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The Value of Tenure in Higher Education

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Our findings indicate that tenure has an important impact on job satisfaction in academia, depending to some extent on the type of academic institution at which one is employed. We estimate its monetary value by determining the additional income needed to keep job satisfaction constant if the benefit of tenure were taken away. Because income has a relatively modest effect on job satisfaction, the increase needed to offset the loss of tenure is quite large. Thus, it would be difficult to compensate for the decrease in job satisfaction if tenure were unilaterally abolished by an institution or educational system.

Keywords: Job Satisfaction, Professional Labor Markets, Compensation Packages, Nonwage Labor Costs and Benefits

JEL Classification: J28, J44, J33, J32

I. Introduction

Academic tenure in higher education is under attack. Wisconsin Governor Scott Walker recently asked his state's Board of Regents to reconsider state university tenure with a goal of removing it from state law.[1] Northwestern University law professors McGinnis and Schanzenbach (2015) argued that tenure has reached its "sell-by" date and imposes significant costs on higher education. These costs include reduced productivity from a graying professoriate, "crowding out" of younger and more productive faculty, and limitations on a university's ability to reallocate resources into growing academic fields. They further argue that these costs have been exacerbated by the 1994 law abolishing mandatory retirement and propose replacing tenure with long-term faculty contracts. A paper by Zemsky (2008) finds the percent of tenured/tenure-track faculty has been in decline for three decades and speculates that tenure abolition may begin to appear on future ballot initiatives. In 2012, a bill was introduced, but defeated, in the Utah legislature that would have forbidden state colleges and universities from offering tenure to incoming faculty members. A similar bill was considered in 2011. Representative Christopher Herrod, who proposed the measure, said: "There's been no academic research that tenure benefits the system."[2]

This paper shows that—while it may have costs—tenure does provide at least one important benefit to the state system: it allows colleges and universities to attract and retain qualified faculty at a substantially lower monetary price than would otherwise be possible. Tenure, which provides a degree of job security and status, is an important non-pecuniary benefit that is highly valued in

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[1] See Ehlke (2015)

[2] See Maffly (2012).

academia. Unilaterally eliminating it would force an institution or state system to increase other compensation to attract the same quality of faculty.

Moreover, the institution of tenure benefits society in general by increasing the number of highly educated persons. Largely due to the high opportunity costs associated with prolonged time-to-degree and postdoctoral appointments, estimates indicate that for many disciplines the pecuniary returns on obtaining a PhD are substantially inferior to what might otherwise be realized.[3] Thus, the non-pecuniary job attributes associated with a doctoral degree, such as intellectual satisfaction, must be substantial to compensate.[4] Our results show that tenure is an important component of the non-pecuniary benefits associated with a doctoral degree and suggest that abolishing it throughout academia, without offsetting increases in salaries or other benefits, would essentially shift the demand curve for PhDs downward and, in the long run, result in a lower quantity and/or quality of persons with doctoral degrees. Fewer of our best and brightest students would pursue PhDs.

This raises an important question: if tenure were abolished, how much would PhD faculty have to be compensated to offset the loss of this job benefit? This paper estimates the dollar value of academic tenure to PhDs collectively in the fields of physical and life sciences, technology, engineering, math, and social science (hereafter called "PhDs"). We use data from the 2003 Survey of Doctorate Recipients to explain job satisfaction as a function of demographic characteristics and job attributes, including tenure or the possibility of tenure. We then calculate the increase in salary required to hold job satisfaction constant if tenure were removed from the equation. The estimated number is relevant to an institution or state system that might unilaterally abolish tenure, and then have to compete with tenure-granting institutions for qualified faculty. Admittedly, if tenure were abolished generally throughout academia, there would be market and other adjustments over time, and we make no attempt to predict what these might be.

II. Previous Research

The existing body of research on job satisfaction has produced some consistent findings.[5] Job satisfaction is inversely correlated with quit rates and absenteeism. Age and job satisfaction are related in a convex manner—job satisfaction is highest for younger and older workers. Non-union workers have higher job satisfaction. Job satisfaction is found to decrease as average weekly work hours increase. Workers generally report higher job satisfaction in small firms. Minorities tend to report lower job satisfaction than whites. Female workers tend to report higher job satisfaction than male workers *ceteris paribus* (Bender *et al*., 2005; Hull, 1999; Clark, 1997).

A consistent finding is a weak association between pay and job satisfaction. Hamermesh (2004) found that workers in high-income categories do not report higher job satisfaction. Clark and Oswald (1996) find evidence that being "overpaid" compared to expectations, and not absolute income, is what produces satisfaction. Groot and van den Brink (1999) argue the absence of a pay/job satisfaction association occurs from "preference drift," which means that as workers become accustomed to higher wages, the wage effect on job satisfaction disappears.

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[3] A recent paper estimates the internal rate of return on PhD training in the sciences and engineering to be less than four percent. See Baker *et al*. 2010.

[4] Job satisfaction of PhD S&Es exceeds that of the professions save medicine. However, this is largely the result of a disproportionate share of PhDs employed in the academic sector, which produces higher job satisfaction for professionals as well as PhDs. See Baker *et al*. 2010.

