Factors affecting student load debt accrued by graduates of US veterinary medical colleges

Ryan Blake Williams[1], Aaron Benson[1], Bridgette Bain[2], and Michael Dicks[2]

[1]Department of Agricultural & Applied Economics, Texas Tech University
Box 42132, Lubbock, TX 79409
Email: ryan.b.williams@ttu.edu
agbenson@gmail.com

[2]Economics Division, AVMA
1931 N. Meacham Rd, Ste 100, Schaumburg, IL 60173
Email: bbain@avma.org
mdicks@avma.org

Selected Paper prepared for presentation at the Southern Agricultural Economics Association's 2016 Annual Meeting, San Antonio, Texas, February 6-9, 2016

Abstract

Graduates of colleges of veterinary medicine have experienced a marked increase in acquired student loan debt. The mean inflation-adjusted student loan debt for graduating veterinarians has increased at an average annual rate of 5.11% over the period of 2002-2014 while starting salaries have decreased at a rate of 0.9% annually. This research aims to identify the factors associated with the increase in student loan debt accumulation by veterinarians in the face of relatively unchanged wages. We utilize data collected from the American Veterinary Medical Association (AVMA) fourth-year veterinary student surveys for 2001 through 2014. The variable of interest is the inflation-adjusted total student loan debt attributed to the study of veterinary medicine. Due to the nature of debt totals, there are a large number of observations of zero in the data (14%). We employ a two-part hurdle model to identify the factors affecting both the decision to borrow and the amount which was borrowed. We find that the majority of the annual increase in debt can be explained by increases in tuition costs and an increase in the share of students paying out-of-state tuition, with some of the change attributable to the increasing share of veterinary students that are women.

Keywords: Labor Market, Veterinarian, Student Loan Debt

Introduction

"High Debt and Falling Demand Trap New Vets." This is the title of an article appearing in the New York Times in 2013, which suggests that the supply of Doctors of Veterinary Medicine (DVMs) is growing at too fast of a pace (Segal, 2013), arguing that as supply outpaces demand for services, wages don't grow as rapidly. Combined with increasing costs of education, some graduates of veterinary colleges of medicine are finding themselves with a substantial debt to income ratio, matching a national trend of increasing educational debt at all levels, evidenced by student loan debt overtaking credit card and auto debt in 2012 (de Vise, 2012). Typically, lifetime earnings (and therefore, the benefits of accruing debt for education) increase for students who earn post-baccalaureate degrees. So, in the context of professional programs, the student debt question is perhaps less pressing (Avery and Turner, 2012). However, calls for reform have led to at least one state board of regents freezing tuition at the state's veterinary school (Lerner, 2014).

Individuals pursue advanced degrees for a multitude of reasons. Some are passionate about a field of study while others may desire a particular type of career which necessitates a particular degree. However, the most likely factor influencing an individual decision to matriculate into a post baccalaureate program is the opportunity to increase the future stream of earnings through an investment in enhanced human capital. Obtaining an advanced degree not only increases and strengthens the individual's set of skills, it also serves as a signal to potential employers that they are clearly different than an individual without the advanced degree, thereby commanding a higher level of compensation.

The potential for an increased salary requires a significant investment on the part of the student, as the opportunity cost of additional education can be quite large. Students pay tuition and fees over multiple years, while also needing to support themselves and sometimes a family. In addition to the direct expense of the particular degree program, students are foregoing earnings during those years. The average starting annual salary for college graduates is in excess of $45,000 according to the National Association of Colleges and Employers 2014 Salary Survey.[1] Assuming that those pursuing advanced degrees are above-average in their abilities, the foregone earnings are significant. This is especially true for programs that don't offer teaching/research assistantships or tuition remittance (as is the case for students in colleges of veterinary medicine). In these instances it is typical for a student to accumulate student loan debt while foregoing the possibility of earning a salary. An individual choosing to pursue an advanced degree, therefore, is choosing to invest in the potential to earn a higher salary over their career. In other words, the stream of earnings with the degree, less the direct costs of the degree and foregone earnings, is expected to exceed the stream of earnings without the degree. For example, if a student expected to earn a $25,000 premium annually after completing a degree, the degree would be worth $310,000 over 30 years and with a discount rate of 7%. That is, for this student, the value of that annual premium is worth about $310,000 today.

