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Veterinary Economics

Estimating the financial return on a veterinary education

Ross Knippenberg, PhD; Michael R. Dicks, PhD; Bridgette Bain, PhD; Michael Dow, BS

Economics is a social science that, among other things, attempts to describe human behavior. An important concept in this regard is utility, which economists define as the total satisfaction received from consuming a good or service. Utility can perhaps be most easily understood as a measure of happiness and consists of a combination of tangible and intangible benefits.

A basic assumption underlying many economic analyses is that people attempt to maximize utility. Consider, for example, an individual who is trying to decide whether to pursue a veterinary degree. The primary tangible benefit of this additional schooling is the increased income that can be expected as a result. However, there are benefits beyond increased income that come with working in the veterinary profession, such as the enjoyment of helping animals, improving public health and safety, or teaching new veterinarians. Thus, the total benefit veterinarians receive from their veterinary degree includes both tangible (eg, income) and intangible benefits.

Net Present Value and Return on Investment

Because practicing veterinary medicine provides some combination of tangible and intangible benefits, it is not possible to directly measure the utility of obtaining a veterinary degree. It is possible, however, to estimate the tangible benefits. Two ways to do this are estimating the net present value (NPV) and estimating the return on investment (ROI).

In general terms, NPV is discounted future income minus the purchase price. In calculating the NPV of obtaining a veterinary degree, future income is the income one would earn as a veterinarian over and above the income that would have been earned had one not acquired a veterinary degree. The purchase price represents the costs of attending veterinary college and consists of two parts: the tuition, fees, and other school-related expenses associated with attending veterinary college, and the income one foregoes while attending veterinary college. In calculating NPV, future income is discounted because a person can earn a return on cash invested today in financial assets, such as stocks or bonds, but cannot invest future income without borrowing. As a result, $100,000 today is worth more than $100,000 ten years in the future.

Return on investment is the percentage earned per year from an investment. In this case, it is estimated by dividing NPV by the costs, and then dividing this value by the number of years of earning potential.

Estimating the NPV and ROI for Obtaining a Veterinary Degree

To estimate the NPV of obtaining a veterinary degree, we first considered the 2-fold costs of attending veterinary college: tuition, fees, and other school-related expenses and foregone income. We did not have a good estimate of mean tuition, fees, and other school-related expenses; therefore, we elected to use educational debt instead. According to results of the AVMA's first annual employment survey, year-2012 graduates of the 28 US veterinary medical colleges incurred a mean educational debt of $131,192. For the purposes of our model, we used this value and assumed that this educational debt would be completely repaid over a 30-year period after graduation.

Estimating forgone income was less straight-forward. In general, most individuals attending veterinary college have a bachelor's degree at the time of admission. Thus, we considered foregone income to be the income that could have been earned by an individual with a bachelor's degree who entered the workforce after graduating, rather than attending veterinary college.

To estimate NPV, we needed to estimate the future income one would earn as a veterinarian over and above the income that would have been earned had one not acquired a veterinary degree. Estimating income over an individual's working career is difficult because as workers gain experience, they become more productive and are paid a higher wage. After approximately 55 years of age, however, additional experience no longer adds to one's employability. This change in income over a worker's lifetime is known as the age-earnings profile.

Using data from the 2014 AVMA Biennial Economic Survey, we estimated the age-earnings profile for a typical veterinarian. That is, by means of regression analysis, we estimated the conditional mean annual salary for a veterinarian from 26 through 65 years of

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age. Also, to evaluate differences among veterinarians grouped on the basis of practice type, we used the same dataset and found that veterinarians in companion animal practice, food animal exclusive practice, and civil service; veterinarians working for nonprofit organizations; and veterinarians working for state and local governments earned salaries that were not significantly different from each other. Veterinarians serving in the uniformed services, veterinarians working in commercial or industrial practice, and veterinarians working as university faculty earned 25%, 33%, and 15% higher salaries, respectively, compared with other veterinarians. In contrast, veterinarians working in mixed animal practice, in mixed animal practice with a food animal predominant focus, and in equine practice earned 18%, 37.5%, and 42% lower salaries, respectively, compared with other veterinarians.

For the starting points of the age-earnings profiles, we used two sources. Starting salaries reported in the 2014 AVMA Senior Survey served as our starting point for veterinarian salaries. For non-veterinarians, we began with the overall mean starting salary for class of 2014 college graduates reported by the National Association of Colleges and Employers[1] of $44,928. According to Stanford University, 56.7% of college graduates that year were women, and according to the American Association of University Women, women earned 81% of men's salaries on entering the workforce with a bachelor's degree. From these values, we calculated that in 2014, mean starting salary was $50,352 for a college-educated man and $40,785 for a college-educated woman, and we used these values as our starting points for individuals who did not pursue a veterinary degree.

To estimate the difference in age-earnings profiles between veterinarians and college graduates, we used the relative growth rates of age-earnings profiles calculated by Gohmann et al.[2] To account for the cost of education, we subtracted educational debt payments amortized to a 30-year payment plan from the estimated income for veterinarians. We then discounted the difference in estimated earnings for veterinarians versus other college graduates, assuming an annual discount rate of 4%, and summed the resulting values for each year of a veterinary career from 26 through 65 years of age (40 years).

To calculate ROI, we divided NPV by total estimated costs, and then divided this value by 40 (the number of years of earning potential from 26 through 65 years of age). Finally, we converted this value to a percentage by multiplying by 100.

In addition to NPV and ROI, we estimated the breakeven age, which represents the age at which a typical veterinarian's total income (over and above the income that would have been earned had he or she not acquired a veterinary degree) just equaled the total costs (tuition, fees, and expenses plus foregone income). For this calculation, veterinary students were assumed to start their careers at 26 years of age.