[5] This review is based upon an excellent job satisfaction literature survey in Bender *et al*. (2005).

Although the literature on job satisfaction for doctoral degree holders is meager, the findings for this group tend to be consistent with studies of other populations (see for example Sloane and Ward, 2001; Sabharwal and Corley, 2009; Bender and Heywood, 2006; Baker *et al.*, 2010). Some exceptions were observed by Moguérou (2001), whose study found that certain PhD job satisfaction characteristics ran counter to previous findings (e.g., females with PhDs were more likely to have lower job satisfaction; higher work hours were associated with increased job satisfaction). However, a very robust finding of the work involving PhDs in academia is a strong association between job satisfaction and tenure status.

To the authors' knowledge there have been no previous estimates of the economic value of tenure. Steven Levitt, a prominent economist and author of the popular book *Freakonomics*, indicated that he would gladly accept another $15,000 in pay instead of tenure. Economist Gregory Mankiw responded that Levitt's "star power" allows him to place a much lower value on tenure than typical academic economists.[6]

Previous research on the tenure-salary tradeoff has focused upon the effect of tenure on salaries. Formby and Hoover (2002) and Monks (2007) found that tenure status had a substantial impact on entry level faculty salaries with tenure-track hires receiving salary premiums over non-tenure-track hires. Barbezat and Donihue (1998) argued that tenure resulted in "golden handcuffs" by reducing labor mobility. This reduced mobility created monopsony power over senior tenured faculty and lower wages especially in late career. Ehrenberg *et al.* (1998) found evidence that a trade-off existed between tenure probability and pay; economic departments that had low tenure rates paid higher salaries.

III. Data

This study uses data from the 2003 Survey of Doctorate Recipients (SDR), conducted in October 2003 by the U.S. Census Bureau for the National Science Foundation. The SDR provides information from a nationally representative sample of individuals who received a doctorate from a U.S. university in a science, engineering, or health field; were citizens or non-citizens residing in the U.S.; and were under 76 years old. The survey response rate was 79.1 percent overall, and generally within the range of 75-85 percent when stratifying by key respondent characteristics; thus, non-response bias is minimal. The full data set consists of 29,923 raw cases, 23,531 usable cases of persons employed in the non-health fields and, for purposes of this study, 10,728 usable cases of PhDs employed in the academic sector.

The dependent variable is based on the response to a survey question indicating overall job satisfaction on a 4-item scale of "very satisfied," "somewhat satisfied," "somewhat dissatisfied," or "very dissatisfied." Since the large majority of respondents rated their level of job satisfaction as either very satisfied (49 percent) or somewhat satisfied (42 percent), and to simplify the analysis, the dependent variable was specified as a binary response equal to 1 if very satisfied and 0 otherwise.[7] We use the term "job satisfaction" to paraphrase the estimated probability that a doctorate would report being "very satisfied."

Table 1 provides descriptions of the dependent variable and all explanatory variables considered in this analysis. Information on persons working outside of academia in the government and business sectors is shown for comparison. Most of the explanatory variables listed in Table 1

[6] This was discussed in Mankiw's Blog (http://gregmankiw.blogspot.com/2007/03/levitt-on-tenure.html, accessed November 5, 2013).

[7] We also estimated ordered probit models, with a dependent variable indicating each of the four levels of overall job satisfaction. Since the key results were essentially the same, we used the binary model for simplicity.

are commonly used to explain job satisfaction, and definitions are evident.[8] Note that sets of exhaustive categorical variables are grouped together and set apart by spaces.

We expected the type of employing academic institution to be an important factor for this analysis and therefore constructed a set of dummy variables to capture this effect based upon the Carnegie Classification system. The 2003 Carnegie system was composed of 11 different categories which we collapsed into five categories as follows:[9]

1. Research 1 (R1) universities correspond to Carnegie R1. Institutions that award at least 20 doctorates annually and engage in very high levels of research. (49%)
2. Doctorate Institution includes Carnegie Classification schools Research 2, Doctoral 1, and Doctoral 2. Institutions that award at least 20 doctorates annually but perform less research than R1 institutions. (19%)
3. Comprehensive Institutions include Carnegie Classification schools Comprehensive 1 and Comprehensive 2. These institutions award at least 50 master's degrees annually. (18%)
4. Liberal Arts 1 corresponds to Carnegie LA1. Small, mostly private, very selective institutions that award primarily baccalaureate degrees. (4%)
5. Other Institutions include remaining Carnegie Classifications Liberal Arts 2, two-year schools, theological schools, and medical schools. (10%)

Table 1: Variable Descriptions

		Employment Sector							
		Academic		Government		Business		Total	
Description	**Type**	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**
Dependent variable: very satisfied w/ job	Binary choice	0.51	0.50	0.50	0.50	0.47	0.50	0.49	0.50
2002 earnings from all sources, in $1000s	Quant	80.8	52.5	88.6	47.2	113.3	98.2	96.4	78.0
Career age	Quant	16.9	11.2	17.4	10.3	16.8	10.5	16.9	10.8
Female	Binary	0.28	0.45	0.24	0.43	0.23	0.42	0.25	0.43
Married	Binary	0.77	0.42	0.76	0.43	0.79	0.41	0.78	0.42
Children present	Binary	0.48	0.50	0.47	0.50	0.52	0.50	0.50	0.50
Disability	Binary	0.08	0.27	0.07	0.26	0.07	0.25	0.07	0.26
Not a US citizen	Binary	0.10	0.29	0.04	0.19	0.12	0.32	0.10	0.30
Typical work hours per week	Quant	48.2	12.6	44.1	8.4	44.1	12.2	45.9	12.2

[8] We included a unique variable that identifies graduates of highly ranked PhD programs, defined as graduate programs with a reputational ranking in the top 20 departments in a given PhD field (Finn, 2010), to see if this factor might have an impact—it did not.