However, given that the amount of debt held by a graduate can adversely affect her access to credit and quality of life, a "rule of thumb" that is typically recommended to students is that total debt should not be larger than the value that would require monthly

[1] Obtained online at: https://www.naceweb.org/salary-resources/starting-salaries.aspx

payments greater than 10% of post-graduation income (Griener, 1996). Assuming a 15-year repayment and 5% interest, this restricts total debt to be equal to a single-year's-worth of post-graduation income. That is, for a 15-year loan at 5% interest, the maximum recommended debt-to-income ratio is 1/1. For more favorable terms, say a 3% interest rate and a 25-year loan, the maximum recommended debt-to-income ratio is 1.76/1.

If the market is generating appropriate signals to potential entrants, then a reduction in the payoff from the investment would be met with reduction in enrollment (albeit a lagged response). Given that enrollments in colleges of veterinary medicine have increased by 60% over the past decade, and that the competition for a seat in those programs has declined by only 16% (Larkin 2015), it follows that the market for DVMs is not signaling the existence of a sufficiently large surplus, so as to discourage the investment in education. That said; the mean total inflation-adjusted student loan debt for graduating DVMs has increased at an average annual rate of 5.11% for those taking some amount of debt over the period of 2002-2014 while the self-reported mean inflation-adjusted starting salaries have decreased at an average annual rate of 0.9%.[2] Figure 1 provides a graphical presentation of this trend, which has resulted in the average loan debt approaching three times that of the average starting salary. However, there appears to be a correction back toward below the 3:1 ratio in the last couple of years (see Figure 2). While it isn't clear that the market for DVMs isn't functioning properly, we can

[2] These estimates are calculated from raw data collected from the AVMA fourth-year veterinary student surveys for 2001 through 2014. This data is self-reported, and salaries are only available for those students having accepted a position prior to completing the survey.

objectively state that students have been amassing a significantly larger amount of real debt in their pursuit of veterinary careers.

Given the rate at which debt has increased, it is logical to assume that the increase in debt is a function of increasing tuition at colleges of veterinary medicine. According to the Veterinary Information Network (VIN) Foundation's data for the period of 2001-2014, tuition increased at a rate of 5.1% per year on average for in-state students and 3.4% per year on average for out of states students. During the same time period, the share of total DVMs that were graduating from an out-of-state institution increased from 19% to 28%; an average increase of 3.2% per year. The combined impact of increasing tuition and an increasing share of graduates paying out-of-state tuition results in an average annual increase in four-year tuition costs of 4.86%. While these changes are clearly the primary factor in the overall average debt of graduating DVMs, there is still an approximately .25% per year increase in debt that is not explained by increases in tuition. Furthermore, the above analysis doesn't help to identify the factors that are correlated with whether or not a student chooses to borrow for their education, and if so, how much total debt is accumulated.

The objective of this research is to investigate the relevance and magnitude of factors which affect the level of student loan debt that students of veterinary medical colleges acquire while pursuing their degrees. In what follows, we provide a detailed description of the unique data utilized in this research, followed by an explanation of the methodology employed and results of the statistical analysis of data.

Data

The data utilized for this research was collected from the American Veterinary Medical Association (AVMA) fourth-year veterinary student surveys for 2001 through 2014. Information gathered by the surveys is self-reported and constitutes the most extensive data available for graduating veterinarians over this time period. The variable of interest is the total student loan debt attributed to the study of veterinary medicine, inflation-adjusted to year 2010 US dollars using the Consumer Price Index (CPI). There are a total of 29,753 observations from the 14 years of surveys. After dropping 330 observations for missing data the final sample consists of 29,423 observations.

