ABSTRACT

Determinants of Faculty Salaries at Elite Liberal Arts Colleges

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In this paper we focus on the determinants of faculty salary levels at elite liberal arts colleges for specific years over the past decade. We address the role regional personal income per capita and endowment play in average salary determination. Other variables we consider include ranking, enrollment, tuition, discipline concentration, the professor to student ratio, the concentration of female professors among faculty and the ratio of research to instructional expenses. We find that regional personal income and endowment have a positive effect on average salaries, while ranking has a negative effect. Research has a positive effect on salaries in the later years, and tuition is not a consistent determinant of salary. Results also seem to be stable over time for most years and professor rankings.

Determinants of Professor Salaries at Elite Liberal Arts Colleges

by

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A Thesis

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LIST OF ABBREVIATIONS

AAUP	American Association of Universities and Professors
FTE	Full Time Equivalent
IPEDS	Integrated Postsecondary Education Data System
LAC	Liberal Arts College
Log	Natural Logarithm
MSA	Metropolitan Statistical Area
Obs.	Observations
OLS	Ordinary Least Squares
PIC	Personal Income per Capita
St. Dev.	Standard Deviation
STEM	Science, Technology, Engineering and Mathematics
USNWR	U.S. News and World Report

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John Donne wrote a series of meditations while enduring an illness, one of which coined the infamous phrase "no man is an island." While writing a thesis is not comparable to enduring an illness (on most days), Donne's insight could not be truer for such an endeavor

I'd like to thank Dr. Green, my thesis advisor, for his guidance and patience through this process. Not only was he always available for direction, instruction and clarification, but he always had an encouraging word. I never left his office without a "hang in there."

Thank you to my committee members, Dr. Henderson and Dr. Cloud, for being a part of this process. The opportunity cost of their time is not low, and I appreciate their willingness to provide feedback in this academic process.

To my cohort, friends and family who have listened to me expound upon economic ideas they surely find trivial and superfluous—thank you for nodding and smiling anyway.

CHAPTER ONE

Introduction

Professor salary has been a popular topic in academic research circles for quite some time. In a profession concerned with answering questions, it seems natural that professors research the question concerning how their compensation is determined—it hits close to home and even closer to the wallet.

While professors across disciplines and schools may be united in a desire to know what determines their compensation, the colleges and universities they call home across the United States are not homogenous. Even with differences among institutional types, are professors compensated according to many of the same factors? In this paper we focus on the determinants of faculty salary levels at elite liberal arts colleges (LACs) over the past decade using the same methodology used for other institutional types.

We address the role regional personal income per capita and endowment play in average salary determination at prestigious LACs in the 2002, 2007 and 2008 academic years. Other variables we consider include ranking, enrollment, tuition, discipline concentration, the professor to student ratio, the concentration of female professors among faculty and the ratio of research to instructional expenses. We are also concerned with how the magnitude and importance of

professor salary determinants vary with the business cycle and if structural differences exist across time in salary determinants.

We find that regional personal income and endowment have a positive effect on average salaries, while ranking has a negative effect.[1] Research has a positive effect on salaries in the later years, and tuition is not a consistent determinant of salary. Results also seem to be stable over time for most years and professor rankings.

[1] Since the better the rank is, the lower the number of that ranking is (first is better than second), we see a "negative" relationship, even though we traditionally think the higher the ranking the higher the average salary, which infers a positive relationship.

CHAPTER TWO

Professor Salaries: Trends and Issues

Every year, *Academe*, a bi-monthly magazine by the American Association of Universities and Professors (AAUP), publishes a report on the economic status of the profession. In reviewing the reports for the 2001-2002 through 2007-2008 academic years, there are a couple reoccurring themes that pervade the report. The AAUP is concerned with ability of faculty salaries to keep up with inflation, the performance of endowments, and distance between faculty salaries and those of comparable professions.

The report for each year begins by discussing the state of the economy and how faculty salaries are keeping up with inflation. In the 2001-2002 academic year, we see professor salary growth outpaced that of inflation with a real growth of 2.2%.[2] This is the highest real growth since the mid-1980s, but the optimism for the profession is limited. According to Hamermesh (2002), "…institutional administrators now believe that inflation will be lower than last year, and they will therefore probably set nominal salary increases lower than last year's so as not to overcompensate faculty in relation to the expected rate of

[2] Real growth is growth calculated after taking inflation into account. The AAUP uses national CPI to deflate average salary.

inflation." The theme of faculty salary growth outpacing inflation continued in the next academic year in spite of dismal economic conditions such as increased unemployment, low rates of return for college endowments and an economic recession. Faculty salaries kept up with inflation, though barely, for the 2003-2004 year with only a 0.2% increase in real salary. The next two years did not fare well for faculty salaries as they were not able to keep up with inflation. In the 2004-2005 academic year, real salaries were 0.5% lower than the previous year. While the real salaries were lower, the nominal salary increase was higher than that of the previous year's nominal increase; however, inflation was also higher. We see the same phenomenon in the next academic year. Average inflation adjusted salaries declined by 0.3% in the 2005-2006 academic school year. During the 2006-2007 academic year faculty salaries rose by 1.3% even when accounting for inflation. However, unfortunately, the next year real salaries returned to their stagnant state as raises barely kept up with rising inflation. Professors are seeing increases in nominal salary, but as inflation has been volatile over the decade, they have not been guaranteed an increase in purchasing power.

Endowments have become increasingly important to universities. The AAUP reports that while endowment sizes vary widely across educational institutions the spending rates are fairly homogenous. The average spending

rate for universities is 4.6%. Thornton (2007) also found in her research that the biggest endowments engaged in riskier investments because they had the substance to cover any losses due to the increased risk, while those with small endowments chose more stable investments. If this pattern continues it is likely that we will see a divergence in endowment sizes and, therefore, access to funding for faculty salaries and other institutional needs. The stock market produced negative return rates in 2001 and 2002, but we still saw increases in real professor salary until 2004. This fact may bring into question the role of endowment growth in operational budgeting.

In this paper, we are concerned with the years 2002 through 2008. In 2002, the U.S. economy was in the early stages of expansion. The economy stayed in this expansionary stage until December 2007, when the economy began contracting and continued doing so until June 2009, as determined by the U.S. Bureau of Economic Research.

The gap between salaries of higher education teachers and that of other professional occupations continues to grow. Not only is there a difference in real salary levels, but Thornton (2006) writes that "faculty salary increases compare unfavorable to pay increases in these [engineers, architects, physicians and lawyers] other professions." If the disparity between faculty wages and other

professional occupation wages continues to grow, there could be a major siphoning of talent from academia to other industries.

The issues addressed in this paper include not only endowment, as addressed by the AAUP, but specifically what role regional income plays in determining salary and the implications of such. The role that ranking, a measure of prestige, serves in salary level determination is also considered. Other variables included are enrollment, tuition, discipline concentration, the professor to student ratio, the concentration of female professors among faculty and the ratio of research to instructional expenses. We are also concerned with how the magnitude and importance of professor salary determinants vary with the business cycle and if structural differences exist across time in salary determinants.

CHAPTER THREE

Theory

Salary levels are determined by the demand and supply for academics. In a standard human capital model used by Hamermesh, Johnson and Weisbrod (1982), earnings are a function of productivity, which relates to the demand side, as well as any factors that can affect the equilibrium supply of labor. Institutions are willing to pay professors based on their productivity. How might this be different in an environment that is prestige and profit maximizing? The developing literature on colleges suggests non-profit colleges are prestige maximizers as well as profit maximizers (Brenaman, 1970; Brewer, Gates and Goldman, 2002; Garvin, 1980; James, 1990; Massy and Zemsky, 1994; Zemsky, Wegner and Massy, 2006).

