
# Pet Insurance Product Development

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## Abstract

This project examines an insurance company's pricing process for pet insurance. We modeled the product after existing pet insurance and human health care. To develop the prices, we collected and analyzed data about pet treatments, costs, and incidence rates. We created a simulation model to test the profitability and measure the company's success. The results show that the dog business is more successful than the cat business and that there is room for future adjustments as experience data becomes available.

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## Executive Summary

There are many challenges an insurance company must address when a new insurance product is launched on the market for the first time, or an existing product is offered by a new company. A large part of the success of the insurance product lies in the pricing that takes place before it is offered to the public. Since the success is measured through profits, extensive testing is also necessary so there is confidence that the product will be worthwhile for the company to sell. The riskiness of this task causes the process to be very involved and it should be addressed carefully.

The purpose of our project was to explore the pricing methods used for a new or existing insurance product and develop a premium that would be charged to customers. Pricing the product was a significant part of ensuring that the endeavor would be profitable; it was also a key objective that the company saw profits in the first few years and was confident in continued success for future years. Our goals for the project were as follows:

- Choose an insurance product that is sustainable and preferably part of a growing or underutilized area of the insurance market
- Develop a premium that would be competitive with the market prices and generate profit for our company
- Create a reliable model to simulate our company's profitability

After discussing different options for our insurance product, our group settled on pet insurance. Our initial research suggested that this product was continuously gaining popularity among the numerous pet owners in the United States, so it provided a good opportunity from a business perspective. From a practical standpoint for the project, we felt that there was more likely to be publicly available data that would provide the foundation for our pricing models in comparison to our other insurance ideas (earthquake, trampoline, athlete, etc.). With these considerations satisfied, our team was ready to move forward in addressing our project goals and objectives for Live Laugh Math Pet Insurance (LLM).

Our pet insurance covers both cats and dogs; however, they were priced separately since there were evident differences between the two. We designed a feline and canine model which produced the premiums for cat and dog policies, respectively. Since existing pet insurance companies on the market offer various care packages for customers to choose from, we followed a similar approach for the options that our company will provide. There are three options for insurance care packages: Emergency Care, Extra Care, and Extra Care with Dental. Emergency Care, the most basic policy, covers treatments for injuries and illnesses. Extra Care is our middle level of coverage, which provides general wellness treatments in addition to injuries and illnesses. Extra Care with Dental is our most comprehensive option and includes everything offered in the Extra Care package with the addition of dental treatment. The customer must also choose their cost sharing element of the policy, which includes the deductible and coinsurance amount. The deductible options are $100 or $250, which represents the amount the customers are responsible for paying annually before our company will cover the remaining cost of claims. The exception for this is the Emergency Care package for cats; only the $100 deductible is offered. The coinsurance is the percentage that the policyholder wishes to be repaid after they have

passed the deductible amount. The coinsurance levels offered are 70%, 80%, and 90% of veterinary services and this is applicable up to the policy's annual maximum amount of $7,000.

In addition to customer preferences, there is other information that we must obtain before producing a premium for the animal. Other important factors that affect the amount of treatment a pet is likely to need include: age, size (dogs only), gender, if the pet has been spayed or neutered, and whether the pet is an indoor or outdoor animal (cats only). This information is collected from the customer at the time of purchase and is factored into the amount of expected claims, which ultimately affects the premium that is charged. Once we have the pet information and customer preferences, the model outputs the final premium.

Once our team completed the models for pricing premiums, we tested profitability and adjusted the models based on our findings. We created a simulation that uses the probabilities from our research to conduct trials which randomly generate profits for a one year period. A trial represents the potential outcome for LLM during a one year period. Each trial is independent from all other trials in the simulation because they neither impact nor influence the other randomizations or outcomes. There are six inputs for the model which consist of the following:

1. Number of simulation trials: 1,000 – It is important to do many trials to produce more accurate estimates
2. Monthly interest rate: 0.04% – This is the same interest rate used in the feline and canine models to calculate the monthly premiums and future value of premiums
3. Markup value: 30% – The percentage by which the premium is increased
4. Fixed expense amount per policy: $7.00 – Base amount that every policy is charged
5. Percentage increase in premium to cover expense: 15% – This expense charge is based on the price of the premium
6. Annual company expenses: $628,000 – Yearly operating expenses for LLM

When the simulation runs, the number of policies is first randomized based on a normal distribution. From our research regarding the market share for pet insurance, we expect about 5,000 policies; this serves as the mean for the distribution. For purposes of this distribution, we also find it reasonable to use 750 as the standard deviation when randomizing the number of policies.

