professors spend a greater fraction of their time on research and less time on teaching. As tenure as an associate increases, time spent doing research falls while time spent on teaching increases. Finally, upon promotion to full professor, there is a significant reduction in teaching and an increase in service related activities.

¹⁵ The marginal effects are calculated at the means for academic fields and from zeros for all of the rank descriptors.

¹⁶ One faculty member in our sample has been an assistant professor for 11 years and another for 14 years. Our findings do not change when these two are deleted from our analysis.

It is important to note, that the estimates do not come from panel data on a sample of faculty. Thus, these predictions should be interpreted as describing the experience of faculty researchers in 2005 rather than as describing the casual effects of promotion. In that light, the discontinuities between assistants and associates is indicative of the fact that faculty who receive tenure at research oriented universities are likely to spent more time conducting research than the whole population of advanced assistant professors. Interestingly, though, we see essentially no such selection for grant writing.

Finally, Tables 7 through 10 report results from fully specified models. These models include additional demographic variables as well as university effects. Generally,

In subsequent analyses, which are not reported here, we

III. Implications of Our Findings

- faculty productivity literature
- future limited extramural funding and increased competition
- no tradeoff between teaching and research contrary to the education literature.

Table 1
Allocation of Faculty Time by Category of Activity

Activity	Percent of Time	
	Mean	Standard Deviation
<i>Teaching^a</i>	0.317	0.007
<i>Research^b</i>	0.357	0.007
<i>Grant Writing</i>	0.083	0.003
<i>Service^c</i>	0.243	0.006

Notes:

^a Includes preparation time and meetings outside class.

^b Includes both grant and non-grant research.

^c Includes administering grants, advising students, paid consulting, and all levels of service. Sample size = 1,403; population size = 29,715.

Table 2
Tenure, Rank and Average Time Allocation

	Teaching	Research	Grant Writing	Service
Non-Tenured	0.315	0.401	0.115	0.169
All Tenured	0.318	0.346	0.075	0.261
Associate	0.363	0.329	0.078	0.230
Full	0.300	0.353	0.074	0.274

Notes:

Fractions may not add to 1 due to rounding. All associate professors and full professors hold tenure; no assistant professor holds tenure. Sample = 1,403; population = 29,715.

Table 3
Variables Considered in Alternative Specifications

Variable	Description	Mean	Standard Deviation
<i>tenure</i>	1 if faculty member holds tenure, 0 otherwise	0.806	0.015
<i>yrstenure</i>	years faculty member has held tenure	13.859	0.470
<i>male</i>	1 if faculty member male, 0 if female	0.894	0.006
<i>asst</i>	1 if faculty member assistant professor, 0 otherwise	0.194	0.015
<i>assoc</i>	1 if faculty member associate professor with tenure, 0 otherwise	0.223	0.016
<i>full</i>	1 if faculty member full professor with tenure, 0 otherwise	0.576	0.019
<i>yrssast</i>	years assistant professor as proxied by years in a tenure-track position	4.270	0.120
<i>yrssassoc</i>	years associate professor has been associate professor	8.108	0.583
<i>yrssfull</i>	years full professor has been full professor	15.613	0.515
<i>white</i>	1 if faculty member white; 0 otherwise	0.799	0.016
<i>asian</i>	1 if faculty member Asian; 0 otherwise	0.136	0.014
<i>citizen</i>	1 if faculty member born or naturalized US citizen; 0 otherwise	0.857	0.014
<i>married</i>	1 if faculty member married; 0 otherwise	0.899	0.011

Notes:

All associate professors and full professors hold tenure; no assistant professor holds tenure. Only assistant professors are used to calculate *yrssast*; only associate professors are used to calculate *yrssassoc*; and only full professors are used to calculate *yrssfull*. Sample = 1,403; population = 29,715.

Table 4
Parsimonious Models of Time Allocation: Marginal Effects

	ME % Time Teaching	ME % Time Research	ME % Time Grant Writing	ME % Time Service
<i>tenure</i>	0.003 (0.014)	-0.061*** (0.015)	-0.037*** (0.007)	0.096*** (0.012)
Log Likelihood	-12,989.75	-13,447.08	-6246.78	-11,655.66
<i>yrstature</i>	0.0006 (0.0006)	-0.002** (0.0007)	-0.002*** (0.0002)	0.002*** (0.0006)
Log Likelihood	-12,986.48	-13,466.06	-6,206.65	-11,709.70

Notes:

Robust standard errors in parentheses. Academic field dummies are included in all specifications. As a group, the field effects are significant. Sample = 1,403; population = 29,715.