The main venue through which colleges attain prestige is through their faculty according to Melguizo and Strober (2007). Institutions derive prestige from the individual departments who derive prestige from their faculty. Incentives exist for institutions to hire faculty they believe will be prestige maximizers.

Schools interested in prestige maximizing, as elite LACs would be, will reward faculty not only for their productivity (be that measured in research or in

teaching ability or both) but also for the prestige they bring to the school. Salary levels should reflect the institution's prestige maximizing behavior.

Fairweather (2005) notes that existing theory on faculty pay can be split into two main categories: market competition and institutional forces.

Market competition theory is based on the notion that changes in salary occur because there are changes in the supply and demand for academics. A national market or a segmented market can exist. If a national market exists, salaries will be based on research and prestige; however, if the market is segmented, a school's mission will determine how they reward their faculty. For instance, an LAC, in theory, would reward faculty based on teaching quality rather than research output.

Institutional forces can also dictate salary levels. According to these theories, pay is an expression of the norms and values of academia, regardless of a school's individual mission. In this case, LACs would reward research, rather than teaching, because that is where academia places value.

CHAPTER FOUR

Literature Review: Faculty Salary Determinants

An extensive body of literature regarding determinants and trends in faculty pay exists, motivated surely by academic curiosity as well as self interest. Economists have been professionally interested in this topic since the early 1970s with Katz (1973) publishing findings on productivity and pay at research universities. Since then, economists have produced much research on the academic labor market.

The body of empirical literature can be split between studies focusing on determinants of individual salaries and studies focusing on determinants of salary levels (average salaries); special attention should be paid to the roles of teaching and research in determining faculty salary.

Individual Salary Determinants

The majority of the existing literature examines survey data on individual faculty salary taken either at the institutional or national level. Individual salary data is beneficial in that it allows researchers to study the effects of demographic characteristics on salary such as sex and race.

Early research unearthed discrimination based on sex in faculty salaries. According to Tuckman, Gapinski and Hagermann (1977), Gordon, Morton and Braden (1974) and Hoffman (1976), women earn less than men in faculty roles even after controlling for factors that would account for differences in human capital. Hoffman (1976) notes interestingly that discrimination does not only exist in women earing less, but also women being promoted at a slower rate. However, in later years, Lassiter (1983) and Melguizo and Strober (2007) found no significant difference between male and female faculty salaries. Many of the studies finding discrimination used data from the 1970s, and corrective action in the late 1970s may have reduced, if not eliminated, the gender bias in salary determination.

Early research also shows wage differentials among races. Gordon, Morton and Braden (1974) found that African American professors (holding all else equal) earn more than their Caucasian peers. According to Lassiter's (1983) research, minorities in general earn more than Caucasian counterparts.

Mobility also plays an important role in salary determination. Langton and Pfeffer (1994) note that mobility decreases wage variation because it allows for information exchange between employers and employees. With low mobility, wage structures are less sensitive to market conditions.

The selectivity of the institution that the professor graduated from is significant in determining salary (Langton and Pfeffer 1994; Melguizo and Strober 2007). The better the college the Ph.D. was attained from, the higher the salary the individual received. The discipline the professor teaches in also has a significant effect on salary (Fairweather 1993, 1995, 2005; Gordon, Morton and Braden 1974; Katz 1973; Lassiter 1983;). Those in disciplines that offer higher paying jobs outside of academia, like professional and scientific fields, are compensated more than those in fields like the humanities and fine arts.

Seniority also plays a role in salary determination. Gordon, Morton and Braden (1974) and Ransom (1993) found that seniority has a negative effect on salary after controlling for other traditional factors affecting salary like rank (full, associate, assistant). However, we still see that the rank of the professor has a positive effect on salary. The higher ranked the professor, the more he or she will make (Gordon, Morton and Braden 1974; Lassiter 1983). Along with rank, years of experience also have a positive effect on salary, though with diminishing returns (Cohn 1973; Fairweather 1993, 1995, 2005; Katz 1973; Langton and Pfeffer 1994; Melguizo and Strober 2007; Ransom 1993; Tuckman, Gapinksi and Hagemann 1977), which we would expect from human capital theory. However, Hamermesh, Johnson and Weisbrod (1982) find that the effects of experience are diminished when controlling for publication output.

Fairweather (2005) finds that institutional wealth is a positive determinant of professor salary; however, diminishing returns exist.

Average Faculty Salary: Determinants

The literature using salary averages is not quite as extensive. Cohn (1973) found that state personal income per capita is positively correlated with professor salary levels as well as control type. Private institutions pay better than public institutions, and Christian affiliated schools compensate faculty members less than secular schools. The relationship between salary and size is positive, according to Cohn's research, but with decreasing marginal returns. Cohn also found region to not be a significant factor in determining faculty salary level. Mohanty, Dodder and Karman (1986) also found region to have no effect on faculty salary. In recent years, Ehrenberg (2003) has found that faculty continuation rates have a positive correlation with average faculty salary.

In analyzing salary levels, the role of outside options becomes important, because a professor's outside option, in theory, sets the minimum compensation they are willing to accept. Dillon and Marsh (1981) find that faculty earnings are roughly comparable to those of professions in the same field. They also note that any differences in compensation can be accounted for with the non-monetary benefits that professors receive. The AAUP reports in later years tell a different

story—one in which professor salaries are not keeping up with comparable professions.

The dispersion of average salaries across universities has increased according to Erhenberg's (2003) findings. Most of the increase in the dispersion is due to an increase in the dispersion of endowment wealth, which adds evidence to the AAUP's concern regarding endowment disparity.

Role of Research and Teaching

Based on the theory discussed earlier, we believe that professors are rewarded for their skill sets and productivity. How the school values an academic's skills also matters. Fairweather (1993) discusses that the "homogeneity of beliefs" among department chairs regarding the relative importance of both research and teaching in determining faculty rewards is inaccurate. While department chairs lauded the importance of an instructional skill set, the data reveal that teaching is "at best a neutral factor in pay," and research and scholarship are rewarded. Faculty who spend more time on research than teaching are paid more; this is true not only for research institutions, but LACs as well. In later studies, Fairweather (2005) finds that there are diminishing returns to both publishing and teaching.

Melguizo and Strober (2007) also find that teaching has little effect on salary while publications were rewarded at all institution types. They discuss

the idea of "mission creep," in which LACs emulate research universities, as an explanation for this reward structure at traditionally instructional based institutions like LACs.

Research output is commonly measured by quantity of journal publications, research grants and book authorship (Fairweather 1993, 1995, 2005; Tuckman, Gapinski and Hagemann 1977; Melguizo and Strober 2007; Katz 1973; Langton and Pfeffer 1994). However, Hamermesh, Johnson and Weisbrod (1983) find that while quantity matters for publications, the quality of the journal is a strong determinant in rewarding research activities.

CHAPTER FIVE

The Data

Data Sources

The data available for studying professor salaries are fairly expansive. The salary information was taken from the March-April issue of *Academe*—a publication distributed by the AAUP each year. Along with a report regarding the state of the profession, they also publish average salary levels by rank along with other metrics for most postsecondary educational institutions in the United States. The average salary is the average contracted salary for full time instructional faculty at that institution, not including summer teaching. Average salary is reported in thousands and is rounded to the nearest hundredth. They report average salary for each rank—full, associate, assistant, instructor and all ranks. In this analysis, we use the average salaries for full, associate and assistant professors.