[9] We experimented with different aggregations; this mix was chosen based upon statistical significance and like institutions.

Table 1: Variable Descriptions: Continues

		Employment Sector							
		Academic		Government		Business		Total	
Description	**Type**	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**	**Mean**	**s.d.**
Job involves supervising others	Binary	0.56	0.50	0.55	0.50	0.54	0.50	0.55	0.50
Organization has less than 500 employees	Binary	0.10	0.30	0.03	0.17	0.50	0.50	0.27	0.45
Job and degree closely related	Binary	0.82	0.38	0.61	0.49	0.52	0.50	0.66	0.47
More than 4 articles or books, last 5 years	Binary	0.49	0.50	0.32	0.47	0.15	0.35	0.32	0.47
Received a patent within last 5 years	Binary	0.09	0.29	0.09	0.29	0.26	0.44	0.17	0.38
White (omitted)	Binary	0.79	0.40	0.81	0.39	0.74	0.44	0.77	0.42
Black	Binary	0.04	0.19	0.03	0.18	0.02	0.13	0.03	0.17
Asian	Binary	0.13	0.33	0.12	0.32	0.22	0.41	0.17	0.37
Hispanic	Binary	0.03	0.18	0.02	0.15	0.02	0.14	0.03	0.16
Other race	Binary	0.01	0.09	0.01	0.11	0.01	0.09	0.01	0.09
PhD field in social science (omitted)	Binary	0.34	0.47	0.31	0.46	0.26	0.44	0.30	0.46
PhD field in engineering	Binary	0.11	0.32	0.15	0.36	0.26	0.44	0.18	0.39
PhD field in biology, ag or environment	Binary	0.31	0.46	0.29	0.45	0.20	0.40	0.25	0.44
PhD field in computer or math	Binary	0.09	0.28	0.04	0.19	0.06	0.23	0.07	0.25
PhD field in physical science	Binary	0.16	0.37	0.22	0.41	0.23	0.42	0.20	0.40
Primary job activity is research (omitted)	Binary	0.39	0.49	0.49	0.50	0.42	0.49	0.41	0.49
Primary job activity is teaching	Binary	0.43	0.50	0.01	0.08	0.01	0.10	0.19	0.40
Primary job activity is management	Binary	0.11	0.31	0.28	0.45	0.25	0.43	0.19	0.39
Primary job activity is other	Binary	0.07	0.25	0.23	0.42	0.32	0.47	0.20	0.40
Graduate of a top 20 PhD program	Binary	0.35	0.48	0.28	0.45	0.33	0.47	0.33	0.47
Employed at R1 institution or med. school	Binary	0.49	0.50					0.22	0.41
Employed at Doctoral institution	Binary	0.19	0.39					0.08	0.27
Employed at Comprehensive institution	Binary	0.18	0.39					0.08	0.27
Employed at Liberal Arts 1 institution	Binary	0.04	0.20					0.02	0.14
Employed at Other academic institution	Binary	0.10	0.30					0.04	0.20
Tenured faculty	Binary	0.51	0.50					0.23	0.42
Tenure-track faculty	Binary	0.16	0.37					0.07	0.26
Not-tenure-track faculty	Binary	0.10	0.30					0.04	0.21
Tenure not applicable	Binary	0.22	0.42					0.10	0.30
Employed in the academic sector	Binary							0.44	0.50
Employed in the business sector	Binary							0.46	0.50
Employed in the government sector	Binary							0.10	0.30
No. of Observations (raw count)		10,728		2,425		10,378		23,531	

Source: 2003 Survey of Doctorate Recipients.

Following previous work (e.g., Clark and Oswald, 1996; Bender and Heywood 2006), we assumed that relative or comparison income, which is income relative to benchmark or expected income, is the most appropriate factor to control for the effects of income on job satisfaction. Most empirical studies of job satisfaction find that absolute income has an insignificant, and sometimes even negative, effect while relative income has a statistically and economically significant, positive effect. The income benchmark was created by estimating an earnings equation in the standard way: the natural log of earnings was regressed on factors that are expected to affect income including career age, average work hours per week, professional field, primary work activity, supervisor status, publication success, patent success, and geographic region. The residual from this regression was then used as an explanatory variable to control for salary.

Relative or comparison income can be interpreted as the amount one is over- or underpaid relative to the average person with similar observed characteristics. Therefore, our analysis considers how much a non-tenured PhD would have to be "overpaid" relative to the average non-tenured faculty salary to increase their job satisfaction such that it is comparable to tenured faculty, *ceteris paribus*.