Next, the pets themselves are randomized. Whether the animal is a cat or dog, each characteristic of the pet, the deductible, coinsurance, and care package are all randomized based on the probabilities for our model and additional research in order to generate a "random" pet. Once the pet is developed, the simulation calculates a premium for the pet.

Finally, the veterinary visits for the pet are randomized. This is based on:

- The probability of getting a particular treatment at the veterinarian
- The average cost of treatments
- The probability of going to the veterinarian a certain number of times per year

Both the simulation and the model provide the probabilities of having veterinary visits up to 10 times. For each visit, the treatments are randomly generated. If the treatment occurs, the average cost of treatment is used as the cost, otherwise zero. The simulation performs a summation of all of the costs based on the type of policy and whether the pet has already been spayed or neutered. The amount of visits to the vet the pet will have throughout the year is randomized and can fall anywhere from 0 to 10. Once the model chooses this number, it sums all of the costs for this number of vet visits to arrive at the total claim amount that the pet has accrued for the year. Then we account for the deductible and coinsurance as appropriate to arrive at the amount of claims paid by LLM.

Once we completed the simulation trials, we used the aggregate results for analysis. We were able to look at our expected loss ratio in comparison to the actual loss ratio to see how our expectations lined up with the "actual experience" that the simulation produced. We were also able to examine the profit for each trial in order to test the company's ability to generate sufficient profit in any random year. Until the results were satisfactory, our team used the results to adjust the models so that we could be sure the profit would be adequate for our business.

After analyzing the data from our simulation trials and performing additional splits to examine profitability for different areas and options in our business, we felt that it is worth starting LLM. Based on 1,000 trials, the average profit was $560,000 and the average loss ratio was 0.667. These numbers provide confidence that LLM is likely to be successful. Upon further investigation of the more and less profitable areas of our business, we found that the cat business is not profitable for neither indoor nor outdoor cats. We concluded that the cat business will have to be closely monitored and adjusted in the first few years. If LLM is not able to make the necessary changes to increase profitability, cat insurance should be closed for new business. In addition, we found differences in profitability between several of our options such as the deductible, coinsurance, and care package. Here we felt that only small adjustments will be needed after initial company experience to make the differences in profits less significant. The goal with any adjustments would be to change the pricing formula so that the company would not be disadvantaged by selling an insurance policy with particular options.

For our investor, profits that average $560,000 are a good sign. With an initial investment of $2 million and a business worth $5.6 million (based on a 10% interest rate), our investor will receive 36% of our profits. We expect 36% of our profits to be $200,000 per year. This means that at a reasonable market interest rate of 3%, the investor can expect to break even by the end of 13 years.

After several years of selling policies, LLM will have its own company experience data to adjust premiums and calculations. This data will allow us to price premiums with more specific variables, such as locations, breeds, owner demographics, among others. We also expect the number of policies to increase throughout the years. This will result in higher expenses and perhaps company expansion. Not only do we expect our expenses to increase, but we also expect veterinary costs to increase by a factor of approximately 1.04 per year. These increases will be offset by an increase of 1.40% in premiums each year. With these considerations and a sustainable plan in place for the future, LLM expects to steadily increase profitability and competitiveness on the market.

# Chapter 1: Introduction

Since the future is uncertain, insurance products exist for consumers to protect themselves against financial loss. These products take on many different forms in the market. Some products, such as health insurance or auto insurance, are popular among consumers and even mandatory in some areas of the United States. Other insurance products, like cell phone insurance or extended warranties on electronics, are seen as less necessary. Despite this view, many consumers still feel that the risk of loss is greater than the cost of insurance, and therefore choose to purchase the insurance. Insurance companies are continually exploring innovative and profitable products that range from new products in a niche market to riders for well-established insurance products.