The rest of the data came from various sources. The metropolitan statistical area (MSA) personal income per capita (PIC) data were collected from the Bureau of Economic Analysis (BEA). An MSA is a geographical area with a relatively high population density with at least one urbanized area with a population of 50,000 or more. The areas included in an MSA have a high degree

of social and economic integration. Endowment data were provided by the National Association of College and University Business Officers. Rankings data were collected from a yearly publication by U.S. News and World Report (USNWR) entitled *America's Best Colleges*. In this publication, USNWR ranks all national LACs. An LAC is defined by the Carnegie Foundation as a college where more than 50% of its degrees are awarded in the liberal arts (literature, philosophy, sciences, etc.) The rest of the data were collected from the Integrated Postsecondary Education Data System (IPEDS) maintained by the U.S. Department of Education.

Sample

For this analysis, we decided to focus on LACs because they are a subset that is largely ignored in the literature. While many of the studies include a dummy variable for the different types of institutions (research, master's, comprehensive and LACs), only Fairweather actually analyzes the institution types separately, and he does so using individual survey data. The literature reveals there is a difference between the types, but do determinants of salary level persist across type?

In creating the dataset, we decided to include any LAC that had been ranked in the top two tiers of the yearly USNWR rankings from 1997 to 2009[3]. These schools are likely concerned with prestige not only because of the nature of LACs but also because of the national recognition they receive. It's possible that because they are known nationally, they compete for faculty on a national level and many of the factors affecting salaries at bigger schools will affect salaries at these smaller ones as well. Because of potential "mission creep," we believe that they may emulate some practices of research universities, and we are able to use many of the same determinants of professor salary in developing our model. This sample of LACs includes 135 schools in every region of the United States, from Massachusetts to California and Texas to Minnesota.[4]

We chose the years 2002, 2007 and 2008 because of data availability as well as the state of economy during these years.[5] In the 2002 school year, the U.S. was sinking into and coming out of trough in the business cycle. The 2007 school year was an expansionary one, while the 2008 school year was positioned around a peak in the business cycle.

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[3] The sample years for LAC inclusion are so extensive because the scope of this analysis was originally quite broader, but due to some data difficulties had to be narrowed.

[4] See Appendix A for full list of LACs.

[5] The years correspond with the academic year as follows: 2002 is the 2001-2002 academic year, 2007 is the 2006-2007 academic year and 2008 is the 2007-2008 academic year.

Table 5.1 Variable Definitions

Variable	Description
full_sal	Full professor salary in thousands
assoc_sal	Associate professor salary in thousands
asst_sal	Assistant professor salary in thousands
msapic	Personal income per capita
stem_ratio	Ratio of science, technology, engineering and mathematics conferrals to total conferrals that year
ft_fe	Full time fall enrollment
net_tuition	Tuition revenue net institutional aid per full time student
endow_ft	Endowment per full time student in thousands
prof_ft_ratio	Professor to student ratio
perc_f_full	Female percentage of full professor faculty
perc_f_assoc	Female percentage of associate professor faculty
perc_f_asst	Female percentage of assistant professor faculty
rsch_inst_ratio	Research expense to instructional expense ratio
rank	USNWR ranking
tier2	Dummy indicating whether school was ranked in tier two for that year
tier3or4	Dummy indicating whether school was ranked in either tier three or four for that year

Variables & Summary Statistics

Our dependent variable used in the regression analysis is the natural logarithms (logs) of average professor salary; however, the summaries below are in levels rather than logs for easier interpretation[6]. The definitions for the dependent variables are in Table 5.1, and the summary statistics for the dependent variables can be found in Table 5.2. An "l_" prefix on any variable means it is in log form (which we will see in the results section).

Table 5.2 Salary Summary Statistics (in thousands)

Variable	Year	Mean	Std. Dev.	Min	Max	Obs.
full_sal	2002	76.89	13.13	54.00	104.96	127
	2007	90.16	17.17	57.40	130.80	120
	2008	94.08	18.54	60.20	139.10	122
assoc_sal	2002	58.23	7.28	44.65	73.28	127
	2007	68.17	10.02	46.70	94.70	120
	2008	70.97	11.13	48.20	97.40	122
asst_sal	2002	47.07	5.20	35.59	62.35	127
	2007	55.84	7.48	37.20	81.60	120
	2008	57.79	7.70	41.00	75.80	122

[6] Summary statistics of the logged variables are available in Appendix B.

From the Table 5.2, we see that average professor salaries rose between 2002 and 2007 and between 2007 and 2008. Also, looking at the standard deviation, we see more salary compression among the lower ranks, but a larger variance among full professors.

Our independent variables used in the regression analysis are either logs or ratios; however, the summaries below are all in levels for easier interpretation[7]. The descriptions for the independent variables are in Table 5.1, and the summary statistics for the independent variables can be found in Tables 5.3-5. For our independent variables, an "l_" prefix on any variable means it is in log form (which we will see in the results section).

Our independent variables require some additional explanation. The metropolitan statistical area (MSA) personal income per capita (PIC) variable is either the PIC of the closest MSA if that MSA is closer than approximately 20 miles to the college, or it is the PIC of the state in which the college is located.[8] We expect MSA PIC to be a positive indicator of average professor salary. If regional PIC is higher, professor salary should be higher as well, and urban areas

[7] Summary statistics of the logged variables are available in Appendix B.

[8] We created a variable to control for the differences in using state and MSA PIC. Since this variable is just used as a control and insignificant in most of the regression results, we excluded it from the tables in this paper.

often have higher costs of living, so we would expect higher salaries in these areas.

Table 5.3 Regional Income and Financial Variables

Variable	Year	Mean	Std. Dev.	Min	Max	Obs.
msapic	2002	32,271.13	4,140.37	24,273.00	47,601.00	134
	2007	39,951.84	6,104.22	31,003.00	62,634.00	134
	2008	40,829.97	6,099.09	31,911.00	62,598.00	134
net_tuition	2002	13,856.98	4,841.61	3,684.00	31,326.00	131
	2007	18,052.11	6,259.18	3,650.00	44,564.00	131
	2008	19,074.69	6,297.81	3,963.00	46,684.00	130
endow_ft	2002	151.40	145.78	11.70	750.81	119
	2007	218.334	218.417	17.765	1138.27	118
	2008	225.141	241.342	18.2047	1441.21	118

Net tuition is calculated using IPEDS data by the Delta Project, a group providing information on postsecondary education costs, productivity and accountability. To calculate net tuition, they divide net tuition revenue (total revenue from students net of all institutional grant aid) by the number of full time equivalent (FTE) students enrolled that academic year.[9] Tuition and fees are a major source of income for colleges, but one must consider what students

[9] We would prefer to be consistent in using full time fall enrollment for all per student variables, but because part time students are rare if not non-existent at LACs, we believe the differences to be immaterial.

actually pay in considering the effect of tuition on salaries. We expect the higher tuition is the higher salaries to be as well because there is more revenue available to compensate professors. Also, more elite schools tend to charge higher tuition (though they may also discount it more with scholarships), and these institutions may also have higher quality professors who require higher pay.

Endowment per full time student is calculated by dividing the market value of the school's endowment on June 30 by full time fall enrollment.[10] The data is in thousands. As mentioned earlier, endowment differences play a significant role in salary differentials. Bigger schools tend to have larger endowments, but they also have more expenses, which is why we felt endowment per student is a better measure of institutional wealth. We expect this variable to have a positive coefficient because higher endowment per student infers there are increased resources for institutional use.

The STEM (science, technology, engineering and mathematics) ratio was calculated using degree or certificate conferrals. The ratio is the total conferrals in these disciplines divided by the total conferrals that year. Our STEM ratio is meant to proxy for the percentage of professors in these disciplines. As more students confer with these degrees, more professors in these disciplines are needed to handle the additional students. However, some schools may just opt

[10] For example, for the 2008 school year the endowment value on June 30, 2008 is divided by the fall enrollment for the 2007-2008 school year.