IV. Determinants of Job Satisfaction

A binary probit model was estimated to explain job satisfaction for persons with PhDs working in the academic sector. For comparison, we estimated similar models for the government and business sectors, and for all sectors combined. Table 2 presents the marginal effects, evaluated at the sample means, of each explanatory variable.[10] Statistical significance, based on the underlying coefficients rather than the marginal effects, is indicated with asterisks. With respect to the control variables, the results are generally consistent with the received literature on job satisfaction in general and PhD job satisfaction in particular. Key findings are briefly described below.

Table 2: Binary Probit Regression Results Marginal Effects on Probability of Being Very Satisfied

	Sector of Employment			
	Academic	**Government**	**Business**	**All Sectors**
Relative income, in $1000s	0.14% ***	0.13% ***	0.07% ***	0.08% ***
Career age	0.32% ***	0.31% ***	0.49% ***	0.42% ***
Female	2.51% **	4.78% *	5.06% ***	3.76% ***
Married	3.77% ***	9.65% ***	5.39% ***	5.09% ***
Children present	0.69%	-0.22%	-1.37%	-0.23%
Disability	-5.64% ***	-7.96% *	-7.28% ***	-6.52% ***
Not a US citizen	-5.49% ***	10.48% *	-5.87% ***	-5.27% ***
Typical work hours per week	0.05%	0.53% ***	0.20% ***	0.13% ***
Job involves supervising others	5.41% ***	7.44% ***	5.33% ***	5.72% ***
Organization has less than 500 employees	-0.44%	0.50%	12.05% ***	9.76% ***
Job and degree closely related	9.06% ***	10.57% ***	11.11% ***	10.67% ***
More than 4 articles or books, last 5 years	2.11% *	6.56% **	6.20% ***	4.91% ***
Received a patent within last 5 years	0.23%	5.39%	-3.81% ***	-2.81% ***

[10] An appendix table shows the estimated probit coefficients and corresponding standard errors.

Table 2: Binary Probit Regression Results Marginal Effects on Probability of Being Very Satisfied: Continues

	Sector of Employment			
	Academic	**Government**	**Business**	**All Sectors**
Black	-7.79% ***	-2.80%	-4.04%	-5.94% ***
Asian	-9.70% ***	-14.06% ***	-10.44% ***	-10.94% ***
Hispanic	1.68%	4.29%	2.13%	2.11%
Other race	-7.18%	-7.43%	-6.09%	-7.07% *
PhD field in engineering	-1.45%	4.67%	-5.35% ***	-3.05% ***
PhD field in biology, ag or environment	-3.35% **	1.11%	-4.31% ***	-3.05% ***
PhD field in computer or math	-2.29%	0.76%	-7.41% ***	-4.06% ***
PhD field in physical science	-1.29%	8.05% **	-7.16% ***	-3.41% ***
Primary job activity is teaching	-7.52% ***	-1.77%	16.39% ***	-5.46% ***
Primary job activity is management	0.18%	4.58% *	1.60%	1.63%
Primary job activity is other	-0.09%	-1.05%	4.27% ***	3.14% ***
PhD from a top 20 program	0.95%	-4.19% *	1.78%	0.74%
Not tenured/ten. track at R1 institution	-14.30% ***	--	--	-12.35% ***
Tenured/ten. track at Doctorate institution	-9.78% ***	--	--	-9.73% ***
Not tenured/ten. track at Doctorate institution	-16.11% ***	--	--	-13.81% ***
Tenured/ten. track at Comp. institution	-1.76%	--	--	-2.54%
Not tenured/ten.track track at Comp. institution	-15.46% ***	--	--	-14.52% ***
Tenured/ten. track at Liberal Arts 1 institution	9.44% ***	--	--	3.70%
Not tenured/ten. track at Liberal Arts 1 institution	1.56%	--	--	-0.51%
Tenured/ten. track at Other institution	3.39%	--	--	0.73%
Not tenured/ten.track track at Other institution	-8.10% ***	--	--	-7.86% ***
Employed in business sector	--	--	--	-9.86% ***
Employed in government sector	--	--	--	-5.35% ***
No. of Observations (raw count)	10,728	2,425	10,378	23,531
McFadden Pseudo R^2	0.060	0.057	0.081	0.064
Log likelihood function	-6,986	-1,585	-6,594	-15,271
Percent correctly predicted	60.3	60.4	63.4	61.1
Predicted prob of very satisfied, at sample means	50.7%	49.4%	46.5%	48.7%

Notes: Asterisks indicate significance at 10% (*), 5% (**) or 1% (***) levels, based on corresponding parameter estimates. Marginal effects are changes in the probability of being in the very satisfied category, evaluated at sample means. Excluded variables for each set of mutually exclusive and exhaustive categorical variables are as follows: White, PhD field in social science, primary job activity research, tenured at R1 institution.

Relative income (i.e., the residual from the earnings function) has a significant positive effect on job satisfaction in all sectors, but the impact is relatively small. An annual increase of $10,000 relative to expected earnings increases the probability of being very satisfied by less than 1.5 percentage points in all cases. It is somewhat surprising that the effect of relative earnings is least in the business sector, where one would think pecuniary benefits are more valued. Another surprising result is that relative earnings have the strongest impact on job satisfaction in the academic sector, although the effect is still modest.

