Journal of Agricultural and Applied Economics, 49, 1 (2017): 120–138
 doi:10.1017/aae.2016.28

STARTING ON THE RIGHT FOOT: DOES SCHOOL CHOICE AFFECT VETERINARIAN STARTING SALARIES?

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Abstract: Both schools and industry members are concerned about wages in the veterinary profession that are low relative to the years of schooling and tuition costs. This study examines the differences in starting salaries for the 2009–2014 graduates of the 28 schools accredited by the American Veterinary Medicine Association. Findings show relatively small (less than $4,000) but statistically significant differences in starting salaries related to school choice. A larger differential effect is present among the different practice types of veterinary medicine, with equine practitioners and private industry veterinarians (e.g., pharmaceutical researchers) representing the least and greatest average starting salaries, respectively.

Keywords: Heckman procedure, labor, starting salaries, veterinary economics

JEL Classifications: Q13, I26, J31

1. Introduction

Veterinarians are employed in a wide array of fields, including companion animal care, food animal inspection (livestock, poultry, and meat inspection), zoology and wildlife research, military animal care, and animal pharmaceutical research. During the past several years, the veterinary profession has been concerned about the relatively high cost of schooling relative to starting salaries of new graduates. According to a recent report from the American Veterinary Medical Association

Financial support from the American Veterinary Medical Association, the Oklahoma Agricultural Experiment Station, and the National Institute for Agriculture is gratefully acknowledged. We would also like to thank Dr. Mike Dicks and an anonymous reviewer for their comments on the preparation of this manuscript.

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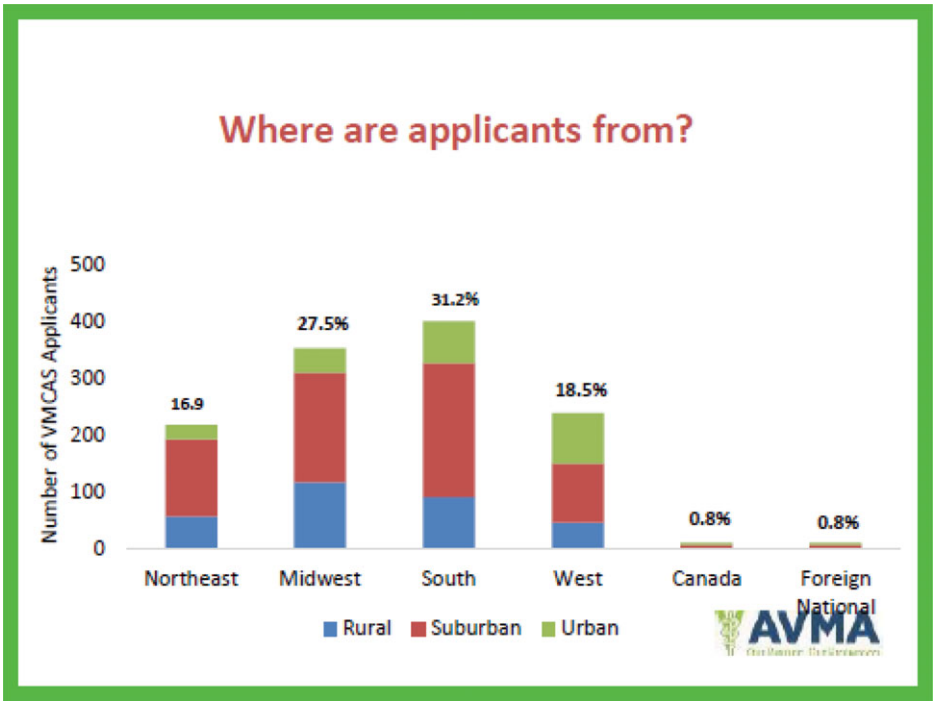

Figure 1. Locations of Applicants to AVMA Accredited Schools, 2015 (source: Greenhill, 2015; figure republished with permission)

(AVMA), the average debt for new veterinarians was approximately $135,000 in 2014, and the average starting salary for new veterinarians entering private practice in 2014 was roughly $67,000 for those employed full-time (Dicks, Bain, and Knippenberg, 2015). In view of high student debt, information about differences in salaries across schools and across specialties should help students make choices that better able them to service the debt.

The income potential for new veterinarians has obvious and direct implications for animal agriculture, but the issue is also especially poignant for southern states. According to the Association of American Veterinary Medical Colleges (Greenhill, 2015), almost one-third of all veterinary school applicants in recent years have come from the South (Figure 1). Similarly, the southern states of Florida, Georgia, North Carolina, Virginia, and Texas have been top destinations for graduating veterinarians between 2009 and 2014 (Figure 2).