Table 5.4 Academic and Institutional Variables

Variable	Year	Mean	Std. Dev.	Min	Max	Obs.
stem_ratio	2002	0.20	0.11	0	0.91	134
	2007	0.20	0.11	0	0.95	134
	2008	0.20	0.11	0	0.93	134
ft_fe	2002	1,705.46	761.07	330	4,309	134
	2007	1,790.69	773.53	360	4,487	133
	2008	1,787.19	780.39	340	4,553	134
prof_ft_ratio	2002	0.08	0.01	0.05	0.11	127
	2007	0.08	0.01	0.05	0.13	119
	2008	0.08	0.01	0.05	0.14	122
rsch_inst_ratio	2002	0.04	0.08	0	0.55	132
	2007	0.04	0.08	0	0.56	134
	2008	0.04	0.08	0	0.67	134
perc_f_full	2002	0.24	0.11	0.05	0.58	127
	2007	0.24	0.11	0.05	0.58	120
	2008	0.30	0.10	0.11	0.58	122
perc_f_assoc	2002	0.43	0.13	0	0.88	127
	2007	0.43	0.13	0	0.88	120
	2008	0.45	0.10	0.13	0.86	122
perc_f_asst	2002	0.49	0.10	0.28	0.77	127
	2007	0.50	0.10	0.21	0.79	120
	2008	0.51	0.10	0.14	0.80	122

for larger class sizes, so this is an imperfect proxy, but one that may be enlightening, nonetheless. It also raises an interesting question regarding the mission of LACs and their usual humanities and interdisciplinary focus. Maybe STEM professors are not rewarded at these schools, because the professional degrees in technology and engineering are not what garner attention.

We chose to control for STEM disciplines because professors teaching in these disciplines have lucrative outside options. Because of these outside options, we believe that this variable should be positively correlated with salary. The more STEM professors working at an institution, the higher we expect average salary to be since they should be compensated more compared to professors in disciplines without well-paying industry options, such as the humanities.

Full time fall enrollment is the total number of full time students enrolled in the fall semester of the academic year. For instance, the full time fall enrollment in 2007 is used for the 2008 academic year. In analyzing post-secondary education, most researchers prefer to use FTE student enrollment (as was used for net tuition); however, sufficient data on FTE enrollment was not available. For LACs, full time enrollment will be adequate because, generally, at these schools most students are enrolled full time, and there are few, if any, part time students. We are not sure what relationship we expect to see between

average salary and enrollment, but felt it was important to control for differences in enrollment among schools.

The professor to student ratio is meant to capture the teaching load and associated workload of each professor. It is calculated by dividing total professors (all ranks) by full time fall enrollment. The sign on this variable may be positive or negative, because there are a couple different phenomena that could be occurring here. It's possible that with more professors to students, each professor has a smaller workload. In this case, we might expect a negative effect because each professor is working less and, according to theory, should be compensated less than counterparts that work more. This would depress average salary. However, we might also tell a quality story in which schools with more resources and a high quality reputation are able to hire more professors so the professor to student ratio is smaller. In this case, we would expect a positive correlation.

Female percentage of faculty is meant to pick up any gender bias in average salary levels. If a school has a high percentage of female faculty members, we might expect lower salary levels if gender discrimination still exists. We see in Table 5.4 that in 2002 and 2007 the percentage of female faculty for assistant and associate professors was about twice that of full professors. We would expect the coefficient for this variable to be negative if it is significant.

The literature indicates that most gender bias has been eradicated in professor salaries.

The research to instruction expense ratio is calculated by dividing total research expenses by total instruction expenses. Many schools had zero research expenses, which is not surprising since, traditionally, LACs focus on teaching. This ratio could be positively or negatively related to professor salary levels depending on the presence of "mission creep." If LACs are emulating their bigger-research oriented brothers in higher education, we expect the coefficient to be positive, because research would be rewarded. However, if LACs are truly endorsing their teaching missions, they will be rewarding instructional activities, and we'd expect the coefficient to be negative. This is assuming that expenses are correlated with professor activity, so that higher research expenses mean more research activity.

The ranking variables were calculated using the national LAC rankings from USNWR. This rank variable is either the numerical rank of the school or zero if the school was in tier two, three or four in 2002 and tier three or four in 2007 and 2008. The numerical ranking is published for the top tier in 2002 and the top two tiers in 2007 and 2008; the rest of the schools are listed alphabetically by tier. The lower the tier number, the higher the school is ranked. USNWR

Table 5.5 USNWR Ranking Variables

Variable	Year	Mean	Std. Dev.	Min	Max	Obs.
rank[11]	2002	25.16	14.67	1	48	51
	2007	54.22	30.96	1	104	110
	2008	61.22	35.32	1	122	124
tier2	2002	0.46	0.50	0	1	134
	2007	0.45	0.50	0	1	134
	2008	0.54	0.50	0	1	134
tier3or4	2002	0.07	0.25	0	1	134
	2007	0.10	0.30	0	1	134
	2008	0.04	0.21	0	1	134

roughly divides the schools into four equal tiers. The tier two dummy is one if the school is in tier two and zero otherwise. Tier two is defined as being ranked in the top 50 for this analysis. The tier three or four dummy is one if the school is in tier three or four and zero otherwise. Tier one is the excluded category.

We expect the coefficients for each of the ranking variables to be negative if salary levels are partially determined by institutional prestige. The higher the rank (lower the number), the higher average salary we expect. Also, because tier one is the excluded category, we expect the coefficients on the tier dummies to be

[11] The summary statistics for rank are for the observations that do not equal zero. An institution's rank equals zero if it was not ranked in that year, but was included in one of the lower tiers.

negative. The magnitude of the tier three or four dummy is expected to be larger than that of tier two since those schools are ranked lower than tier two schools.

Data Issues

As most researchers know, data can be wily—not only to work with but also to procure. This research endeavor is no different. The most formidable data issue presented during this project is missing observations.

Many LACs, and other college types for that matter, believe that ranking does not provide a holistic picture of the college experience and may abstain from providing data to USNWR. Some schools also abstain from providing average salary data to the AAUP. Also, if a school does not receive federal funding, they are not required to report to the U.S. Department of Education. If the schools were missing for a systematic reason there would be bias and inconsistency in our estimators; however, we have no reason to believe this.

CHAPTER SIX

Cross Section Analysis

The Model

Many previous papers have captured the determinants of professor salary levels. In creating this model, we've tried to capture the same effects using slightly different variables. The model is as follows, with salary and percentage female faculty (perc_f) varying with rank:[12]

$$\begin{aligned} l\_sal = \beta_0 + \beta_1 l\_msapic + \beta_2 msa\_state + \beta_3 stem\_ratio + \beta_4 l\_ft\_fe \\ + \beta_5 l\_net\_tuition + \beta_6 l\_endow\_ft + \beta_7 prof\_ft\_ratio \\ + \beta_8 perc\_f + \beta_9 rsch\_inst\_ratio + \beta_{10} rank + \beta_{11} tier2 \\ + \beta_{12} tier3or4 + \mu \end{aligned}$$

Figure 6.1 Average Professor Salary Equation

We are estimating the model using Ordinary Least Squares (OLS) estimation and are using heteroskedasticity-robust standard errors to correct for heteroskedasticity. Heteroskedasticity is when the variance of the error term is not constant and affects the validity of our t-statistics, which determine significance. Assuming our sample is sufficiently large, the robust standard errors should provide us with valid t-statistics to use for inference.