As outlined in the introduction, tuition increases over the study period can account for approximately fifty percent of the change in loan debt. The survey doesn't ask respondents to indicate the amount of tuition paid; therefore we control for differences in tuition by including dummy variables for the school attended, the year of graduation, and for students paying in-state tuition. The dummy variable for in-state takes a value of one if the student indicated being a resident of the state in which the school is located. It also takes a value of one if the student was from a state which contracts with the school to allow for in-state tuition. As an example, students attending Auburn University in Alabama from the states of Kentucky and West Virginia would pay the same tuition as students from Alabama (AAVMC, 2014). For all students paying an amount for tuition greater than the in-state rate, the dummy variable takes a value of zero.

The dummy variable for school, in addition to controlling for the growth of tuition through time, serves to capture differences between schools in other, unobservable, costs of attendance. While we are able to control for the rate of inflation by using inflation-adjusted debt totals, the actual cost of living varies by location. Housing costs, in

particular, vary significantly from one location to another. Similarly, the dummy variable for year of graduation provides a fixed effect to account for unobserved costs that vary by year but are not captured by the CPI.

While it is clear how the cost of education influences the amount of debt that students of veterinary medicine accumulate, the personal characteristics of, and choices made by those students are also likely factors in determining the level of debt. Included in the analysis are variables for age, gender, marital status, and whether or not the individual has a child. We hypothesize that married individuals and those with a child will have higher total loan debt, all else equal. Being more costly to maintain a household of multiple individuals should increase both the likelihood of a student obtaining loans and the total amount of loans taken. Additionally, we hypothesize that older students will have accumulated more debt as they are likely to have assumed more financial obligations than their younger counterparts.

The gender variable is included to account for differences in student loan debt between male and female students of veterinary medicine. The proportion of women graduating from colleges of veterinary medicine has increased from 70% in 2001 to 77% by the 2014 survey, constituting an increase of one half of one percent per year. If women represent a greater share of the student population, and they borrow more money while being a student, this may partially explain the remaining increase in average debt over time. However, our hypothesis is that male students accumulate more debt, on average, than their female counterparts in veterinary school. Given that males have higher average starting salaries upon graduation than females they should be more willing to accept more student loan debt.

The final explanatory variables that are included in the model are related to the professional choices of the student. Binary variables were generated for those students possessing post baccalaureate education other than veterinary school and those that have not pursued a specialization. In addition, variables indicating that the student had sought employment and received a job offer, at the time of the survey, are included.

Methods

Although student loan debt has increased over the study period, not all graduates of veterinary medical colleges have borrowed money during their education. In fact, 14% of the sample reported no student loan debt from their veterinary training. As such, we must not only determine how various factors influence the total amount of debt, but also must evaluate factors which explain participation in the credit market in the first place. Figure 3 presents the distribution of values for loan debt. In order to account for the zeros in our sample, we employ a two-part hurdle model.

The two-part model of Cragg (1971) treats non-zero positive values of the dependent variable as observations that have participated, while observations of zeros are considered nonparticipants. We define a latent variable *debtdum* such that *debtdum* = 1 if veterinary debt is greater than zero for any given observation, and equals zero otherwise. A probit model is estimated with *debtdum* as the dependent variable to determine the likelihood of participation in student loan debt. In the second part of the model only those observations with positive values for debt are included. Because only positive values are included, the distribution of the dependent variable is assumed to be log-normal. The second part of the model is estimated via ordinary least squares (OLS)

regression, with the natural log of inflation-adjusted student loan debt as the dependent variable.

The same explanatory variables are used in both parts of the hurdle model, with the exception of how time is treated. For the log-level OLS regression, dummy variables for each survey year have been included to account for changes in tuition and other costs from year to year. In the probit model, which estimates the likelihood of a student having loan debt, the relative difference in likelihood is less informative than is a general year-to-year trend. Therefore, a time trend variable is used in the probit portion of the analysis rather than year-specific dummy variables.