The *AVMA Report on Veterinary Markets* (AVMA, 2015b) projects slow income growth for veterinarians. This is echoed by the U.S. Department of Labor, Bureau of Labor Statistics (2015), which argues that an increase in new graduates from veterinary schools has resulted in greater competition for jobs. The Bureau of Labor Statistics projects fewer job opportunities in companion

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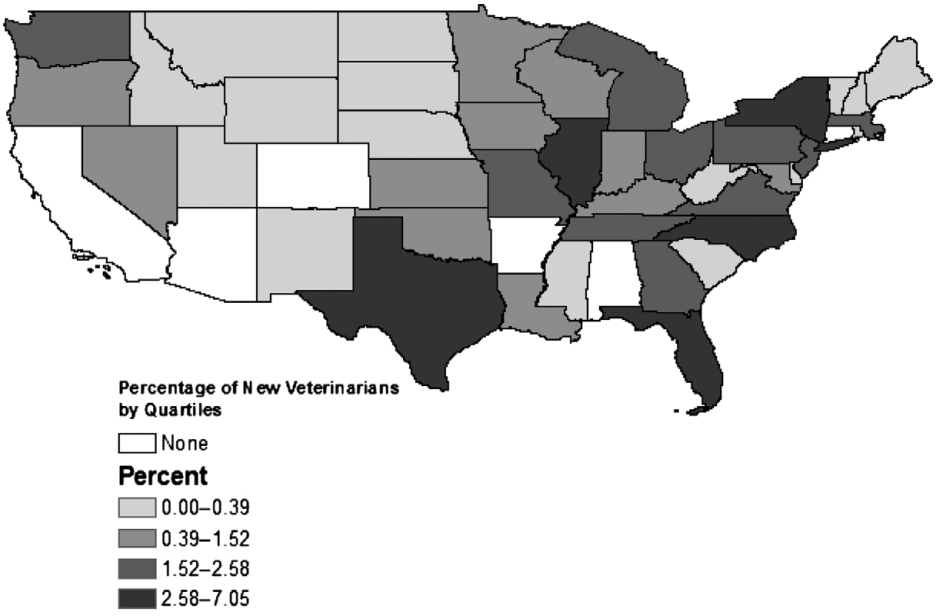

Figure 2. Practice Locations of Graduating Veterinary Students by State, 2009–2014 (source: AVMA Senior Survey; for details of the survey, see Dicks, Bain, and Knippenberg, 2015)

animal care, but better job prospects in public health, disease control, corporate sales, and population studies.

Higher starting salaries are one path to lower debt-to-income ratios. Previous studies have identified differences in salaries attributable to the type of practice (Brown and Silverman, 1999; Dall et al., 2013; Weigler et al., 1997), and this study likewise considers the impact of practice choice on starting salaries. These previous studies, however, have not provided much information on how graduates' income varies across veterinary schools.

Conventional wisdom suggests that attending an "elite" institution or obtaining a degree from an academically rigorous program will positively affect one's income potential. Previous works have addressed the concept of differences in returns because of college major choice and school choice (Bound and Johnson, 1992; Brewer, Eide, and Ehrenberg, 1999; Katz and Murphy, 1992; Koshy, Seymour, and Dockery, 2016; Levy and Murnane, 1992). In the veterinary medicine field, the curriculum has been largely normalized because of accreditation procedures as set forth by the AVMA. As a result, veterinary schools are not expected to have much difference in prestige as Oyer and Shaefer (2016) found for law schools. However, this normalization provides an opportunity to better analyze variations in starting salaries attributable to institutional choice and other factors such as area of specialization and student characteristics (e.g., age, gender, and marital status).

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2. The Value of a Degree

Human capital theory suggests that an increase in human capital because of education results in higher productivity and reduces income inequality (Battistón, García-Domench, and Gasparini, 2014; Glomm and Ravikumar, 1992; Mincer, 1958). Yet, there have been convexities identified in returns to education. Referred to as the "paradox of progress," some studies have found that an increase in schooling actually magnifies differences in incomes associated with gender or institutional choice (Baliamoune-Lutz and McGillivray, 2015; Battistón, García-Domench, and Gasparini, 2014; Bourguignon, Ferreira, and Lusting, 2005; Brewer, Eide, and Ehrenberg, 1999). Differences in starting salaries among graduating veterinary students could be representative of the paradox of progress.

The impact of institutional reputation on the earning potential of graduates has been addressed in previous studies, although never specifically for colleges of veterinary medicine. For example, Brewer, Eide, and Ehrenberg (1999) used data from multiple studies performed by the National Center for Education Statistics to find that a wage premium may be linked to the degree-granting institution.

This study intends to help veterinary students and school administrators make more optimal choices by providing a unique analysis of factors affecting starting salaries. The information can help current and future veterinary medicine students make more informed decisions regarding choice of specialization and school on their ability to repay potential debt. Further, there is a clear shift in the number of females entering the veterinary profession. As such, this study also addresses gender income inequality, which is of interest as female veterinarians tend to have higher debt-to-income ratios (AVMA, 2015b) and gender pay equity is an issue of general economic interest.