[12] For variable definitions, refer to Table 5.1

Logging the variables allows us to interpret the coefficients approximately as percentage change. The second model for each rank is one in which the insignificant variables were systematically eliminated until all the coefficients on the remaining variables were significant. The second model's purpose is to show the robustness of the results.

We applied the same modeling process to the years 2002, 2007 and 2008 with the goal of testing whether estimated coefficients are stable across time and across the business cycle. To test stability we estimated a regression for the two years we wanted to compare and included interaction terms for each of the independent variables with a dummy for the most recent year. Then we tested whether all of the coefficients on the interactions terms were equal to zero. If we reject the null hypothesis that they are equal to zero, the coefficients are significantly different across the two years. If we fail to reject, the coefficients are not significantly different from each other across the years.

In comparing the years 2002 and 2007, we are concerned with differences in the equations because of the passage of time. In both academic years, the economy was expanding—though the U.S. was at different points in the expansionary process. When comparing the years 2002 and 2008, we are concerned about differences in equations because of points in the business cycle.

A trough occurs in the 2002 academic year, and the 2008 academic year is situated around a peak in the business cycle.

Results

For each professor ranking—full, associate and assistant—some variables were consistently significant, while others varied with year or professor rank. As stated earlier, regressions are organized by professor rank, and there is a table for each rank showing the full model and the model with only significant variables for each year.

In Table 6.1 we see that regional personal income per capita, enrollment, endowment and the ranking variables are significant for all three years. The MSA PIC variable is positive as expected, and the magnitude of the coefficient ranges from about 0.22 to 0.36. If regional income increases 10%, we can expect average professor salary to increase about 3%. The enrollment and endowment variables are positive, and the magnitudes of each are around 0.05, which suggests a very small effect on professor salary. Our ranking variables are negative. The coefficients on the rank variable suggest that if a school moves up one place in the rankings, average professor salary will increase 0.1-0.3% depending on the year. Schools in tier two are paying around 7% less than tier one in 2007 and 2008, but closer to 20% less in 2002. Schools in tier three or four

are paying professors on average even less—about 25% less than those in tier one.

Table 6.1 Full Professor Cross Section Analysis

Dependent Variable: Log(Average Full Professor Salary)						
Year	2002		2007		2008	
	All	Significant	All	Significant	All	Significant
l_msapic	0.2266***	0.2431***	0.3383***	0.3639***	0.3333***	0.3371***
	(0.0808)	(0.0797)	(0.0538)	(0.0505)	(0.0629)	(0.0595)
stem_ratio	-0.0289		-0.0222		0.0118	
	(0.1042)		(0.0841)		(0.0962)	
l_ft_fe	0.0568**	0.0678***	0.0552**	0.0615***	0.0633***	0.0605***
	(0.0247)	(0.0240)	(0.0256)	(0.0227)	(0.0234)	(0.0230)
l_net_tuition	0.1043**	0.1036**	0.0555*		0.0750**	0.0766**
	(0.0449)	(0.0422)	(0.0312)		(0.0361)	(0.0352)
l_endow_ft	0.0630***	0.0599***	0.0448**	0.0428***	0.0656***	0.0644***
	(0.0222)	(0.0178)	(0.0183)	(0.0155)	(0.0167)	(0.0139)
prof_ft_ratio	-0.3945		0.3083		-0.0802	
	(0.9568)		(0.8872)		(0.6965)	
perc_f_full	0.0939	0.1352**	0.0729		0.0502	
	(0.0715)	(0.0624)	(0.0819)		(0.0847)	
rsch_inst_ratio	0.2206		0.4992***	0.4615***	0.5656***	0.5482***
	(0.1854)		(0.1498)	(0.1375)	(0.1547)	(0.1446)
rank	-0.0028***	-0.0030***	-0.0019***	-0.0022***	-0.0011**	-0.0011**
	(0.0010)	(0.0010)	(0.0006)	(0.0006)	(0.0005)	(0.0005)
tier2	-0.1887***	-0.1964***	-0.0639*	-0.0752**	-0.0783**	-0.0776**
	(0.0486)	(0.0507)	(0.0331)	(0.0319)	(0.0332)	(0.0324)
tier3or4	-0.2175***	-0.2214***	-0.2573***	-0.3099***	-0.2546***	-0.2519***
	(0.0600)	(0.0599)	(0.0501)	(0.0514)	(0.0728)	(0.0703)
Constant	0.4149	0.1655	-0.1905	0.1225	-0.4796	-0.4970
	(0.7737)	(0.7266)	(0.6358)	(0.5912)	(0.6966)	(0.6483)
Observations	108	108	102	102	107	107
R – Squared	0.83	0.82	0.87	0.87	0.88	0.88
F – Statistic	62.36	92.35	69.98	111.78	92.72	105.43
F – Test for Stability Across Time [H_0: Coefficients do not change between 2002 and current year]						
F – Statistic			1.57		1.20	
Prob > F			0.1036		0.2828	
Decision?			Fail to Reject		Fail to Reject	

Note: Robust standard errors are given in parentheses under the coefficients; the individual coefficients are significant at *10% level, **5% level, or ***1% level

Some variables were significant in only certain years—tuition, percentage female and the research ratio. Net tuition has a positive correlation in 2002 and 2008. If net tuition increased by 10%, average professor salary would be expected to increase 0.7-1% depending on the year. In 2002, the percentage of female full professors is significant and positive, so a higher percentage of female faculty is associated with a higher average salary. The research ratio indicates that an increase in the ratio of 0.1 would translate into an increase in average salary of around 5%.

The STEM ratio, as well as the professor to student ratio, were insignificant each year once controlling for other institutional factors suggesting that discipline concentration has no effect on average salaries.

In testing whether the coefficients are different between 2002 and 2007, we find that we fail to reject the hypothesis that they change. The same is true when looking at the 2002 and 2008 equations. It appears the determinants of salary are stable across time and across the business cycle for full professors.

In Table 6.2, we see that the only variables consistently significant across all three years for associate professors are PIC and the tier two dummy. The coefficient is positive as expected, and the magnitude ranges from about 0.20 to 0.27. We can roughly interpret the coefficient as an elasticity, so a 10% increase in the regional per capita income translates into an increase of about 2.5% in

Table 6.2 Associate Professor Cross Section Analysis

Dependent Variable: Log(Average Associate Professor Salary)						
Year	2002		2007		2008	
	All	Significant	All	Significant	All	Significant
l_msapic	0.1992***	0.2088***	0.2563***	0.2724***	0.2474***	0.2604***
	(0.0680)	(0.0684)	(0.0487)	(0.0409)	(0.0497)	(0.0460)
stem_ratio	0.0779		0.0199		0.0275	
	(0.0727)		(0.0998)		(0.0849)	
l_ft_fe	0.0526***	0.0507***	0.0282		0.0440**	0.0490**
	(0.0199)	(0.0184)	(0.0251)		(0.0214)	(0.0203)
l_net_tuition	0.0675*	0.1123***	0.0345	0.0498**	0.0481	
	(0.0347)	(0.0293)	(0.0246)	(0.0191)	(0.0305)	
l_endow_ft	0.0574***	0.0799***	0.0237		0.0472***	0.0396***
	(0.0157)	(0.0079)	(0.0164)		(0.0146)	(0.0108)
prof_ft_ratio	-0.3132		0.2397		-0.1372	
	(0.7743)		(0.7451)		(0.6485)	
perc_f_assoc	0.0399		0.1256		0.0585	
	(0.0521)		(0.0861)		(0.0700)	
rsch_inst_ratio	-0.0060		0.2623**	0.3246***	0.4274***	0.4008***
	(0.1174)		(0.1150)	(0.1186)	(0.1306)	(0.1266)
rank	-0.0009		-0.0019***	-0.0023***	-0.0010**	-0.0012***
	(0.0008)		(0.0005)	(0.0004)	(0.0004)	(0.0004)
tier2	-0.0976**	-0.0281*	-0.0405	-0.0490**	-0.0621**	-0.0735***
	(0.0378)	(0.0150)	(0.0244)	(0.0230)	(0.0237)	(0.0239)
tier3or4	-0.1095**		-0.2277***	-0.2747***	-0.2233***	-0.2698***
	(0.0490)		(0.0542)	(0.0423)	(0.0538)	(0.0490)
Constant	0.7251	0.0653	0.8725	0.9951**	0.6322	1.0120**
	(0.5976)	(0.5305)	(0.5731)	(0.4714)	(0.5666)	(0.4851)
Observations	108	116	102	111	107	108
R – Squared	0.78	0.77	0.83	0.86	0.86	0.85
F – Statistic	43.96	97.04	42.87	78.30	55.23	83.63
F – Test for Stability Across Time [H_0: Coefficients do not change between 2002 and current year]						
F – Statistic			1.42		1.47	
Prob > F			0.1616		0.1283	
Decision?			Fail to Reject		Fail to Reject	