Results

The two-part hurdle model was estimated using STATA/MP 12.0. The results of the estimation are presented in Table 1. The dependent variable in the probit regression is *debtdum*, the latent variable taking a value of one for non-zero student loan debt and a value of zero otherwise. For the OLS regression, only observations which crossed the hurdle of participation in acquiring student loan debt were included. This subsample of the data includes 25,315 observations. The variable of interest in the second part of the model is the natural log of inflation-adjusted loan debt.

In the probit regression, the time trend is found to be statistically significant at the one percent level. The probability of a student in veterinary medicine taking on some amount of debt is increasing over time through the study period. Given that the cost of training has increased over the 14 years of data it is reasonable that the likelihood of any given student needing to borrow some money to pay for school would also increase. It is

surprising, however, that the variable for in-state students is not significant in predicting the likelihood of student loan debt. If in-state students pay less in tuition they should be less likely to need to borrow funds. Students that indicate no specialization are more likely to have student loan debt ($p < 0.001$) and those having received a job offer prior to graduation are more likely to have borrowed ($p = 0.034$).

Additional significant variables in predicting the likelihood that an individual acquires student loan debt include the age of the graduating student, their sex, and whether or not they have a child. Older students within the sample have a greater probability of graduating with student loan debt ($p = 0.071$) and male students are less likely to have borrowed during their veterinary education ($p = 0.021$). Those graduating students that indicated that they had a child were also more likely to have taken out a loan ($p < 0.001$). The parameter estimates for the school dummy variables represent the change in likelihood of a student having loan debt at that school relative to attending Tufts University, the one private institution included in the data.

In the OLS regression we are interested in factors that are related to the amount of debt that a student had upon graduation only if they indicated the presence of debt. Again, dummy variables for each school, excluding Tufts University, are included to control for fixed effects. All estimates for the school variables are negative, indicating that on average the loan debt accumulated by students at schools other than the private Tufts University is lower. The estimates are also all statistically significant at the one percent level with the exception of University of Pennsylvania ($p = 0.057$) and University of Minnesota (0.639).

Having controlled for variations in cost between institutions we can evaluate the level of debt for students that would have paid in state tuition rates compared to out of state rates. The variable *resident* is statistically significant ($p < 0.001$) and economically significant. A student that attended a veterinary medical school in their own state, or a state in which their state of residence contracts with for in state tuition rates, accumulated an average of 20.33% less debt than their out of state counterpart, holding all else equal.

In order to account for increases in tuition over the study period we have included dummy variables the year in which the student is anticipating graduation. The variable for the year 2014 is left out of the model to avoid perfect multicollinearity. The parameter estimates on each of the other year dummy variables, therefore, reflects a comparison to the year 2014 average debt. Each of the variables for years 2001 through 2012 are statistically significant ($p < 0.001$) and only the variable for 2013 isn't statistically significant ($p = 0.719$). Each of the statistically significant dummy variables for year of graduation is negative, indicating a lower level of loan debt in those years as compared to 2014. More importantly, the magnitude of the estimates decreases as the year gets larger, which accurately reflects the observation that the average amount of student loan debt has been increasing over the study period.

While the fixed effects for veterinary college and year of graduation, in addition to the *resident* variable, account for much of the variation in the amount of inflation-adjusted student loan debt accumulated, there are a number of other factors that help to explain the remaining variation. First, graduating students that have sought employment have, on average, 3.6% more debt than those indicating that they haven't yet looked for a job ($p = 0.091$). Second, those students that have received an offer have, on average, a

lower amount of debt upon graduation. These two variables are likely capturing differences in a student's perception of his or her ability relative to peers.