3. Data

In cooperation with the 28 U.S. schools and colleges of veterinary medicine, the AVMA conducted an annual survey of fourth-year veterinary medical students between 2009 and 2014. Surveys were sent to all veterinary medical students expected to graduate in each year. Surveys were distributed approximately 4 weeks before graduation, and the survey instrument remained active until graduation. Information on veterinary students' employment choices, expected salaries, and estimated educational indebtedness was collected from survey respondents (Shepherd and Pikel, 2012). All schools participated in web-based surveys, and there was a 95% response rate (Dicks, Bain, and Knippenberg, 2015). Several students did not report a starting salary. These students are not included in the summary statistics. Summary statistics for those that reported a starting salary are shown in Table 1.

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Table 1. Summary Statistics from Second Stage of Heckman Procedure (N = 9,429)

Variable	Variable Description	Mean/Percent	Median	Standard Deviation
Individual characteristics				
SS1000	Starting salary in thousands of dollars (2014 dollar values)	44.49	38.80	18.90
MHI1000	Mean household income in thousands of dollars for employment state	90.54	86.81	12.13
debt1000	Student debt in thousands of dollars (2014 dollar values)	126.42	128.27	77.54
Age	Age of the student	27.44	26.00	3.19
Female	Whether the student is female	76.00%		0.42
Married	Whether the student is married	30.00%		0.46
Children	Whether the student has children	6.00%		0.24
School/program characteristics				
Business program	Whether the veterinary program has a business program	29.83%		0.46
Percent female	Percentage of graduating class that is female	77.25%		0.05
Percent out of state	Percentage of graduating class that is enrolled as an out-of-state student	66.07%		0.15
Fellowships	Whether the veterinary program offers fellowships	53.93%		0.50
Internships	Whether the veterinary program offers internships	71.68%		0.45
Residency	Whether the veterinary program offers residencies	88.55%		0.32
Employment characteristics				
Self_employed	Student will be self-employed	50.00%		0.50
Student_internship	Student is taking an internship	13.26%		0.34
Student_residency	Student is taking a residency	0.90%		0.09
Student_Food	Student will be working in food animal practice	3.37%		0.18
Student_mixed	Student will be working in mixed animal practice	7.89%		0.27
Student_Equine	Student will be working in equine practice	1.81%		0.13
Student_Federal	Student will be working for federal government	0.24%		0.05
Student_Uniformed	Student will be working for a uniformed service	1.60%		0.13
Student_localgovt	Student will be working with a local government	0.02%		0.01
Student_Industry	Student will be working in a for-profit company	0.15%		0.04
Student_NfProfit	Student will be working in a not-for-profit company	0.39%		0.06
Student_College	Student will be working for a college	0.27%		0.05
Student_advedu_other	Student will be pursuing advanced education or other practice	40.74%		0.49
Student_Companion	Student will be working in a companion animal practice	29.36%		0.46

Variables included in the analysis are the starting salary (in real dollars[1]) of the graduating student, the mean household income[2] (U.S. Census Bureau, 2014) in the state that the graduate has accepted an offer, demographic variables (i.e., age, gender, marriage status, and whether the student has children), whether the graduate will be self-employed (as opposed to being employed by a practicing veterinarian or an institution), the practice type the student is entering, the amount of debt the student has upon graduation (in real dollars), whether the veterinary program has a business program, the percentage of females and out-of-state students in the graduating class, and whether the school offers fellowships, residencies, and internships (Black and Smith, 2004).

It is important to note the differences between fellowships, residencies, and internships and that each of these may be completed during school or postgraduation but is considered an extension of formal education in this study. Most internships take place at private practices and cover multiple areas of the private practice, whereas residencies largely take place at veterinary colleges. A fellowship is similar to an internship, except that it usually takes place at the veterinary college and is targeted to a specific area of veterinary medicine or research topic (Shepard and Pikel, 2012). Although there is a clear distinction between fellowships, residencies, and internships, not every veterinary school requires an internship or has available positions for students to complete a residency or fellowship.

Table 2 shows the number of respondents from each school (denoted as "Total" in the table) and the number of those respondents that reported a starting salary. A total of 14,957 graduating seniors responded to the survey, and 9,429 reported a starting salary. The average percentage of students who reported a starting salary from each school was 63%, with the maximum rate being 72% and the minimum 56%.

Figure 3 provides a visual description of the starting salary distribution. This graph shows the distribution of starting salaries for all students and all forms of employment across all schools for the years between 2009 and 2014. A bimodal distribution is present and can largely be explained by the salary differences between those students taking an internship (much lower average starting salary) and those who begin practicing immediately.

4. Procedures

Every student was a graduating senior of an AVMA-accredited veterinary school. However, not all students had a pending job, which means not all had a starting

1 Starting salaries and debt upon graduation were adjusted to 2014 dollars by the Consumer Price Index reported by the U.S. Department of Labor, Bureau of Labor Statistics (2016).

2 Mean household income for the respective state in which the graduate has accepted the offer is used as a proxy for cost of living. Suggested by Kahn (1998), this measure is used as there is no standardized government source for the cost of living index and can be calculated differently depending on the source.