Note: Robust standard errors are given in parentheses under the coefficients; the individual coefficients are significant at *10% level, **5% level, or ***1% level

average professor salary. The tier two dummy is negative as expected. According to the coefficients, schools in tier two can expect to make 2-10% less than their tier one counterparts when controlling for other institutional factors.

Other variables were significant in some years and not in others. In 2002 and 2008, full time enrollment is positive and significant with a coefficient around 0.05, so a 10% increase in enrollment would create a 0.5% increase in average salary. Net tuition is positive and significant in 2002 and 2007. The coefficient's magnitude in 2007 is roughly half that of 2002. Endowment per student is significant in 2002 and 2008. An increase in endowment per student of 10% translates into an increase in average professor salary of around 0.5%. The research ratio is positive and significant in 2007 and 2008. An increase in this ratio of 0.1 would create an increase in average salary of 3-4%. Both rank and the tier three or four dummy are negative and significant in 2007 and 2008. The rank variable suggests that if a school moves up one place in the rankings, the average professor salary will increase by 0.1-0.2%. Also, the tier three or four dummy indicates that schools in this tier make about 20% less than those in tier one.

The STEM ratio, professor to student ratio and female percentage are not significant in any of the years suggesting once other factors are controlled for, they have no significant effect on average salary.

Testing for stability across time, we, once again, fail to reject that the coefficients are significantly different from each other between 2002 and 2007 and between 2002 and 2008.

Table 6.3 Assistant Cross Section Analysis

Dependent Variable: Log(Average Assistant Professor Salary)						
Year	2002		2007		2008	
	All	Significant	All	Significant	All	Significant
l_msapic	0.1541**	0.1531***	0.2236***	0.1982***	0.1691***	0.1695***
	(0.0670)	(0.0509)	(0.0488)	(0.0502)	(0.0567)	(0.0521)
stem_ratio	0.1214		0.0646		0.0865	
	(0.1028)		(0.0843)		(0.0705)	
l_ft_fe	0.0408*	0.0564**	0.0471**		0.0468**	0.0434*
	(0.0238)	(0.0260)	(0.0235)		(0.0213)	(0.0229)
l_net_tuition	0.0499		0.0602**	0.0737***	0.0506	0.0483*
	(0.0369)		(0.0264)	(0.0209)	(0.0310)	(0.0272)
l_endow_ft	0.0525***	0.0367***	0.0273	0.0250**	0.0396***	0.0402***
	(0.0156)	(0.0110)	(0.0174)	(0.0125)	(0.0138)	(0.0122)
prof_ft_ratio	-1.1532		0.8406		0.1431	
	(0.8718)		(0.8462)		(0.5881)	
perc_f_asst	-0.0269		0.0410		0.0408	
	(0.0711)		(0.0683)		(0.0758)	
rsch_inst_ratio	-0.0262		0.1962*	0.1936*	0.3664***	0.3761***
	(0.1260)		(0.1065)	(0.1143)	(0.1032)	(0.1272)
rank	-0.0019***	-0.0024***	-0.0013**	-0.0019***	-0.0008	-0.0008*
	(0.0007)	(0.0006)	(0.0005)	(0.0003)	(0.0005)	(0.0005)
tier2	-0.1198***	-0.1522***	-0.0216		-0.0446	-0.0496*
	(0.0348)	(0.0297)	(0.0283)		(0.0308)	(0.0297)
tier3or4	-0.1277***	-0.1642***	-0.1561***	-0.1966***	-0.1739***	-0.1882***
	(0.0468)	(0.0461)	(0.0525)	(0.0530)	(0.0551)	(0.0505)
Constant	1.3690**	1.7580***	0.5692	1.1757**	1.2079*	1.3198**
	(0.5943)	(0.5354)	(0.5862)	(0.5442)	(0.6365)	(0.5801)
Observations	108	109	102	102	107	107
R – Squared	0.76	0.73	0.75	0.73	0.80	0.79
F – Statistic	36.73	49.77	31.93	57.52	49.00	69.40
F – Test for Stability Across Time [H_0: Coefficients do not change between 2002 and current year]						
F – Statistic			1.63		1.43	
Prob > F			0.0860		0.1552	
Decision?			Fail to Reject at 5% level		Fail to Reject	

Note: Robust standard errors are given in parentheses under the coefficients; the individual coefficients are significant at *10% level, **5% level, or ***1% level

We see in Table 6.3 that for assistant professors, personal income and endowment are positive and significant for all years. The PIC coefficient suggests that a 10% increase in regional income will be correlated with an

increase in average professor salary of 1.5-2%. The endowment coefficient is between 0.02 and 0.05 across the years suggesting that while there is an effect, it is very small, as we have seen for the other professor rankings.

The rank and tier three or four variables were also significant across all years, though the coefficients on these variables are negative as expected. An increase of one place in the ranking translates into an increase in average salary of 0.1%—a very small effect. However, the tier three or four dummy suggests that schools in these tiers pay about 15-19% less than tier one. The tier two dummy was significant in 2002 and 2008, but not in 2007, suggesting that in 2007, there is no difference in average salary between tier one and tier two schools once we control for other factors.

Some variables were significant in only certain years—enrollment, tuition and the research ratio. The enrollment variable is positive, but once again, the coefficients are very small. Tuition is positive and significant in 2007 and 2008, but only at the 10% level in 2008. The research ratio is also positive and significant in 2007 and 2008. In 2008, an increase in the research ratio of 0.1 can be associated with an increase in average professor salary of about 3.7%.

Once again, the STEM ratio, as well as the professor to student and female percentage ratios, was insignificant once we controlled for other factors.

In testing for stability across time, we once again fail to reject the hypothesis that the coefficients are significantly different from each other in the 2002 to 2007 comparison and 2002 to 2008 comparison. However, we only fail to reject at the 5% level in the 2002 and 2007 comparison.

Implications

These results provide some interesting implications regarding the role of tuition, endowment, USNWR ranking and research at LACs as well as the stability of determinants of salary across time and points in the business cycle.

Regional income plays a significant role in determining professor salary levels across all years and professor types. What does this imply? Schools are sensitive to the regional labor market and the changes in the local economy.

To better understand the effects of regional income, we can look at the isolated effect of this variable for specific schools—Swarthmore College, Rhodes College and Millsaps College. Swarthmore is consistently a top five ranked school. Rhodes is usually ranked around 50, and Millsaps is ranked around 80. By raising income one standard deviation above the regional personal income mean[13], we see some sizable effects on average professor salary at these schools. At Swarthmore, full professor average salary would be about $3,300, $6,700 and

[13] At one standard deviation above the mean, personal income is 13%, 15% and 15% higher for 2002, 2007 and 2008 respectively.