In addition to the employment-related variables, *age*, *male*, and *married* are each statistically significant ($p < 0.001$) and economically significant. Holding all else constant, an increase in the age of a graduating student by one year is associated with a 1.6% greater level of loan debt. This isn't much of a difference for those students that have matriculated to veterinary schools immediately following their undergraduate education, but it is significant for students pursuing a veterinary degree at a later date.

Male students, on average, accumulate 4.3% less debt than their female counterparts. This difference is significant as the share of female students attending veterinary schools in the study period is greater than 50% and has risen to nearly 80% as of 2014. Students that are married also graduate with less average student loan debt than unmarried students (7.1%). This is likely explained by the likelihood that a married student has a source of household income in addition to acquiring student loans to support them while a student. One final variable of interest in the model is the dummy variable *child*. While the existence of a child was highly significant in predicting those students that might have some level of debt in the probit model, it isn't significant in explaining the amount of debt accumulated.

Discussion

The rate of growth in student loan debt for graduating students of veterinary medicine over the period of 2001-2014 can be explained largely by increases in tuition for those programs. This relationship is to be expected. However, loan debt has outpaced

increases in tuition over the study period. The results of this study suggest that the primary remaining factor in explaining the growth in debt for DVMs is the increased percentage of female graduates over time. Due to the fact that female students are likely to borrow more for their veterinary education than their male counterparts, the change in the gender makeup of veterinary schools accounts for the difference between increasing loan debt and increasing tuition.

While the debt to salary ratio, over the past seven years, has climbed well above what would be considered reasonable for most professional degrees, the sudden increase corresponds with the economic downturn in the United States beginning in 2008. It is possible that limited alternatives for employment induced more students to pursue careers in veterinary medicine than otherwise would have given the cost. It is also possible that the increases in tuition are a function of the same economic conditions, as relatively fewer public funds were available to support the training of new veterinarians. However, these questions remain to be answered by future research. Additionally, the choice to pursue a professional degree may not be fully explained by a model comparing increased earnings over time to the cost of achieving those increased earnings. It is likely that veterinarians derive significant non-monetary value from their career choice. An important future direction for this research includes decomposing the utility function of pre-veterinarian students into a component representing consumption of all goods and services and a component representing the satisfaction received from the career itself.

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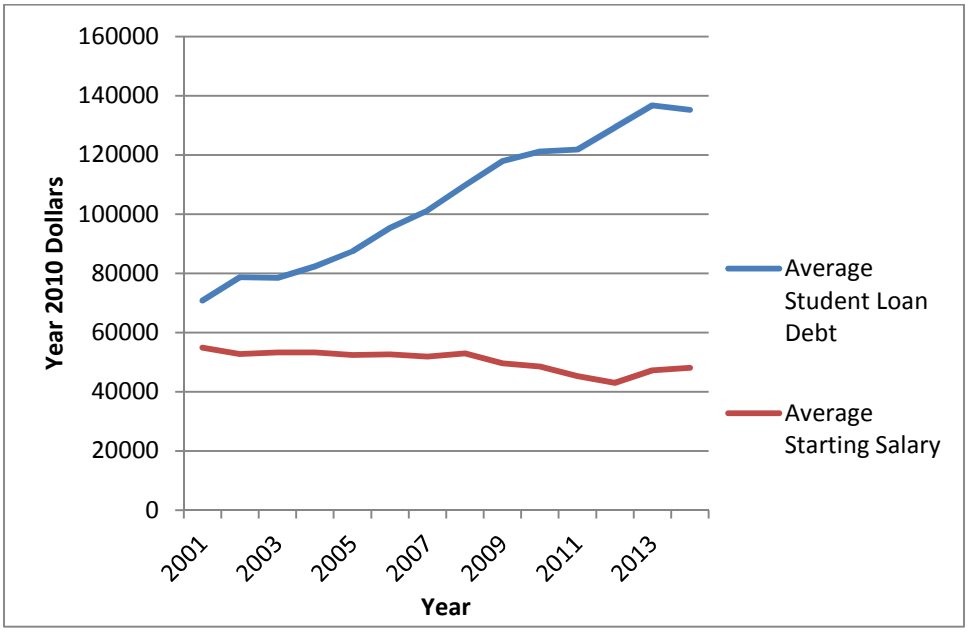

FIGURE 1: Trends in Average Student Loan Debt and Average Starting Salaries for Graduating Students of Veterinary Medical Colleges, 2001 - 2014. Debt and salary values are inflation-adjusted to year 2010 dollars.