Pet insurance is a relatively new niche insurance product that is targeted specifically toward pet owners. It is designed to ease the cost of routine quality pet care and to protect owners from financial loss in the event that the pet incurs an injury, illness, or needs expensive care. Although this insurance was initially in low demand, its popularity is steadily increasing from year to year. This is largely due to the rising cost of veterinary bills and the increased companionship an owner feels with their pet. A pet owner who strongly feels connected to their pet is more likely to spend money on their animal at the veterinarian; therefore this owner is more likely to benefit from pet insurance. The typical consumer for pet insurance is a cat or dog owner who places high value on their relationship with their companion and is likely to visit the veterinarian frequently.

Developing a pet insurance product to be available on the market is a challenging task. A significant piece of the insurance development lies in the product pricing. There are several variables that must be properly addressed in order for the product to be profitable. First, the cost of the insurance, in comparison to the value of the coverage, must be competitive with other companies in order for consumers to consider purchasing it. In addition, the price must also be able to cover both company expenses and insurance claims. The insurance pricing team must investigate many complexities to develop competitive and profitable premiums.

Our company, Live Laugh Math Pet Insurance Company (LLM), was focused on developing a pricing formula to develop the premium for several insurance coverage options that the company offers. There were significant challenges in doing this, primarily because of limited data availability on the frequency of veterinary visits and the associated costs. Another challenge was induced demand, which is the result of consumers deliberately causing a claim in order to take advantage of the insurance benefits. Data on induced demand was particularly hard to find. It was necessary to develop a model that was able to take all significant, available information and accurately estimate claims and company expenses based on relevant variables. This provided the foundation necessary to determine the premium that would be charged to consumers in the market. The approach used to develop the premium is outlined in detail in the following sections. Furthermore, an analysis on the projected profitability of LLM was completed and these results are also provided.

## Chapter 2: Background

Managing risk is a multi-faceted task which requires identifying and evaluating the likelihood of risky future events along with determining ways to minimize and decrease the impact of this risk. Insurance is a way to control risk, making the two closely related. Insurers identify risks and offer insurance products where coverage is desired; these policies protect against the risk of loss in exchange for payment, usually through premiums ("What is an Actuary?," 2013). The risk of potential loss is shared between the insurance issuer and the policyholder. In addition to the risk of loss, insurance companies generally assume additional risks, which include (but are not limited to) market, interest rate, credit, and operational risks.

The main purposes of insurance are to spread risk among all members and to protect against financial loss. The risk is spread by a pooling aspect of insurance. Pooling is the idea the premiums from those with smaller claims cover members with larger claims. Within the industry, insurance companies can be separated into two main categories: life & health and property & casualty (P&C). For life & health companies, policyholders are protected against financial loss from events such as illness, injury, or death; whereas in P&C companies, policyholders are protected against loss of physical assets. Most people have some form of insurance, whether it is health insurance, automobile insurance, or life insurance. However, consumers can buy policies for many more aspects of life beside the basics (Brokaw, Shen, & Yin, 2008; Copp, Mao, & Tolivasia, 2008).

Pet insurance may not be seen as a "basic" form of insurance, but it is becoming increasingly popular which makes it appealing to examine. Pet insurance exists in the global market, yet is not a very common type of insurance. For this reason, pet insurance will be the focus for this project. Pet insurance policies, like any other policy, have various options based on customer needs and these options are reflected in the price of the policy. Pet insurance is available for many different kinds of pets and covers a wide range of services. While pet insurance is typically sold as a P&C product, the pricing techniques used and the types of services that LLM offers will be similar to those of a human health insurance product. This is the most logical method because pet insurance can be viewed as health insurance for animals. The focus for LLM's line of insurance products will be on cats and dogs and will offer coverage options for pet illnesses, injuries, and routine care. Since cats and dogs are the overwhelming majority of household pets, it is most logical to develop insurance for these two animals. In terms of coverage, it is most common for pet insurance packages to cover both injuries and illnesses as the foundation for the insurance policy. Overall, there are minimal restrictions on the coverage, so the product is quite comprehensive.

In the United States, it is common practice to take a pet to the veterinarian for regular visits, illnesses, and injuries. These visits can be quite costly for pet owners, which presents a need for pet insurance. It is common for pet owners to consider their cat or dog to be a member of the family; this means that pet owners may be willing to pay significant amounts of money in the event of an injury or illness. Pet owners that do not have the financial means to pay for such veterinary bills may be faced with the difficult decision to put the animal down. In these situations, pet insurance would be very helpful to avoid either significant financial loss or an emotionally damaging situation. In addition to

these extremes, pet insurance can help reduce the cost of regular veterinary services throughout the lifetime of the animal.