Given these various assumptions, we estimated that the NPV for women entering veterinary college in 2014 was –$71,462 and the NPV for men entering veterinary college in 2014 was $41,480 (**Table 1**). In simple terms, this means that women entering veterinary college in 2014 could expect to accumulate, on average, $71,462 less over their lifetime than they would have earned with only a bachelor's degree and that men could expect to accumulate $41,480 more over their lifetime. Notice that estimated NPV was positive for both women and men who pursued careers in industry, the uniformed services, university-based practice, or mixed animal practice and was negative for both women and men who pursued careers in food animal predominant practice or equine practice.

Comments

On the basis of our model, we estimated that the overall NPV of obtaining a veterinary degree was negative for women and positive, albeit low, for men. In addition, the estimated ROI for both women and men was low. This is important because the long-run ROI for a Standard and Poor 500 index fund is 8%. On the basis of financial return alone, a student contemplating entering veterinary college would be better off in the long run taking the money he or she would spend on tuition, fees, and other school-related expenses and investing in the stock market instead.

Saying that, however, it is important to acknowledge that the ROI for many professions is low. In agriculture, for example, although the profit margin may be > 20%, the cost of the assets required to achieve those profits are so high that the ROI is only approximately 2%. Similarly, it is often said that no one enters the

Table 1—Estimated net present value (NPV), return on investment (ROI), and breakeven age for students entering veterinary college in 2014.

Variable	All students	Industry or commercial	Uniformed services	College or university	Mixed animal practice	Food animal predominant practice	Equine practice
Female students							
NPV ($)	–71,462	427,608	286,108	126,973	–281,993	–463,350	–502,357
ROI (%)	–0.4	3.5	2.4	1.1	–2.1	–3.5	–3.8
Breakeven age (y)	> 65	35	38	46	> 65	> 65	> 65
Male students							
NPV ($)	41,480	694,563	509,396	301,152	–234,019	–471,343	–522,386
ROI (%)	0.4	4.8	3.5	2.1	–1.5	–3.1	–3.4
Breakeven age (y)	58	33	35	39	> 65	> 65	> 65

Net present value was calculated as anticipated future income for a student who obtained a veterinary degree over and above the income that would have been earned had the student not acquired the degree (discounted at an annual rate of 4%) minus the costs of attending veterinary college (ie, mean student debt and projected income the student would forego while attending college). Return on investment was calculated as NPV divided by the costs of attending veterinary college, divided by 40 (the number of years of earning potential from 26 through 65 years of age). Breakeven age was calculated as the age at which a typical veterinarian's total income (over and above the income that would have been earned had he or she not acquired a veterinary degree) just equaled the total costs.

teaching profession for the money, and the ROI for obtaining a teaching degree is likely quite low also.

Of course, farming and teaching are less occupations than they are callings, and the intangible benefits, whether the rural, independent lifestyle for farmers or the possibility of having a positive impact on students' lives for teachers, surely play a substantial role in the decision to pursue those careers. Similarly, the fact that individuals are still interested in pursuing a veterinary career would seem to suggest that there are substantial intangible benefits to being a veterinarian that offset the low NPV and ROI.

There is, of course, nothing irrational about giving up a measure of income to obtain intangible benefits, and doing so can still represent utility-maximizing behavior. But there are practical limits. A farmer can't give up so much income that he earns less than he needs to stay in business, and a teacher can't give up so much income that she can't pay her rent or other living expenses. Assuming that student debt continues to increase at a much higher rate than starting salaries, then at some point, the net financial benefits of obtaining a veterinary degree will not be sufficient to overcome the costs of obtaining that degree. And when this happens, the flow of applicants to veterinary college will decrease.

Of course, this assumes that students applying to veterinary college have sufficient information about the financial costs and benefits of pursuing a veterinary degree to make a rational decision about the financial return and that they are rational enough to use that information to make a decision. Susan Dynarski,[3] a professor of education, public policy, and economics at the University of Michigan, recently wrote,

> Behavioral economists, building on the work of psychologists, have shown that the rational model fails predictably when people have to pay in the present to gain benefits in the future. When do people face such a trade-off between present costs and future gains? When deciding whether to save for retirement, exercise for health, or go to college.

However, she also points out that information is not available on how changing factors such as interest rates could modify students' decisions. Thus, there is a gap in our knowledge of how effective policies that alter the returns on a veterinary education or increase students' understanding of those returns would be at influencing their decision to pursue a veterinary education. That said, a recent California Veterinary Medical Association survey of veterinarians in that state found that 28% of respondents indicated that had they known, prior to enrollment, the debt-to-income ratio they would face following graduation, they would not have or may not have pursued a veterinary degree.[4] Although this supports the idea that better information on the financial costs and benefits of pursuing a veterinary degree will affect the supply of new veterinarians, it leaves open the question of whether expectations are as potent a force as buyer's remorse. It also doesn't tell us how knowledgeable applicants currently are about the financial costs and benefits of pursuing a veterinary degree.

One other intriguing finding of our model was the large gap in NPV (nearly $1 million for industry vs equine practice) between practice types. This suggests that the horizontally related markets comprising the overall market for veterinarians are disconnected; however, if this is truly the case, the reason why remains to be understood.

In conclusion, results of our model suggest that the NPV and ROI of obtaining a veterinary degree are currently quite low. This raises important questions about why we haven't seen a substantial decrease in the number of students apply for veterinary college admission. Do applicants have access to this information? Do they understand what these results mean? Are the intangible benefits of becoming a veterinarian so large that applicants are willing to overlook the low financial return? Is there a public value to veterinary services that is not reflected in veterinary compensation? These are all important questions, not just for the veterinary profession but for the American people as well.

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