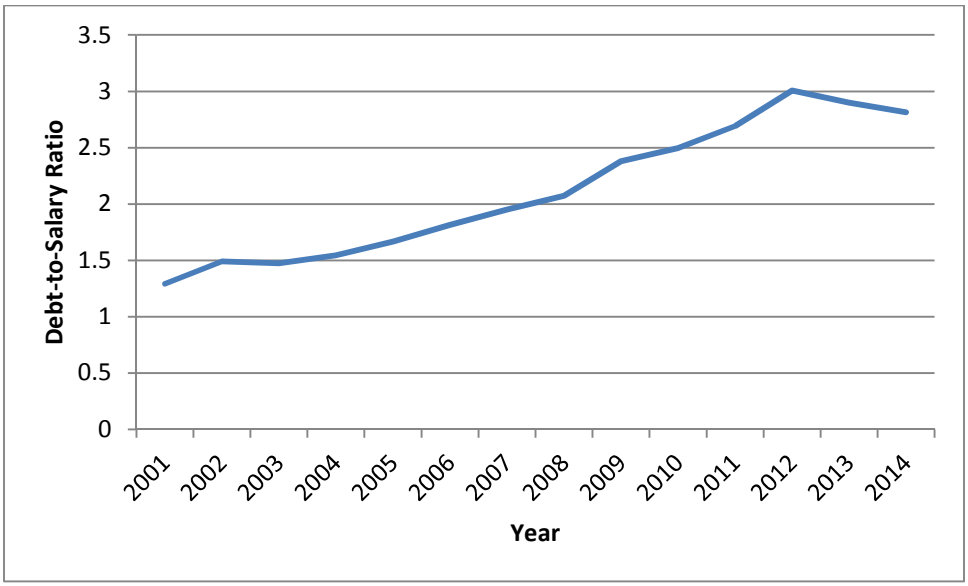

FIGURE 2: Inflation-Adjusted Student Debt-to-Salary Ratio for Graduating Students of Veterinary Medical Colleges, 2001 - 2014.