## 2.1 Market for Pet Insurance

In order for an insurance product to be successful on the market, it needs to be in demand, inclusive, and affordable. In 2012, there were an estimated 74.1 million cats and 70 million dogs in the United States and nearly one-third of all American families had either a cat or a dog in their household ("U.S. Pet Ownership," 2012). Of these pets, only about 1% of them are currently insured. Despite this low percentage, research shows that the number of pets in the pet insurance industry is growing at a rate of 3.4% per year (Bennett, 2010). People across the United States are noticing and understanding the products that this rapidly growing insurance sector offers. Since many owners consider their pets to be a member of the family, it is not uncommon for these owners to have the mentality that pets deserve their own health insurance just like humans. Whether their incentive for purchasing insurance is to decrease regular pet bills or to protect against larger potential loss, the demand for pet insurance is increasing.

One key aspect of pet insurance that makes the product appealing to insurers is that it applies to anyone who has a pet. In contrast, some property insurances (such as earthquake and volcano insurance) only apply to individuals in specific areas of the country. This exclusiveness limits the insurance company's potential growth. Since the insurance is offered nationwide, insurance companies can alter policies with ease; this would be helpful in specific instances such as if a pet owner were to move. Additionally, pet insurance can be marketed and sold to all areas of the country. According to the North American Pet Health Insurance Association, the size of the pet insurance industry is roughly $500 million and growing at a rate of 13% per year (Andrianova, 2013). Since unforeseen accidents and health issues relating to pets can happen anywhere and at any time, insuring against such risk is a valuable option for all pet owners.

Even though purchasing pet insurance may seem like a good decision in theory, it needs to be offered at the right price in order for the consumer to see value. A pet owner needs to consider the risk of potential injuries and illnesses in the future and the costs associated with them. Some medical treatments for pets cost between $1,000 and $10,000. Unless insured, a pet owner may have trouble affording such treatments for their pet. Thus, a pet owner needs to determine whether to be safe by purchasing some variation of pet insurance or bear the full financial risk of the pet in years to come.

## 2.2 Risk to Insurance Provider

Like all insurance carriers, pet insurance providers are at risk when offering a product. The most prevalent financial risk for pet insurance companies is the potential claim payouts for pet injuries and health related issues. Unfortunately, for individual pets, accident causing injuries are unpredictable. Common accidents that result in medical examinations and treatments involve cuts, car accidents, bite wounds, and swallowed objects, among others. When a pet insurance company insures an animal, it is unknown if or when that specific pet will be injured and require medical attention. Furthermore, the severity of the injury is also unknown. Some injuries may be minor and only involve medication while others could be more severe and require surgery. Insurance companies face the risk of both frequent

and significant claims. Illnesses are another major risk pet insurance providers encounter. Common health related issues arising in pets include infections, upset stomachs, diseases, arthritis, and diabetes. Such illnesses can require costly medical examinations and treatments from veterinarians. Factors that contribute to these illnesses and general wellness include the pet's day-to-day activities, breed, age, gender, or even the living conditions in a household. Pet insurers are unable to monitor certain factors such as daily activities and living conditions for the pet, which creates additional risk. However, the idea of insurance is that the aggregate number of accidents and illnesses for a large group of pets can be predicted.

Another factor contributing to the total risk is the potential lack of information on a pet upon starting a new policy. When a pet owner signs up for a policy, pet insurance carriers may have limited information when determining the medical history, family history, and past treatments for pets. It is difficult to determine if the history is accurate and trustworthy. For example, some animal breeds are more prone to specific types of injuries or illnesses compared to others or may have pre-existing conditions at the time insurance is purchased. A pet owner may intentionally be ambiguous about their pet's history in the hopes to receive a better price on the policy. Even if this is not the case, the pet owner may not be fully aware of the pet's entire history. Many health related issues in pets can be hereditary or can result from previous treatments. If the insurance carrier does not obtain this information, they unknowingly could be insuring a high risk pet.