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Table 2. Survey Response Rate by Year and School

	2009		2010		2011		2012		2013		2014	
School	Total	Reported a Salary	Total	Reported a Salary	Total	Reported a Salary	Total	Reported a Salary	Total	Reported a Salary	Total	Reported a Salary
Auburn University	97	36	94	65	90	54	90	48	90	49	88	54
Colorado State University	54	24	57	46	59	44	69	37	61	47	66	38
Cornell Veterinary College	108	59	128	93	124	69	128	74	134	84	135	75
Cummings School of Veterinary Medicine at Tufts University	107	63	97	73	118	70	101	58	112	71	119	63
Iowa State University	75	34	82	59	84	46	81	53	84	54	90	61
Kansas State University	96	50	94	53	97	58	97	48	102	67	103	67
Louisiana State University	99	68	104	63	104	70	90	47	109	75	107	59
Michigan State University	107	58	107	58	118	70	133	80	129	73	136	81
Mississippi State University	98	53	76	47	106	54	103	56	103	61	94	54
North Carolina State University	80	40	81	42	75	46	82	53	82	47	78	43
Oklahoma State University	77	35	73	42	67	41	78	61	82	48	96	53
Oregon State University	93	62	91	64	106	73	90	71	98	53	91	54
Purdue University	87	64	80	53	88	65	81	63	94	55	85	53
Texas A&M University	66	44	71	52	72	54	78	67	76	50	80	52

Table 2. Continue

School	2009 Total	2009 Reported a Salary	2010 Total	2010 Reported a Salary	2011 Total	2011 Reported a Salary	2012 Total	2012 Reported a Salary	2013 Total	2013 Reported a Salary	2014 Total	2014 Reported a Salary
The Ohio State University	63	40	57	40	72	47	67	52	64	50	57	39
Tuskegee University	81	49	87	56	87	57	82	62	88	57	84	50
University of California, Davis	78	44	75	51	82	55	85	59	92	61	89	59
University of Florida	86	42	83	59	87	56	97	58	97	70	64	38
University of Georgia	118	66	125	89	123	80	124	80	128	84	132	87
University of Illinois	96	64	95	60	102	67	95	59	93	60	95	58
University of Minnesota	69	46	62	36	59	41	68	39	101	82	109	60
University of Missouri, Columbia	126	88	128	76	124	78	112	71	119	84	122	78
University of Pennsylvania	40	32	49	28	46	34	50	42	40	24	52	33
University of Tennessee	62	36	65	41	63	37	93	72	79	48	79	54
University of Wisconsin	86	59	87	47	85	55	91	66	93	60	95	61
Virginia-Maryland Regional College of Veterinary Medicine	75	43	77	51	78	46	76	56	72	52	81	41
Washington State University	69	44	75	39	81	55	78	58	77	53	81	51
Western University (California)	92	70	96	65	86	52	83	61	94	50	90	58
Total across schools	2,385	1,413	2,396	1,548	2,483	1,574	2,502	1,651	2,593	1,669	2,598	1,574

Table 3. Reasons for Not Having a Starting Salary (N = 5,495)

Reason	Percentage
I haven't found a job that offers appropriate compensation	6.98
I haven't found a position in my preferred geographical area	53.25
I haven't found a job in my employment sector	14.29
I am waiting to find out about a private practice internship	1.14
I am waiting to find out about an academic internship	0.32
I am waiting to find out about a residency	0.65
Other	23.38