*** significant at .01 level; ** significant at .05 level; * significant at .10 level.

Table 5
Models of Time Allocation with Tenure and Gender: Marginal Effects

	ME % Time Teaching	ME % Time Research	ME % Time Grant Writing	ME % Time Service
<i>tenure</i>	0.004 (0.014)	-0.065*** (0.015)	-0.036*** (0.007)	0.097*** (0.012)
<i>male</i>	-0.009 (0.011)	0.042*** (0.011)	-0.012** (0.005)	-0.020** (0.010)
Log Likelihood	-12,989.24	-13,436.52	-6,244.00	-11,652.71
<i>yrstenure</i>	0.0007 (0.0006)	-0.002** (0.0007)	-0.002*** (0.0002)	0.003*** (0.0005)
<i>male</i>	-0.013 (0.012)	0.044*** (0.011)	-0.005 (0.005)	-0.026** (0.010)
Log Likelihood	-12,985.41	-13,454.66	-6,206.17	-11,705.14

Notes:

Robust standard errors are in parentheses. Academic field dummies are included in all specifications. As a group, the field effects are significant. Sample = 1,403; population = 29,715.

*** significant at .01 level; ** significant at .05 level; * significant at .10 level.

Table 6
Models of Time Allocation with Tenure, Gender, and Rank: Marginal Effects

Variable	ME % Time Teaching		ME % Time Research		ME % Time Grant Writing		ME % Time Service	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>male</i>	--	-0.010 (0.011)	--	0.042*** (0.011)	--	-0.006 (0.005)	--	-0.026** (0.010)
<i>yrsasst</i>	0.001 (0.006)	0.001 (0.006)	-0.008 (0.008)	-0.008 (0.008)	-0.008 (0.006)	-0.008 (0.007)	0.010*** (0.003)	0.010*** (0.003)
<i>assoc</i>	-0.024 (0.034)	-0.024 (0.034)	-0.033 (0.042)	-0.034 (0.042)	-0.048* (0.026)	-0.047* (0.026)	0.105*** (0.023)	0.104*** (0.022)
<i>yrsassoc</i>	0.009*** (0.002)	0.009*** (0.002)	-0.010*** (0.002)	-0.010*** (0.002)	-0.002*** (0.0004)	-0.003*** (0.009)	0.001 (0.001)	0.001 (0.001)
<i>full</i>	-0.022 (0.034)	-0.022 (0.034)	-0.105** (0.040)	-0.106** (0.042)	-0.045* (0.028)	-0.044* (0.026)	0.160*** (0.023)	0.160*** (0.023)
<i>yrsfull</i>	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.0008 (0.001)	-0.002*** (0.004)	-0.002*** (0.0004)	-0.0001 (0.001)	0.0000 (0.001)
Log Likelihood	-12,875.14	-12,874.52	-13,375.85	-13,365.49	-6,201.40	-6,200.71	-11,618.72	-11,614.13

Notes:

Robust standard errors are in parentheses. Academic field dummies are included in all specifications. As a group, the field effects are significant. Sample = 1,403; population = 29,715.