$6,300 more in 2002, 2007 and 2008 respectively. In contrast, if Millsaps was located in a richer area, average professor salaries would be $2,000, $4,400 and $4,100 higher in 2002, 2007 and 2008. Rhodes' salary increases would be comparable to Millsaps. Solely based on being located in a richer area, Swarthmore professors would earn, on average, an extra $2,000 than Millsaps or Rhodes would earn if they experienced the same increase in regional per capita income. The effects are similar for associate and assistant professors.

Another effect we see across ranks and years is the positive significance of endowment per student. Since the percentage of endowment spending stays stable across time (approximately 5%), we can say that as endowment grows, so will professor salary levels, however the effect of endowment on salary is very small.

If endowment per student were 10% higher, the effect on professor salaries is rather insignificant when compared to the effect of regional income. The average full professor salary at Swarthmore would increase between $500 and $800 depending on the year. At Rhodes, a less prestigious college, on average, full professors would earn an extra $350 to $530 a year. Millsaps full professors would see approximately the same increase in average salary. As we look at associate and assistant professors, the increase in average salary associated with an increase in endowment per student decreases, with the

average assistant professor salary increase ranging from $125-$280. Once again, the increase in average salary for Swarthmore professors ($170-$280) is greater than that of Rhodes and Millsaps ($125-$208).

The role of tuition in average salary determination varies almost sporadically across year and professor ranks. For full professors it is significant in 2002 and 2008, while it is significant in 2002 and 2007 for associates and 2007 and 2008 for assistant professors. The inconsistency of tuition's significance (once other institutional factors are controlled for) may suggest that schools do not focus solely on tuition increases to fund salary increases.

The role of USNWR rankings and subsequently prestige are as we expected across professor ranks and years. Schools in tiers three and four are paying professors quite a bit less than schools in tier one, and schools in tier two are paying less than tier one schools—though not much less.

Teaching is thought to be the wheelhouse of LACs, but these regressions indicate that research spending (and subsequently potential research production) leads to higher professor salaries in the later years of this study. We cannot necessarily conclude that "mission creep" is in fact present though, because it is possible that schools treat research as a supplemental activity, and if they have the money to spend on research, they are well off financially and are willing to pay their professors more.

The consistent insignificance of the STEM ratio is surprising. It suggests that a higher concentration of STEM professors (assuming schools with higher conferrals in these subjects have more professors teaching these subjects) does not skew average salary upward, as we would expect it to if these professors were paid more according to their outside options. Also the insignificance of the female percentage variable suggests that gender bias is not apparent in departments. The professor to student ratio is also insignificant once we control for other factors. The quality story probably fits better in this case. Because we are controlling for financial factors that allow schools to hire professors to keep class size small and increase educational quality, we might not expect the ratio to be significant because the other variables are capturing this quality measure.

The last results we'd like to discuss are the tests for stability of these equations over time. We fail to reject that the coefficients are significantly different across the years for each rank at the 5% level; however, we do reject this hypothesis at the 10% level for assistant professors when comparing 2002 and 2007. We could be seeing this result for assistant professors because schools are more likely to hire from an external market for these positions—schools are hiring fresh Ph.D.s or assistant professors from other schools while they promote internally to fill full professor positions. What they are able and willing to offer new professors may depend on what the market conditions are, and those will

vary across time. Also, if an institution plans on making changes in salary spending, it is likely they will do so with new hires rather than making big salary changes for professors who have been at the school for a while.

Endogeneity

In any analysis of post secondary education data, one must be careful in thinking about the endogeneity problems that can exist. Which way does causality run, and what conclusions can be made?

We suspect there exists an immeasurable quality variable that affects average professor salary that could be a part of the error term. Because of this, we may be overestimating the effects of our variables. For instance, it is possible that higher quality professors who would earn more because of their productivity are drawn to urban environments, which could be why we see a persistent positive effect of regional income on average professor salaries.

Also, we should note that professor salary is explicitly considered in the USNWR rankings calculation, so while we have ranking determining average professor salary in our model, average professor salary also determines rank. However, salary accounts for only 7% of the ranking calculation.

Because of these issues, we must be careful in the terminology we use as far as causality is concerned. Using instrumental variables in future research can help alleviate the endogeneity issues seen here.

CHAPTER SEVEN

Conclusion

The answers to the question of professor salary level determination in this paper are fairly consistent with the previous literature. Regional income and endowment have a consistent positive effect on salary level, while other variables like tuition vary across years and professor rank. Rank plays a surprisingly strong role in average salary determination, with the strongest effects being seen between the tiers. The role of research at LACs is still somewhat vague, but this research indicates that "mission creep" may exist. Professors at these teaching oriented institutions may be rewarded more if the school takes an interest in research. We see that determinants are stable across time except possibly for assistant and associate professors between the years 2002 and 2007, and this could be because of the role of external and internal markets in the hiring and promoting processes.

Future research should focus on instrumenting for the endogeneity issues that arise when looking at institutional variables. Also, there is room for studies of professor salary across time, as most research looks at one or few years of data. Much research has preceded this paper, and much research will follow—

professors will surely stay interested in their salary determinants as institutional policies and missions evolve.

APPENDICES

APPENDIX A

Liberal Arts Colleges in Sample and MSA

Table A.1 Liberal Arts Colleges and MSAs in Sample

Institution Name	State	MSA or State Used for "msapic" Variable
Birmingham Southern College	AL	Birmingham-Hoover, AL
Lyon College	AR	AR
Hendrix College	AR	Little Rock-North Little Rock-Conway, AR
Claremont McKenna College	CA	Los Angeles-Long Beach-Santa Ana, CA
Harvey Mudd College	CA	Los Angeles-Long Beach-Santa Ana, CA
Mills College	CA	San Francisco-Oakland-Fremont, CA
Occidental College	CA	Los Angeles-Long Beach-Santa Ana, CA
Pitzer College	CA	Los Angeles-Long Beach-Santa Ana, CA
Pomona College	CA	Los Angeles-Long Beach-Santa Ana, CA
Scripps College	CA	Los Angeles-Long Beach-Santa Ana, CA
Thomas Aquinas College	CA	CA
Westmont College	CA	Santa Barbara-Santa Maria-Goleta, CA
Colorado College	CO	Colorado Springs, CO
Connecticut College	CT	Norwich-New London, CT
Trinity College	CT	Hartford-West Hartford-East Hartford, CT
Wesleyan University	CT	Hartford-West Hartford-East Hartford, CT
New College of Florida	FL	North Port-Bradenton-Sarasota, FL
Agnes Scott College	GA	Atlanta-Sandy Springs-Marietta, GA
Berry College	GA	Rome, GA
Spelman College	GA	Atlanta-Sandy Springs-Marietta, GA
Augustana College	IL	Davenport-Moline-Rock Island, IA-IL
Illinois Wesleyan University	IL	Bloomington-Normal, IL
Knox College	IL	IL
Lake Forest College	IL	Chicago-Joliet-Naperville, IL-IN-WI
Principia College	IL	IL
Wheaton College	IL	Chicago-Joliet-Naperville, IL-IN-WI
DePauw University	IN	Indianapolis-Carmel, IN
Earlham College	IN	IN
Hanover College	IN	IN
Saint Mary's College	IN	South Bend-Mishawaka, IN-MI
Wabash College	IN	IN
Central College	IA	IA
Coe College	IA	Cedar Rapids, IA
Cornell College	IA	Cedar Rapids, IA
Grinnell College	IA	IA