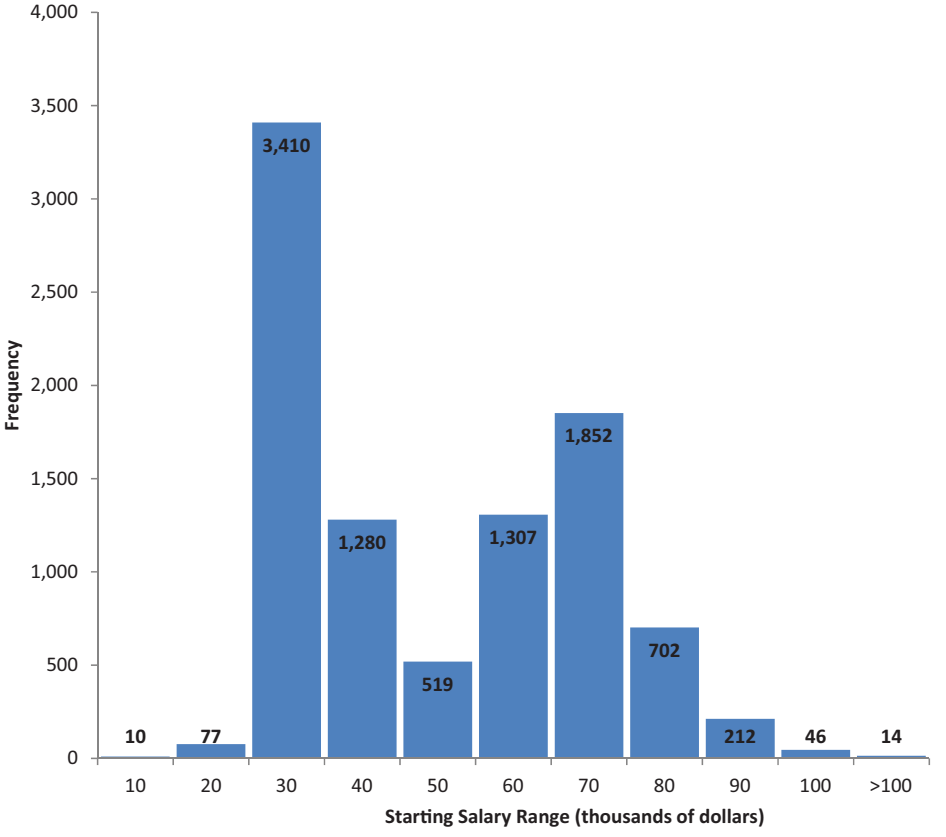

Figure 3. Distribution of Starting Salaries across all Schools between 2009 and 2014 (data source: AVMA Senior Survey; for details of the survey, see Dicks, Bain, and Knippenberg, 2015)

salary to report. A distribution and list of reasons for not reporting a salary can be seen in Table 3. To address the selection bias from not reporting a starting salary, the two-step procedure of Heckman (1976) was used.

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The first stage of the Heckman procedure requires a probit regression, in which the probability that a given student has accepted a job offer and has a starting salary to report is estimated (Haines, Popkin, and Guilkey, 1988; Holcomb, Park, and Capps, 1995). From this information, an inverse Mills ratio for the ith student in year t is computed. All observations are used for the probit analysis, where the dependent variable equals one if the starting salary is nonzero and zero otherwise. Heckman (1976) mathematically characterized the process. Denoting the normal cumulative density function by Φ, Heckman showed that

$$\text{prob}\left[Z_{it} = 0\right] = 1 - \Phi\left(W_{it}\delta_i\right),\ i = 1, \ldots, n; t = 1, \ldots, T, \tag{1}$$

where W_{it} is a vector of regressors related to having accepted a job offer, and δ_i is the coefficient vector associated with these regressors. The regressors in the first stage include both individual and institution-based descriptive variables (i.e., age, gender, marriage status, number of children, self-employment status, amount of debt upon graduation, percentage of females and out-of-state students in graduating class, and availability of fellowships, residencies, and internships). The demographic variables are included in both stages of the regression as they are expected to affect actual starting salary values and the probability of reporting a salary. The institution-based variables are included only in the first stage as their effects cannot be isolated from the school fixed effects in the second stage. However, they are believed to contribute to the probability of reporting/having a starting salary as not every school will offer the same programs.

The first-stage provides estimates of the inverse Mills ratio (MR_{it}):

$$\widehat{MR}_{it} = \left\{ \frac{\phi\left(W_{it}\hat{\delta}_i\right)}{1 - \Phi\left(W_{it}\hat{\delta}_i\right)} \text{ for } Z_{it} = 0 \right\}, \tag{2}$$

where ϕ represents the probability distribution function. In the second stage, the inverse Mills ratio is used as an instrument that incorporates the latent variable (i.e., the predicted values from the probit model) into the estimation of the human capital model. Only observed values (i.e., nonzero responses) are used in the second-stage estimation (Park et al., 1996).

Given that each student has specific attributes associated with him/her, including the school attended, the following model is specified:

$$SS_{itj} = \boldsymbol{X}_{\boldsymbol{itj}}^{'}\boldsymbol{\beta} + \sum_{k=1}^{27} \alpha_{1k} School_{kj} + \lambda_i\left(\widehat{MR_{itj}}\right) + \eta_t + \varepsilon_{itj}, \tag{3}$$

where SS_{itj} denotes starting salary[3] of veterinary student i in year t at school j; $\boldsymbol{X}_{\boldsymbol{ijt}}$ represents a vector of characteristics of veterinarian student i in year t; $School_{kj}$

3 The model was also run using hourly salary as the dependent variable, but no significant difference was found between the two specifications.

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represents indicator variables representing at which school the veterinarian received training; $\widehat{MR}_{itj}$ is the inverse Mills ratio; $\eta_t \sim N(0, \sigma_\gamma^2)$ denotes the random effect for year; and $\varepsilon_{itj} \sim N(0, \sigma_\varepsilon^2)$ denotes the general error term, where η_t and ε_{itj} are independent.

The Heckman procedure is nonlinear, which allows the same variables to be used in both stages of the model. However, it is desirable to have variables that are specific to the first stage to give the inverse Mills ratio greater explanatory power. For this analysis, the demographic variables are used in both stages of the regression, whereas the school/institution-level characteristics (whether the veterinary program has a business program, the percentage of females and out-of-state students in the graduating class, and whether the school offers fellowships, residencies, and internships) and the amount of debt a veterinary student has upon graduation are only included in the first stage of the model. Variables only included in the second stage of the model are the schools and practice types, which are used as fixed effects. Also, because the data were collected from six different years, a year random effect is used. The use of school/institution-level characteristics in the first stage is to introduce heterogeneity into the model that cannot be captured simultaneously with the fixed effects in the second stage.