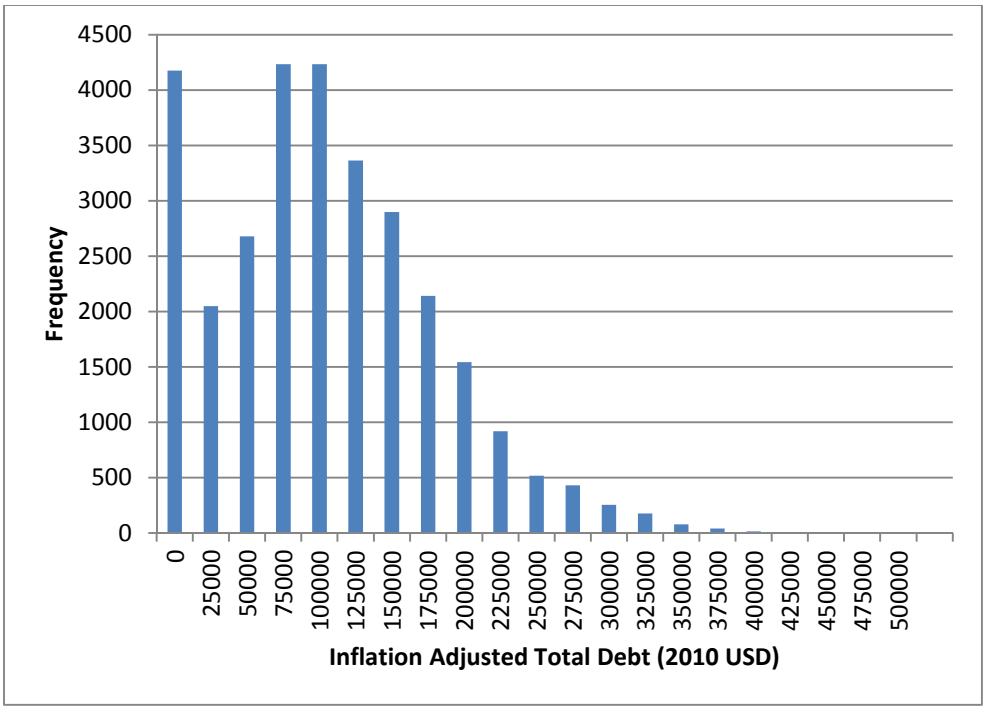

FIGURE 3: Distribution of Inflation Adjusted Total Debt Accumulated by Graduates of Colleges of Veterinary Medicine, 2001 – 2014. Debt values are adjusted to year 2010 dollars.

Table 1.

Dependent Variable:	Probit Regression Latent Participation Variable *debtdum*		OLS Regression Natural Log of Loan Debt (year 2010 dollars)	
Variable	Estimate	p-Value	Estimate	p-Value
Resident	0.025	0.296	-0.227	0.000
Time	0.045	0.000		
yr2001			-1.285	0.000
yr2002			-1.015	0.000
yr2003			-0.953	0.000
yr2004			-0.881	0.000
yr2005			-0.719	0.000
yr2006			-0.573	0.000
yr2007			-0.470	0.000
yr2008			-0.359	0.000
yr2009			-0.271	0.000
yr2010			-0.245	0.000
yr2011			-0.089	0.000
yr2012			-0.080	0.000
yr2013			0.007	0.719
Seek Employment	0.060	0.216	0.035	0.091
Offer	0.053	0.034	-0.016	0.116
Age	0.005	0.071	0.016	0.000
Male	-0.050	0.021	-0.044	0.000
Married	0.029	0.154	-0.074	0.000
Child	0.150	0.000	0.018	0.198
Postbac	-0.056	0.120	-0.013	0.367
No Specialization	0.076	0.000	0.001	0.875
Auburn	-0.137	0.017	-0.412	0.000
Tuskegee	0.221	0.003	-0.362	0.000
UC Davis	-0.087	0.174	-0.386	0.000
Colorado St	0.301	0.000	-0.467	0.000
Florida	0.138	0.051	-0.215	0.000
Georgia	-0.177	0.002	-0.499	0.000
Illinois	0.115	0.055	-0.309	0.000
Iowa St	0.283	0.000	-0.330	0.000
Kansas St	0.112	0.059	-0.329	0.000
Louisiana St	-0.046	0.450	-0.414	0.000
Michigan St	0.160	0.009	-0.153	0.000
Minnesota	0.276	0.000	-0.012	0.639
Mississippi St	0.030	0.646	-0.254	0.000

Purdue	0.080	0.293	-0.503	0.000
Cornell	0.036	0.547	-0.342	0.000
Oklahoma St	-0.003	0.966	-0.434	0.000
Pennsylvania	-0.018	0.788	-0.053	0.057
Texa A&M	-0.118	0.031	-0.538	0.000
Washington St	0.132	0.038	-0.409	0.000
Missouri	0.120	0.094	-0.329	0.000
Ohio St	0.259	0.000	-0.113	0.000
Oregon St	0.327	0.001	-0.350	0.000
Tennessee	-0.168	0.008	-0.311	0.000
Virginia-Maryland	0.103	0.092	-0.319	0.000
North Carolina St	-0.112	0.080	-0.499	0.000
Wisconsin	0.226	0.001	-0.297	0.000
Constant	0.370	0.000	11.869	0.000