*** significant at .01 level; ** significant at .05 level; * significant at .10 level.

Figure 1

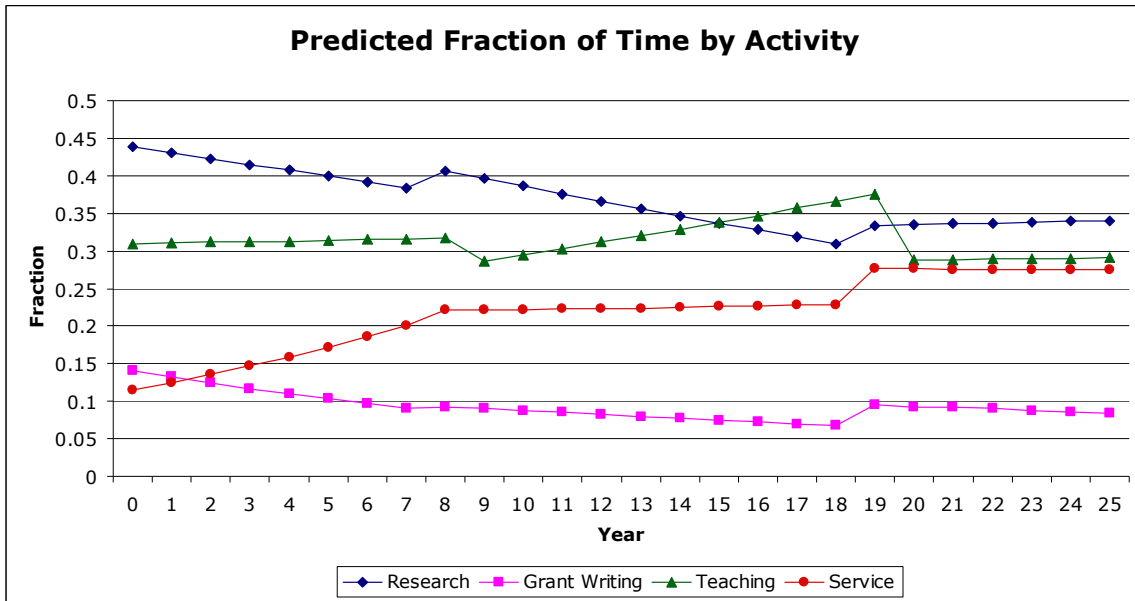


Table 7
Full Specifications of Time Allocation for Teaching Model: Marginal Effects
(standard errors in parentheses; n=1,403)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>tenure</i>				--	--	--	--
	()	()	()				
<i>yrstenure</i>	--	--	--	()	()	()	--
<i>male</i>				()	()	()	()
	()	()	()				
<i>assoc</i>	--	--	()	--	--	()	()
<i>full</i>	--	--	()	--	--	()	()
<i>yrsasst</i>	--	--	--	--	--	--	()
<i>yrsassoc</i>	--	--	--	--	--	--	()
<i>yrsfull</i>	--	--	--	--	--	--	()
<i>white</i>	--	()	()	--	()	()	()
<i>asian</i>	--	()	()	--	()	()	()
<i>citizen</i>	--	()	()	--	()	()	()
<i>married</i>	--	()	()	--	()	()	()
Log Likelihood							

Note:

Academic field dummies are included in all specifications. As a group, the field effects are significant.

University dummies are included in all specifications. As a group, the university effects are significant.

*** significant at .01 level; ** significant at .05 level; * significant at .10 level.

Table 8
Full Specifications of Time Allocation for Research Model: Marginal Effects
(standard errors in parentheses; n=1,403)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>tenure</i>				--	--	--	--
	()	()	()				
<i>yrstenure</i>	--	--	--	()	()	()	--
<i>male</i>				()	()	()	()
	()	()	()	()	()	()	()
<i>assoc</i>	--	--	()	--	--	()	()
<i>full</i>	--	--	()	--	--	()	()
<i>yrsasst</i>	--	--	--	--	--	--	()
<i>yrsassoc</i>	--	--	--	--	--	--	()
<i>yrsfull</i>	--	--	--	--	--	--	()
<i>white</i>	--	()	()	--	()	()	()
<i>asian</i>	--	()	()	--	()	()	()
<i>citizen</i>	--	()	()	--	()	()	()
<i>married</i>	--	()	()	--	()	()	()
Log Likelihood							

Note:

Academic field dummies are included in all specifications. As a group, the field effects are significant.

University dummies are included in all specifications. As a group, the university effects are significant.

*** significant at .01 level; ** significant at .05 level; * significant at .10 level.

Table 9
Full Specifications of Time Allocation for Grant Writing Model: Marginal Effects
(standard errors in parentheses; n=1,403)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>tenure</i>				--	--	--	--
	()	()	()				
<i>yrstenure</i>	--	--	--	()	()	()	--
<i>male</i>				()	()	()	()
	()	()	()	()	()	()	()
<i>assoc</i>	--	--	()	--	--	()	()
<i>full</i>	--	--	()	--	--	()	()
<i>yrsasst</i>	--	--	--	--	--	--	()
<i>yrsassoc</i>	--	--	--	--	--	--	()
<i>yrsfull</i>	--	--	--	--	--	--	()
<i>white</i>	--	()	()	--	()	()	()
<i>asian</i>	--	()	()	--	()	()	()
<i>citizen</i>	--	()	()	--	()	()	()
<i>married</i>	--	()	()	--	()	()	()
Log Likelihood							

Note:

Academic field dummies are included in all specifications. As a group, the field effects are significant.

University dummies are included in all specifications. As a group, the university effects are significant.

*** significant at .01 level; ** significant at .05 level; * significant at .10 level.

Table 10
Full Specifications of Time Allocation for Service Model: Marginal Effects
(standard errors in parentheses; n=1,403)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>tenure</i>				--	--	--	--
	()	()	()				
<i>yrstenure</i>	--	--	--	()	()	()	--
<i>male</i>				()	()	()	()
	()	()	()				
<i>assoc</i>	--	--	()	--	--	()	()
<i>full</i>	--	--	()	--	--	()	()
<i>yrsasst</i>	--	--	--	--	--	--	()
<i>yrsassoc</i>	--	--	--	--	--	--	()
<i>yrsfull</i>	--	--	--	--	--	--	()
<i>white</i>	--	()	()	--	()	()	()
<i>asian</i>	--	()	()	--	()	()	()
<i>citizen</i>	--	()	()	--	()	()	()
<i>married</i>	--	()	()	--	()	()	()
Log Likelihood							

Note:

Academic field dummies are included in all specifications. As a group, the field effects are significant.

University dummies are included in all specifications. As a group, the university effects are significant.

*** significant at .01 level; ** significant at .05 level; * significant at .10 level.

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