Career age has a positive and significant effect on satisfaction in all sectors. While the marginal effects at the sample means are given in Table 2, the variable enters the underlying latent regression model in quadratic form. Estimates imply the function is convex for all sectors and achieves a minimum at a career age of about 4 for the business sector, 11 for the government

sector, and 12 for the academic sector. Females have a somewhat higher probability of being very satisfied in all sectors, but statistical significance is questionable (p=.07) in the government sector. Married persons are more likely to be very satisfied in all sectors. Having children appears to have no effect on job satisfaction.

Persons with disabilities are generally less likely to be very satisfied. Non-US citizens are also less likely to be very satisfied in the academic and business sectors, but are more likely to be satisfied in the government sector.

An increase in typical weekly work hours is associated with higher job satisfaction in the government sector, has a weaker positive effect in the business sector, and is not significant in the academic sector. It should be noted that work hours could be an endogenous factor, if more satisfied persons tend to work longer hours, and, if this is the case, our estimation method is biased with respect to this effect. Nevertheless, work hours is a control variable of relatively minor importance for this study, and the key conclusions do not change if it is omitted from the regression.

Jobs involving supervision have a strong positive effect on job satisfaction in all sectors. Smaller organizations lead to substantially higher job satisfaction in the business sector but, as expected, have no impact in the academic or government sectors.

A somewhat unexpected result is that the variable measuring publishing productivity (a dummy variable indicating more than four articles or books published within the last five years) has a fairly strong positive effect in the government and business sectors but a relatively weak impact in the academic sector. This may have to do with the fact that, as discussed in more detail below, the model controls for tenure status and type of academic institution. Another rather notable result involves the variable indicating whether a person has received a patent within the last five years. Its effect is insignificant in the academic and government sectors and negative in the business sector. We speculate that this occurs because some in the business sector feel they do not receive sufficient rewards for their creations.

In terms of racial differences, blacks have a lower probability of being very satisfied in the academic sector but are not significantly different from whites (the omitted category) in other sectors. Asians are substantially less likely to be very satisfied in all sectors. No other racial group is significantly different when viewed by sector.

PhD field has little impact on satisfaction in the academic sector. In the business sector, all fields are less likely to be very satisfied than social sciences (the omitted category). In the government sector, those in the physical sciences are substantially, and significantly, more likely to be very satisfied than those in other fields.

The last set of categorical control variables involves primary job activity. In the academic sector, controlling for tenure status and type of institution, it is interesting to note that those whose primary activity is teaching are substantially less likely to be very satisfied than those whose primary activity is research (the omitted category). Other primary activities are not statistically different from research. Management jobs appear to have a small positive effect on job satisfaction in the government sector. A focus on teaching in the business sector increases the probability of being very satisfied by 16.4 percentage points, which is the largest marginal effect observed in this study.

V. The Impact of Tenure Status on Job Satisfaction

Because we suspected that job satisfaction might be affected by both the tenure status and the type of academic institution together, additional job classification categories were defined to analyze this issue. Three tenure status indicators were initially defined: (1) tenured, (2) tenure-track and (3) not tenured or tenure-track (includes both "not tenure-track" and "tenure not applicable," hereafter paraphrased as "no-tenure"). Each of these variables was interacted with the five institution-type indicators to create 15 additional categories: tenured at an R1 institution, tenure-track at an R1 institution, no-tenure at an R1 institution, etc.

A related question is whether there is any difference in job satisfaction between tenured faculty, who enjoy greater status and security, and tenure-track faculty, most of whom expect to eventually receive the benefits of tenure. A test of parameter equality across the tenured and tenure-track categories, for each type of institution simultaneously, did not reject the implied restrictions at any usual significance level.[11] A subsequent test of parameter equality across the tenured/tenure-track and no-tenure groups strongly rejected the restriction.[12] Thus the final model was estimated with two tenure-status categories, tenured/tenure-track and no-tenure, interacted with the five institution-type categories, making 10 total tenure-institution categories. The omitted category is tenured/tenure-track at an R1 institution.

To summarize the pertinent results regarding the effects of sector, tenure-status and institution type, Table 3 gives a rank ordering of the various categories with respect to impact on the probability of being very satisfied. The ranking is based primarily on results from the academic sector, but it includes the estimates for business and government PhDs from the combined model so that these two non-academic groups can be incorporated in the comparisons. The benchmark category, tenured/tenure-track at an R1 institution, is shown in bold, and those categories with statistically insignificant coefficients are grouped with the benchmark category (ordered according to the magnitude of the estimated coefficient).

Table 3: Estimated Partial Effects of Tenure Status And Institution Type on Job Satisfaction

Rank	Tenure Status	Academic Institution or Sector	Marginal Effect
1	Tenured or tenure-track	Liberal Arts 1	9.4%
2	Tenured or tenure-track	Other	Insignificant
3	No tenure	Liberal Arts 1	Insignificant
4	**Tenured or tenure-track**	**R1**	**Benchmark**
5	Tenured or tenure-track	Comprehensive	Insignificant
6	--	*Government*	-5.3%
7	No-tenure	Other	-8.1%
8	Tenured or tenure-track	Doctorate	-9.8%
9	--	*Business*	-9.9%
10	No-tenure	R1	-14.3%
11	No-tenure	Comprehensive	-15.5%
12	No-tenure	Doctorate	-16.1%

[11] A likelihood ratio test for the hypothesis involving equality across the tenured and tenure-track categories yielded $\chi^2 = 6.80$ (significance level = 0.24); a Wald test gave similar results. This differs from Bender and Heywood's finding that tenure-track PhDs were significantly less satisfied than those with tenure.