Because of the transformation of Heckman's approach, and the nature of the data, the Murphy and Topel (1985) estimate of variance is used to correct for heteroscedasticity. Specifically, the estimated covariance matrix for the second-stage model needs to be adjusted to take into account the variability in the predicted variables from the first stage (Hole, 2006). The Murphy-Topel estimate of variance for a two-step model is given by

$$\hat{V}_2 + \hat{V}_2 \left(\hat{C} \hat{V}_1 \hat{C}' - \hat{R} \hat{V}_1 \hat{C}' - \hat{C} \hat{V}_1 \hat{R}' \right) \hat{V}_2, \tag{4}$$

where $\hat{V}_1$ $(q \times q)$ and $\hat{V}_2$ $(p \times p)$ are the estimated covariance matrices for model 1 and model 2, respectively, where each is the model-based estimate not taking into account that the estimate of the parameter vector in model 1 is embedded in model 2. Further,

$$\hat{C} = (p \times q) \text{ matrix given by } \left\{ \sum_{i=1}^{n} \left(\frac{\partial ln\, f_{i2}}{\partial \widehat{\theta_2}} \right) \left(\frac{\partial ln\, f_{i2}}{\partial \widehat{\theta_1}'} \right) \right\} \tag{5}$$

$$\hat{R} = (p \times q) \text{ matrix given by } \left\{ \sum_{i=1}^{n} \left(\frac{\partial ln\, f_{i2}}{\partial \widehat{\theta_2}} \right) \left(\frac{\partial ln\, f_{i1}}{\partial \widehat{\theta_1}'} \right) \right\}, \tag{6}$$

where f_{i1} and f_{i2} are observation i's contribution to the likelihood function of models 1 and 2, respectively (Greene, 2012).

Another potential source of heteroscedasticity comes from those reporting an expected self-employment income. These students do not have an actual salary offer from an employer and are most likely estimating their salary. To account

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Table 4. Factors Affecting the Probability of Reporting a Starting Salary: Probit Estimates for the First-Stage Heckman Procedure (N = 14,957)

Variable	Estimate	Standard Error
Intercept	0.4267**	0.2009
Age	−0.0188***	0.0035
Female	−0.0708**	0.0303
Married	−0.1304***	0.0288
Children	−0.3275***	0.0531
Self-employed	2.1099***	0.0414
Business program	−0.0795***	0.0269
Percent female	0.8446***	0.2471
Percent out of state	−0.7378***	0.0929
Fellowships	0.1503***	0.0284
Internships	0.0248	0.0360
Residency	−0.1804***	0.0547
Debt	0.0003	0.0002
−2 Log likelihood	14,716.4778	

Note: Asterisks (*, **, and ***) denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

for this issue, a multiplicative heteroscedasticity correction, with self-employed as the only variable, is included in the second stage of the Heckman procedure.

5. Results

Because a two-step estimation approach was used, the models from each step are presented. The probit model had a 70% correct prediction rate; Table 4 shows that most of the personal characteristics of the students and school-level variables significantly affect the probability of a student reporting a starting salary. Self-employed graduating students had a higher probability of reporting a starting salary, even if the reported salary was an estimate. This is intuitive as they are not pursuing offers from veterinary employers and should, therefore, have some preconceived salary expectation as a self-employed veterinarian. Students who are older, female, married, and have children all have lower probabilities of reporting a starting salary, which is consistent with previous literature (see Baliamoune-Lutz and McGillivray, 2015; Battistón, García-Domench, and Gasparini, 2014; Brewer, Eide, and Ehrenberg, 1999). Debt level does not have a significant effect on the probability of reporting a starting salary, suggesting that the level of debt accumulated during veterinary school is not a factor in the hiring decisions of veterinary employers.

Some school-specific attributes, such as the percentage of females in the graduating class and whether the school offers fellowships, have positive effects on the probability of a graduate reporting a starting salary. Conversely, other school-specific traits such as the presence of a business program specific to the veterinary program, the percentage of out-of-state students, and the presence

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of residencies at the school lead to a lower probability of reporting a starting salary. The school-specific variable that was not significant was the presence of internships, which is not surprising because most schools offer or promote internships.

The mixed model results are shown in Table 5. The results reveal that almost all the school fixed effects are statistically different from the base institution (Western University), except for Michigan State University, Louisiana State University, Washington State University, and Iowa State University. More specifically, students at schools such as Colorado State University; Tufts University; Louisiana State University; Texas A&M University; Ohio State University; University of Minnesota; University of Missouri, Columbia; University of Pennsylvania; University of Tennessee; and the University of Wisconsin tend to have higher starting salaries compared with those at Western University. These starting salary differences control for the impacts of individual student characteristics and chosen practice area.