Pet insurance providers also evaluate a pet's breed and age when considering the full risk. Larger breeds of dogs are more susceptible to develop physical ailments compared to smaller breeds. Common ailments include hip dysplasia, obesity, arthritis, and a weak immune system. ("Extra Care," 2012). Though these conditions are normally found in larger dogs, they ultimately affect all canine breeds and sizes. Dogs with the reputation of bad temperaments such as Rottweilers and Pit Bulls are also a high risk for pet insurance carriers ("Dangerous Dog Breed," n.d.). Innately, these two types of dogs are very aggressive and powerful. These attributes significantly increase the chance of a claim when compared to other breeds of dogs because they can easily become injured. In addition to the breeds and sizes, a pet's age can increase risk for an insurance company. Like humans, higher age is correlated with more medical issues. Pets are more inclined to develop ailments when they become older compared to when they are younger. If an insurance provider were to insure an older animal, the probability of that pet having a claim is more likely.

Another risk which pet insurance providers consider is the lack of judgment from the animal itself. Humans have the ability to assess a situation, make good judgment calls, and avoid possible danger. Animals, on the other hand, do not think like this. Generally, a cat or a dog is neither going to look both ways when crossing the street nor think about what it is about to consume. They do not have to ability to distinguish the difference between what is safe versus harmful. The nature and instincts of an animal are a major liability for pet insurance carriers and thus create additional risk.

Pet insurance companies carry the risk of not selling enough insurance policies. According to Embrace Pet Insurance, approximately 1% of all cats and dogs are insured in the United States (Bennett, 2010). If not enough people are investing their money into pet insurance, the insurer runs a risk of not

being able to spread risk and having enough premium to pay off claims and company expenses. Another problem regarding the insurance product is finding the equilibrium point between price and willingness to buy. High premiums will deter people from purchasing policies for their pets. On the other hand, if the premiums are too low, the pet insurance provider may not generate enough revenue even if they have more customers.

Finally, medical advancements and technology greatly impact how pet owners manage their pet's health. Despite the falling economy and rising costs of medicine, pet owners are refusing to cut back on spending on their pets (Tuttle, 2011). From 2012 to 2013 there has been an increase from $13.67 billion to an estimated $14.21 billion spent on veterinary care in the United States ("Pet Industry Market," n.d.). Medical improvements are one contributor towards this increase in veterinary cost spending. Treatments and surgeries that have been once only been available to humans are now being offered as options to animals as well (Meehan, 2012). And since pet owners are viewing cats and dogs as members of the family, they are willing to consider these expensive treatments. In conclusion, it is imperative for pet insurance providers to be aware of all types of uncertainties that may affect their business and to manage them. Like their policyholders, insurance providers should take action against the unexpected by acknowledging unforeseeable risks and looking for ways to be protected. By staying cognizant and actively managing these risks, pet insurance companies increase their chance of having a reliable and successful business.

# Chapter 3: Research

One of the initial assignments of our project was to research and familiarize ourselves with the topic of pet insurance. We searched existing pet insurance company websites, contacted veterinary librarians, and used online search engines. We found a great deal of useful information regarding competitor products, common claims, treatments costs, and ways to price insurance products. The next step was to use this insight and apply it towards creating models for our business in the hopes to set future premiums for our products.

## 3.1 Research of Data

When compiling data, we first researched current pet insurance companies and the types of packages these companies offered. At this point, we decided it would be most practical for our insurance company to cover specifically cats and dogs. We then looked into common injuries and illnesses for both animals and the probabilities and costs associated with them. We also researched to find if certain claims are more common for specific breeds of dogs. Dog breeds are used to categorize different sizes of dogs and average lifespan. Since most breeds of cats are roughly the same size and have similar lifespans, we found it reasonable not to differentiate among cat breeds.

The vast majority of our data came from two sources: U.S. Pet Ownership & Demographics Sourcebook, and The Veterinary Fee Reference. We came across these two books after emailing approximately 20 veterinary school libraries. Several librarians suggested these two sources, and we visited the Tufts Veterinary School library to borrow the books. U.S. Pet Ownership & Demographics Sourcebook is a very reputable resource and published by the American Veterinary Medical Association. We used the 2012 edition of the book, which is most the recent edition. U.S. Pet Ownership & Demographics Sourcebook provided us with incidence data and statistics regarding the frequency of veterinary visits for both cats and dogs. The other book we used extensively was The Veterinary Fee Reference, published by the American Animal Hospital Association. From here we found the associated costs of the potential claims.