[12] A likelihood ratio test for the hypothesis involving equality across the tenured/tenure-track and no tenure categories yielded $\chi^2 = 106.8$ (significance level = 0.00).

The persons most likely to be very satisfied, by a substantial margin, are those who are tenured/ tenure-track at Liberal Arts1 institutions; moreover, the no-tenure Liberal Arts 1 group is more likely to be very satisfied than any other no-tenure group. Given that Liberal Arts 1 schools have relatively few positions (about 4.3% of the academic sample) with somewhat unique characteristics, perhaps the labor market does especially well in this case of matching idiosyncratic preferences to job characteristics.

In general, the results clearly show the benefits of tenure as the most satisfied tend to be tenured/ tenure-track while the least satisfied tend to be no-tenure. In particular, no-tenure PhDs at Doctorate, Comprehensive and R1 institutions are the least likely to be very satisfied, possibly because they feel disadvantaged relative to their tenure/tenure-track colleagues.

Tenured/tenure-track faculty at R1, Comprehensive, and Other institutions have about the same level of job satisfaction, *ceteris paribus*, and are more likely to be very satisfied than any group save those associated with Liberal Arts 1 institutions. Since R1, Comprehensive, and Other institutions are in many ways quite different from each other, it may be the case that individuals are able to clearly identify and self-select into the respective positions for which they are best suited and thus obtain nearly equal levels of job satisfaction. In contrast, tenured/tenure-track persons at Doctorate institutions are substantially less likely to be satisfied than their counterparts at other types of institutions. A possible explanation is Doctorate institutions may tend to be the second choice for PhDs who would have preferred to obtain positions at other institutions but were unable to do so.

PhDs in the business and government sectors are generally less likely to be very satisfied than those in tenured/tenure-track faculty positions, but are more likely to be very satisfied compared to those in no-tenure academic positions. Persons working in the government sector tend to have higher levels of job satisfaction compared to individuals in the business sector, and the difference is statistically significant.[13]

VI. The Monetary Value of Tenure

To obtain a dollar estimate of the value of tenure we consider the partial effect of tenure on a representative professor. All control variables are held fixed at either the sample mean or mode (for binary variables) and, in particular, relative income is assumed to be zero—thus, the representative professor is neither under- nor overpaid. We then calculate the additional income required to equate the job satisfaction of the representative professor without tenure to that of the representative professor with tenure. This provides an estimate of the premium a no-tenure professor would have to be paid to achieve the same level of job satisfaction as a tenured professor with similar characteristics.

As shown in the prior section, the impact of tenure depends on the type of employing institution. For an R1 institution the probability of our representative PhD being very satisfied is 60.7 percent with tenure/tenure-track status and 46.4 percent without, giving a difference of 14.3 percent. To raise the no-tenure PhD satisfaction from 46.4 to 60.7 percent would require an increase in relative salary of approximately $105,000.

Table 4 shows the results of similar calculations for all institutional categories. The estimated relative salary offsets are astonishingly high, ranging from $48,000 to over $100,000, with a

[13] A likelihood ratio test of the restriction that the coefficients associated with the government and business sectors are equal gave $\chi^2 = 12.73$ (significance level = 0.00).

weighted average of approximately $93,000. These large numbers are driven by both the high value academics put on tenure and the low value they place on relative salary.[14]

Table 4: Estimated Relative Salary Change Required to Offset Tenure Loss, by Type of Institution

Institution Type	Change in Satisfaction From Loss of Tenure	Relative Income Offset
R1	-14.3%	$104,900
Doctorate	-6.6%	$48,100
Comprehensive	-13.9%	$102,000
Liberal Arts 1	-7.3%	$58,000
Other	-11.3%	$83,900

We are not claiming that a non-tenure-granting institution would necessarily have to pay an average premium of $93,000 per person to attract and retain well-qualified faculty. It is possible that other benefits or types of compensation, such as long-term contracts, could offset the loss of tenure. Moreover, a number of factors can affect job choice and satisfaction besides those explicitly captured in our model (e.g., location). Finally, some faculty might be willing to work in a position in which they feel "somewhat satisfied," as opposed to feeling "very satisfied." Nevertheless, these results indicate that tenure has a high monetary value, and it would most likely be impractical to use salary to compensate for tenure abolition.[15] It is clear that tenure results in considerable salary savings for institutions and states—whether these savings exceed the full economic cost of tenure is beyond the scope of this paper.

VII. Summary and Discussion

Consistent with previous research, our findings indicate tenure is an important determinant of job satisfaction. This study adds to the existing literature on job satisfaction for college faculty by showing that the type of academic institution interacts with tenure in determining overall job satisfaction. Among tenured/tenure-track PhDs those at Liberal Arts 1 colleges are the most likely to be very satisfied, while those at Doctorate institutions (save R1) are the least likely to be very satisfied. PhDs working in the private sector are generally more satisfied than no-tenure academics, but tend to be less satisfied than those in the government sector.