The inverse Mills ratio was used to account for censored response bias in the second-stage mixed model and was negative and statistically significant. This accounts for the bias that resulted from the nonresponse/selectivity of students who were unable/unwilling to report a starting salary. More specifically, the negative coefficient of the inverse Mills ratio represents the fact that students who are most similar to those who do not report a salary tend to have lower overall starting salaries.

Also shown in Table 5, four individual-level characteristics have a statistically significant effect on starting salaries: gender, whether the graduating senior is going to be self-employed, mean household income where the student will be practicing, and the age of the student upon graduation. Female graduates had lower reported starting salaries (by about $2,000), but reported starting salaries were higher for those who were self-employed (by about $28,400), older when completing the program (about $70 per year of age), and those locating in areas with a higher mean household income ($60 increase for every $1,000 increase in mean household income).

Students pursuing employment with the federal government, uniformed services, industry, and not-for-profit companies have statistically significant and higher starting salaries as compared with the base, which constitutes companion animal practices. Graduates pursuing a job in the areas of food animal and local government do not have starting salaries significantly different from those pursuing companion animal practices. Those working as equine practitioners average about $24,650 less in starting salary than those who start as companion animal veterinarians. On the other end of the spectrum, a graduate who accepts a job in private industry (e.g., animal genetics and pharmaceutical research) averages about $27,900 more than companion animal practitioners. As for the random error term for year, there is about $5,000 of variance in the estimates attributed to differences across years.

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Table 5. Mixed Model of Veterinarian Starting Salary Estimates with School Fixed Effects in Thousands of Dollars (N = 9,429)

Variable	Estimate	Standard Error
Intercept	63.60***	5.56
MHI1000	0.06***	0.01
Age	0.07	0.05
Female	−2.11***	0.36
Married	−0.10	0.27
Children	0.31	0.48
Self-employed	28.44***	2.31
Inverse Mills ratio	−23.54***	4.77
School fixed effects with Western University as base		
Auburn University	−0.46***	0.07
Colorado State University	1.90***	0.08
Cornell Veterinary College	−0.30***	0.07
Cummings School of Veterinary Medicine at Tufts University	0.32*	0.17
Iowa State University	−0.09	0.14
Kansas State University	−0.56***	0.15
Louisiana State University	0.19	0.18
Michigan State University	0.03	0.16
Mississippi State University	−1.05***	0.17
North Carolina State University	−0.56***	0.14
Oklahoma State University	−1.28***	0.23
Oregon State University	−1.47***	0.20
Purdue University	−1.06***	0.06
Texas A&M University	0.44***	0.06
The Ohio State University	0.35***	0.06
Tuskegee University	−0.70***	0.06
University of California, Davis	−0.62***	0.06
University of Florida	−0.45***	0.07
University of Georgia	−1.87***	0.12
University of Illinois	−0.15***	0.06
University of Minnesota	0.93***	0.06
University of Missouri, Columbia	0.37***	0.05
University of Pennsylvania	0.97***	0.09
University of Tennessee	1.84***	0.10
University of Wisconsin	1.51***	0.10
Virginia-Maryland Regional College of Veterinary Medicine	−0.13*	0.07
Washington State University	−0.09	0.09
Practice type fixed effects with Student_Companion as base		
Student_internship	−16.45***	1.10
Student_residency	−7.74***	1.13
Student_Food	0.74	0.93

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Table 5. Continued

Variable	Estimate	Standard Error
Student_Mixed	−4.95***	0.57
Student_Equine	−24.65***	1.11
Student_Federal	16.60***	2.55
Student_Uniformed	17.93***	1.25
Student_localgovt	−3.01	7.29
Student_Industry	27.93***	3.90
Student_NfProfit	10.65***	2.91
Student_College	−15.49***	2.58
Student_Advedu_other	−13.07***	0.96
Random error term	5.25	
−2 Log likelihood	70,554.50	

Note: Asterisks (*, **, and ***) denote statistical significance at the 0.10, 0.05, and 0.01 levels, respectively.

The mixed model results indicate differences in starting salaries between the 27 other schools and a base school, but to further define institutional differences, the least squares means (LSMEANS) of starting salaries by students from all schools were estimated (Table 6). LSMEANS are used as they adjust mean values across schools in relation to the other covariates within the mixed model and are more informative than a simple mean. From the LSMEANS, the average is $44,455 with the largest difference between schools at about $3,700. This difference is small compared with the full value of the starting salaries, suggesting that, at least in terms of graduates' starting salaries, there is only a small benefit to choosing one veterinary program over another based solely on school reputation.

The reported starting salaries simple mean is lower than actual salaries reported in the *AVMA Report on Veterinary Compensation* (AVMA, 2015a). The mean salary across all veterinarians in private practice[4] with 1 to 2 years of experience is $77,758 (in 2014 dollars). The simple mean of those employed in private practice within our sample is about $59,687. Because the mean reported in the 2015 *AVMA Report on Veterinary Compensation* includes those with an additional year of experience, it could be assumed that there are returns to experience and that those with only 1 year of experience may have a lower salary than the mean.