Table A.1 Liberal Arts Colleges and MSAs in Sample Continued

Institution Name	State	MSA or State Used for "msapic" Variable
Luther College	IA	IA
Berea College	KY	KY
Centre College	KY	KY
Transylvania University	KY	Lexington-Fayette, KY
Bates College	ME	Portland-South Portland-Biddeford, ME
Bowdoin College	ME	Portland-South Portland-Biddeford, ME
Colby College	ME	ME
Goucher College	MD	Baltimore-Towson, MD
St Mary's College of Maryland	MD	MD
St John's College	MD	Baltimore-Towson, MD
United States Naval Academy	MD	Baltimore-Towson, MD
Washington College	MD	MD
Amherst College	MA	Springfield, MA
Hampshire College	MA	Springfield, MA
College of the Holy Cross	MA	Worcester, MA
Mount Holyoke College	MA	Springfield, MA
Smith College	MA	Springfield, MA
Stonehill College	MA	Boston-Cambridge-Quincy, MA-NH
Wellesley College	MA	Boston-Cambridge-Quincy, MA-NH
Wheaton College	MA	Boston-Cambridge-Quincy, MA-NH
Williams College	MA	Pittsfield, MA
Albion College	MI	MI
Alma College	MI	MI
Calvin College	MI	Grand Rapids-Wyoming, MI
Hillsdale College	MI	MI
Hope College	MI	Grand Rapids-Wyoming, MI
Kalamazoo College	MI	Kalamazoo-Portage, MI
Carleton College	MN	Minneapolis-St. Paul-Bloomington, MN-WI
Gustavus Adolphus College	MN	MN
Macalester College	MN	Minneapolis-St. Paul-Bloomington, MN-WI
College of Saint Benedict	MN	St. Cloud, MN
Saint Johns University	MN	St. Cloud, MN
St. Olaf College	MN	Minneapolis-St. Paul-Bloomington, MN-WI
Millsaps College	MS	Jackson, MS
Drew University	NJ	New York-Northern New Jersey-Long Island, NY-NJ-PA
St John's College	NM	Santa Fe, NM
Bard College	NY	Poughkeepsie-Newburgh-Middletown, NY
Barnard College	NY	New York-Northern New Jersey-Long Island, NY-NJ-PA
Colgate University	NY	Syracuse, NY

Table A.1 Liberal Arts Colleges and MSAs in Sample Continued

Institution Name	State	MSA or State Used for "msapic" Variable
Hamilton College	NY	Utica-Rome, NY
Hobart William Smith Colleges	NY	NY
St Lawrence University	NY	NY
Sarah Lawrence College	NY	New York-Northern New Jersey-Long Island, NY-NJ-PA
Siena College	NY	Albany-Schenectady-Troy, NY
Skidmore College	NY	Albany-Schenectady-Troy, NY
Union College	NY	Albany-Schenectady-Troy, NY
United States Military Academy	NY	Poughkeepsie-Newburgh-Middletown, NY
Vassar College	NY	Poughkeepsie-Newburgh-Middletown, NY
Wells College	NY	NY
Davidson College	NC	Charlotte-Gastonia-Rock Hill, NC-SC
Denison University	OH	Columbus, OH
Kenyon College	OH	OH
Oberlin College	OH	Cleveland-Elyria-Mentor, OH
Ohio Wesleyan University	OH	Columbus, OH
Wittenberg University	OH	Dayton, OH
The College of Wooster	OH	Canton-Massillon, OH
Lewis & Clark College	OR	Portland-Vancouver-Hillsboro, OR-WA
Linfield College	OR	OR
Reed College	OR	Portland-Vancouver-Hillsboro, OR-WA
Willamette University	OR	Salem, OR
Allegheny College	PA	PA
Bryn Mawr College	PA	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD
Bucknell University	PA	Harrisburg-Carlisle, PA
Dickinson College	PA	Harrisburg-Carlisle, PA
Franklin and Marshall College	PA	Lancaster, PA
Gettysburg College	PA	Harrisburg-Carlisle, PA
Haverford College	PA	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD
Juniata College	PA	PA
Lafayette College	PA	Allentown-Bethlehem-Easton, PA-NJ
Muhlenberg College	PA	Allentown-Bethlehem-Easton, PA-NJ
Susquehanna University	PA	PA
Swarthmore College	PA	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD
Ursinus College	PA	Philadelphia-Camden-Wilmington, PA-NJ-DE-MD
Washington & Jefferson College	PA	Pittsburgh, PA
Westminster College	PA	Youngstown-Warren-Boardman, OH-PA
Erskine College and Seminary	SC	SC

Table A.1 Liberal Arts Colleges and MSAs in Sample Continued

Institution Name	State	MSA or State Used for "msapic" Variable
Furman University	SC	Greenville-Mauldin-Easley, SC
Presbyterian College	SC	SC
Wofford College	SC	SC
Fisk University	TN	Nashville-Davidson-Murfreesboro-Franklin, TN
Rhodes College	TN	Memphis, TN-MS-AR
Sewanee: The University of the South	TN	Chattanooga, TN-GA
Austin College	TX	TX
Southwestern University	TX	Austin-Round Rock-San Marcos, TX
Bennington College	VT	VT
Middlebury College	VT	Burlington-South Burlington, VT
Saint Michaels College	VT	Burlington-South Burlington, VT
Hampden-Sydney College	VA	VA
Hollins University	VA	Roanoke, VA
Randolph-Macon College	VA	Richmond, VA
Randolph College	VA	Lynchburg, VA
University of Richmond	VA	Richmond, VA
Sweet Briar College	VA	Lynchburg, VA
Virginia Military Institute	VA	VA
Washington and Lee University	VA	VA
University of Puget Sound	WA	Seattle-Tacoma-Bellevue, WA
Whitman College	WA	Kennewick-Pasco-Richland, WA
Beloit College	WI	WI
Lawrence University	WI	Green Bay, WI
Ripon College	WI	Oshkosh-Neenah, WI

APPENDIX B

Additional Summary Statistics

In the body of the paper we included the summary statistics for the variables in levels. Below we include the summary statistics for the variables we logged for our regression analysis.

Table B.1 Summary Statistics for Logged Salary Variables

Variable	Year	Mean	Std. Dev.	Min	Max	Obs.
l_full_sal	2002	4.33	0.17	3.99	4.65	127
	2007	4.48	0.19	4.05	4.87	120
	2008	4.53	0.19	4.10	4.94	122
l_assoc_sal	2002	4.06	0.12	3.80	4.29	127
	2007	4.21	0.15	3.84	4.55	120
	2008	4.25	0.16	3.88	4.58	122
l_asst_sal	2002	3.85	0.11	3.57	4.13	127
	2007	4.01	0.13	3.62	4.40	120
	2008	4.05	0.13	3.71	4.33	122

Table B.2 Summary Statistics for Logged Independent Variables

Variable	Year	Mean	Std. Dev.	Min	Max	Obs.
l_msapic	2002	10.37	0.13	10.10	10.77	134
	2007	10.58	0.15	10.34	11.05	134
	2008	10.61	0.14	10.37	11.04	134
l_ft_fe	2002	7.34	0.48	5.80	8.37	134
	2007	7.39	0.46	5.89	8.41	133
	2008	7.39	0.48	5.83	8.42	134
l_net_tuition	2002	9.47	0.38	8.21	10.35	131
	2007	9.74	0.38	8.20	10.70	131
	2008	9.80	0.35	8.28	10.75	130
l_endow_ft	2002	4.66	0.84	2.46	6.62	119
	2007	5.02	0.85	2.88	7.04	118
	2008	5.02	0.87	2.90	7.27	118

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