Our results suggest that the monetary value of tenure to PhDs in academia is quite high. Because income has a relatively modest effect on job satisfaction while tenure has a relatively large impact, the estimated increase in salary required to offset the removal of tenure is along the order of $50,000 to over $100,000 per annum, depending on type of academic institution. Tenure is therefore a significant benefit in the academic sector and if it were unilaterally abolished by

[14] Since only 3.0% of the no-tenure academics in the sample have a salary that is large enough to offset the lack of tenure, these are out-of-sample predictions to some degree and their accuracy is therefore subject to a higher level of uncertainty—we thank an anonymous referee for pointing this out. In any case, we believe the general point that tenure has a substantial monetary value is strongly supported by the results.

[15] Tenure is also an untaxed job benefit while salary is taxed. This may partially explain the large required relative income offset, i.e., relative income is pre-tax. Some have argued (McArdle, 2004) that the value of tenure should be taxed.

some institution or educational system, it would be difficult to compensate for the decreased satisfaction by changing other job attributes or increasing salary.

Part of the tenure effect on job satisfaction possibly comes from the relative "second-class" status associated with no-tenure positions. If tenure were abolished universally this stigma would be removed and the potential effects of tenure abolition on PhD quantity and quality would be mitigated. But it is more likely that tenure would be abolished one institution or state at a time. In this instance the "relative income offset" gives an idea of the amount a typical PhD in the no-tenure institution or state would have to be "overpaid" relative to her tenured peers. Thus, if Wisconsin Governor Walker's proposals are adopted, the UW system would clearly be at a competitive hiring disadvantage relative to other states, all else being equal. To maintain faculty quality in the long run, UW salaries would need to be increased or other job attributes changed.[16]

Could McGinnis and Schanzenbach's (2015) suggestion to replace tenure with long-term contracts offset the removal of tenure? [17] Some insight into this can be gleaned by examining job satisfaction of PhDs employed in the government sector, which offers a level of job security that could be very similar to long-term contracts in academia. Our representative PhD would have a 53.3 percent probability of being very satisfied in the government sector, 7.4 percentage points short of a tenured faculty member at an R1 institution with otherwise similar characteristics. Since taking tenure away from the same faculty member would reduce the probability of being very satisfied by 14.3 percentage points, we infer that long-term contracts could potentially make up roughly one half of the job satisfaction gap between tenured and non-tenured faculty at R1 institutions.

A thought provoking result of our analysis is that job satisfaction of no-tenure PhDs at Liberal Arts 1 institutions is statistically indistinguishable from that of tenured PhDs at R1 institutions, all else being equal (Table 3). Since they offer salaries that are comparable to R1 institutions, it would seem that Liberal Arts 1 institutions provide non-pecuniary benefits that are able to compensate for a lack of tenure. These benefits or job attributes are likely to be unique to the Liberal Arts 1 environment, such as small classes composed of highly motivated and academically gifted students, and would be difficult for other types of institutions to replicate on a large scale.

The justification for tenure has traditionally been tied to issues of academic freedom. Our results indicate there are strong economic benefits as well. Tenure is an important component of PhD compensation. It allows academic institutions to have a very satisfied faculty at a lower direct cost than would otherwise be possible.

[16] It is interesting to note that Ehrenberg and Zhang (2005) found that a higher number of tenured faculty was associated with an increase in university graduation rates. This might be because faculty having a positive impact on graduation rates are more likely to get tenure or because having tenure influences faculty to have a more positive impact on graduation rates.

[17] For example, a new faculty hire would receive a three-year contract. At the end of three years (corresponding to the standard university tenure practice of a third year review) a decision to award a second three-year contract would be made. After the second three-year contract a decision would be made similar to the tenure decision. Thereafter long-term contracts (such as five years) could be made sequentially and correspond to the growing practice of post-tenure review.

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Appendix: Binary Probit Regression Results
Coefficient Estimates with Standard Errors in Parentheses