When comparing the two stages of the model, we see that that most of the student-level variables change sign from the probit regression to the mixed model. For example, increases in age lower the probability of having a starting salary but increase the actual value of the starting salary. This is also true for those who are married and have children, but none of the parameter estimates for these three variables were significant in the mixed model. On the other hand, whether

[4] Private practice refers to those employed in food, mixed, companion, and equine practices that are not self-employed.

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Table 6. Least Squares Means of Starting Salaries for all Schools (in thousands of dollars; overall mean = 46.54)

Effect	Estimate (thousands of dollars)	Standard Error
Auburn University	44.07	0.08
Colorado State University	46.42	0.06
Cornell Veterinary College	44.23	0.11
Cummings School of Veterinary Medicine at Tufts University	44.84	0.13
Iowa State University	44.44	0.12
Kansas State University	43.97	0.12
Louisiana State University	44.71	0.15
Michigan State University	44.55	0.13
Mississippi State University	43.48	0.15
North Carolina State University	43.96	0.12
Oklahoma State University	43.24	0.17
Oregon State University	43.05	0.16
Purdue University	43.47	0.09
Texas A&M University	44.96	0.10
The Ohio State University	44.87	0.09
Tuskegee University	43.83	0.11
University of California, Davis	43.91	0.08
University of Florida	44.08	0.08
University of Georgia	42.65	0.07
University of Illinois	44.38	0.10
University of Minnesota	45.45	0.11
University of Missouri, Columbia	44.90	0.10
University of Pennsylvania	45.49	0.15
University of Tennessee	46.37	0.17
University of Wisconsin	46.04	0.15
Virginia-Maryland Regional College of Veterinary Medicine	44.40	0.13
Washington State University	44.45	0.17
Western University (California)	44.53	0.11

the student is female and whether the student is to be self-employed retain the same parameter estimate signs. Specifically, females have a lower probability of reporting a starting salary and a lower overall starting salary, whereas those that are to be self-employed have a higher probability of reporting a starting salary and have a higher overall starting salary.

6. Summary and Conclusions

The AVMA slogan is "Our Profession. Our Passion." The emphasis on passion is apparent in the choices made by veterinary students as the average reported starting salary at graduation is $47,000 within this study, which includes

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part-time and full-time employment. This emphasis on passion relative to economic incentives affects both starting salaries and lifetime earnings potential. The analysis of starting salary data shows statistically significant differences (albeit small) in starting salaries, less than $2,000, as a result of institutional choice. However, the greatest differentiating factor is the new veterinarian's choice of practice type with a range of about $53,000 in starting salary differences.

It is no surprise that a person's age, which is presumably a proxy for maturity and experience, and employment location have positive effects on starting salaries. Also, consistent with findings from previous literature, females tend to earn less than their male counterparts in similar positions. Note that this difference in income even exists for self-employed individuals as females make about $4,000 less than males. One possible explanation for this gender income inequality suggested by the *AVMA Report on Veterinary Markets* (AVMA, 2015b) is that female veterinarians sometimes choose to work fewer hours and thus have less compensation than male veterinarians.

The large difference in starting salaries from practice types supports suggestions from previous literature that market pressures (demand, supply, or both) are influencing incomes for veterinarians of specific practice types. For example, equine practitioners tend to have much lower starting salaries than their peers in other types of veterinary practice. Furthermore, a large portion of graduating veterinary medicine students across all schools (at least 28%) pursue additional education or employment with other (nontraditional) practices, which negatively affects their earnings immediately following veterinary school. The lower salary could be a result of being employed part-time (much like those pursing an internship or residency) or because they work fewer hours (but still considered full-time) while pursuing further education. Also, it is plausible that those pursuing further education incur income from being a graduate research/teaching assistant, thereby not being considered a full-time employee. In either case, this information is not explicitly stated within the survey. However, these decisions may be the result of veterinary "passion" or because the graduating veterinarians view greater future income potential from the experience gained in the lower-paying early years of their careers.

In general, this research adds to the growing literature on veterinary economics. Knowing potential earning differences across schools and practice types should help veterinary medicine professionals to assist veterinary medicine students with making more optimal decisions. This information may be especially beneficial in the South (i.e., the home of almost one-third of all recent veterinary school applicants and a region attractive to new, practicing veterinarians).

Although this study dealt specifically with veterinarian starting salaries, there is still some evidence (Dicks, Bain, and Knippenberg, 2015) to support the idea of a greater long-term return for an obtained veterinary degree. Future research will examine the career earnings potential for veterinarians by specialty,

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interaction effects of practice types across schools, spatial effects of earning potential by practice type, practice-specific and geographically dispersed demand for veterinary services, and the impact of experiences (internships, residencies, and further education) on long-term income potential.

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