	Sector of Employment			
	Academic	**Government**	**Business**	**All Sectors**
Relative income, in $1000s	0.003 ***	0.003 ***	0.002 ***	0.002 ***
	(0.000)	(0.001)	(0.000)	(0.000)
Career age	-0.024 ***	-0.015	-0.004	-0.015 ***
	(0.005)	(0.010)	(0.005)	(0.003)
Career age squared	0.001 ***	0.001 ***	0.001 ***	0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	0.063 **	0.120 *	0.127 ***	0.094 ***
	(0.030)	(0.066)	(0.034)	(0.021)
Married	0.095 ***	0.243 ***	0.136 ***	0.128 ***
	(0.033)	(0.069)	(0.035)	(0.022)
Children present	0.017	-0.006	-0.034	-0.006
	(0.029)	(0.060)	(0.030)	(0.020)
Disability	-0.142 ***	-0.201 *	-0.185 ***	-0.165 ***
	(0.047)	(0.105)	(0.052)	(0.033)
Not a US citizen	-0.138 ***	0.265 *	-0.149 ***	-0.133 ***
	(0.048)	(0.149)	(0.048)	(0.033)
Typical work hours per week	0.001	0.013 ***	0.005 ***	0.003 ***
	(0.001)	(0.003)	(0.001)	(0.001)
Job involves supervising others	0.136 ***	0.187 ***	0.134 ***	0.144 ***
	(0.028)	(0.058)	(0.028)	(0.019)
Organization has less than 500 employees	-0.011	0.013	0.304 ***	0.245 ***
	(0.045)	(0.158)	(0.028)	(0.023)
Job and degree closely related	0.228 ***	0.266 ***	0.281 ***	0.269 ***
	(0.035)	(0.056)	(0.027)	(0.020)
More than 4 articles or books, last 5 years	0.053 *	0.165 **	0.156 ***	0.123 ***
	(0.029)	(0.065)	(0.038)	(0.022)
Received a patent within last 5 years	0.006	0.135	-0.096 ***	-0.071 ***
	(0.046)	(0.093)	(0.033)	(0.025)
Black	-0.196 ***	-0.070	-0.102	-0.150 ***
	(0.066)	(0.145)	(0.098)	(0.051)
Asian	-0.244 ***	-0.358 ***	-0.266 ***	-0.277 ***
	(0.041)	(0.087)	(0.036)	(0.026)
Hispanic	0.042	0.108	0.054	0.053
	(0.070)	(0.175)	(0.091)	(0.053)
Other race	-0.181	-0.187	-0.155	-0.179 *
	(0.135)	(0.246)	(0.148)	(0.092)
PhD field in engineering	-0.036	0.117	-0.135 ***	-0.077 ***
	(0.045)	(0.089)	(0.044)	(0.029)
PhD field in biology, ag or environment	-0.084 **	0.028	-0.109 ***	-0.077 ***
	(0.033)	(0.074)	(0.041)	(0.024)
PhD field in computer or math	-0.057	0.019	-0.189 ***	-0.102 ***
	(0.049)	(0.146)	(0.063)	(0.037)
PhD field in physical science	-0.032	0.202 **	-0.181 ***	-0.086 ***
	(0.040)	(0.080)	(0.043)	(0.027)

Appendix: Binary Probit Regression Results
Coefficient Estimates with Standard Errors in Parentheses: Continues

	Sector of Employment			
	Academic	**Government**	**Business**	**All Sectors**
Primary job activity is teaching	-0.189 ***	-0.044	0.417 ***	-0.137 ***
	(0.034)	(0.352)	(0.139)	(0.030)
Primary job activity is management	0.005	0.115 *	0.040	0.041
	(0.046)	(0.069)	(0.035)	(0.025)
Primary job activity is other	-0.002	-0.026	0.107 ***	0.079 ***
	(0.054)	(0.075)	(0.034)	(0.026)
PhD from a top 20 program	0.024	-0.105 *	0.045	0.019
	(0.027)	(0.060)	(0.028)	(0.018)
Not tenured/ten. track at R1 institution	-0.362 ***			-0.315 ***
	(0.038)	(0.000)	(0.000)	(0.037)
Tenured/ten. track at Doctorate institution	-0.247 ***			-0.247 ***
	(0.044)	(0.000)	(0.000)	(0.043)
Not tenured/ten. track at Doctorate institution	-0.413 ***			-0.355 ***
	(0.066)	(0.000)	(0.000)	(0.066)
Tenured/ten. track at Comp. institution	-0.044			-0.064
	(0.045)	(0.000)	(0.000)	(0.044)
Not tenured/ten. track at Comp. institution	-0.396 ***			-0.375 ***
	(0.083)	(0.000)	(0.000)	(0.083)
Tenured/ten. track at Liberal Arts 1 institution	0.239 ***			0.093
	(0.086)	(0.000)	(0.000)	(0.083)
Not tenured/ten. track at Liberal Arts 1 institution	0.039			-0.013
	(0.145)	(0.000)	(0.000)	(0.146)
Tenured/ten. track at Other institution	0.085			0.018
	(0.065)	(0.000)	(0.000)	(0.064)
Not tenured/ten. Track at Other institution	-0.204 ***			-0.199 ***
	(0.074)	(0.000)	(0.000)	(0.073)
Employed in business sector	--	--	--	-0.248 ***
				(0.033)
Employed in government sector	--	--	--	-0.135 ***
				(0.037)
Constant term	-0.130	-1.193 ***	-0.814 ***	-0.421 ***
	(0.090)	(0.191)	(0.083)	(0.063)
No. of Observations (raw count)	10,728	2,425	10,378	23,531
McFadden Pseudo R^2	0.060	0.057	0.081	0.064
Log likelihood function	-6,986	-1,585	-6,594	-15,271
χ^2 statistic for overall significance	891	191	1,166	2,075
Percent correctly predicted	60.3	60.4	63.4	61.1
Predicted prob of very satisfied, at sample means	50.7%	49.4%	46.5%	48.7%

Notes: Asterisks indicate significance at 10% (*), 5% (**), or 1% (***) levels. Excluded variables for each set of mutually exclusive and exhaustive categorical variables are as follows: White, PhD field in social science, primary job activity research, tenured at R1 institution.