## 3.2 Developing the Models

In order to assess the total liability and set premiums for our company, we created a feline and canine model. Both models have the same purpose, but differ slightly in their calculation process. Both models require the user to input the age, breed, gender, and if the animal is spayed or neutered. From there the user selects the pet insurance package, deductible level, and coinsurance level desired. The models are able to calculate the expected claim amount and the premium that the policyholder will be charged. However, in the feline model, an additional factor that must be considered is whether the cat is an indoor or outdoor cat. All factors that the models ask for have a specific purpose. The reason for the indoor/outdoor input is because the life expectancy of an outdoor cat is much shorter than that of an indoor cat. Also, an outdoor cat may be more susceptible to certain illnesses and accidents because of a more risky environment. Additionally, age is an important aspect because the rate which a cat or dog has a particular claim varies throughout its lifetime. A dog's breed is necessary to determine the size since some treatment costs and life expectancies differ based on the size of the dog. It is also important to know if the cat or dog has been spayed or neutered because this will lower both the expected claim

cost and premium since this one-time surgery has already been performed. Finally, the pet insurance package that the customer selects determines which treatments will be covered and ultimately will affect the end costs and premiums. The available care packages are Emergency Care, Extra Care, and Extra Care with Dental. The following table shows what is covered by each package.

**Table 1: Treatments by Care Package**

| Emergency Care | Extra Care | Extra Care With Dental |
|---|---|---|
| Surgery | Surgery | Surgery |
| Laboratory Tests | Laboratory Tests | Laboratory Tests |
| X-Rays | X-Rays | X-Rays |
| Hospitalization | Hospitalization | Hospitalization |
| Euthanasia | Euthanasia | Euthanasia |
| Emergency Care | Emergency Care | Emergency Care |
| Drugs and Medication | Drugs and Medication | Drugs and Medication |
| | Examinations | Examinations |
| | Vaccinations | Vaccinations |
| | Flea or Tick Products | Flea or Tick Products |
| | Spay/Neuter | Spay/Neuter |
| | Deworming | Deworming |
| | | Dental Cleaning/Care |

Once the user selects the appropriate input from each respective drop-down list, the model will output the premiums for each of the care package options. Both the feline and canine models function similarly in the sense that they both contain information about incidence, costs, and expenses in order to produce the expected claims table. For the models, two age vectors adjust the rate of claim for certain injuries and illnesses. The vectors are created in such a way that the average incidence rate remains the same over all the ages and are adjusted to cover the life span of the specific cat or dog. Claim rates that are affected by the age vectors include: drugs and medication, emergency care, euthanasia, hospitalization, spaying or neutering, and other surgery. This is because in some cases, older pets are more likely to need this care, and in other cases, younger pets are more likely to need these services. The incidence rates for cats are also adjusted for physical examinations, drugs or medication, flea or tick products, and emergency care based on whether it is an indoor or outdoor cat. In addition, the canine model has three separate cost tabs depending on the size of the dog: small, medium, and large.

After entering the inputs, every pet insurance package table is filled with expected claims. Such costs are determined from the incidence rates multiplied by the treatment costs. Additionally, this is where the model calculates the total expected claim by factoring in the number of veterinary and/or hospital visits per year. The total expected claim cost results from multiplying probability of ‘x’ visits with the respective cost for ‘x’ visits and sums them up.

After the user selects the appropriate options describing their pet and the model calculates the expected claim costs, a monthly premium is calculated. Some supplementary data needed to calculate the premiums are a monthly discount rate, a markup factor, and number of policies.

## Chapter 4: About Our Product

As noted in the previous section, LLM Pet Insurance has three different coverage options for both cats and dogs: Emergency Care, Extra Care, and Extra Care with Dental. Emergency Care is the least expensive option and covers treatments related to injury and illnesses. Standard treatments include x-rays, surgery, laboratory tests, drugs and medication, emergency care, hospitalization, and euthanasia. Extra Care includes everything in the Emergency Care package, and additionally includes physical examinations, vaccinations, flea and tick products, spaying or neutering, and deworming. Extra Care with Dental, our most complete coverage, provides dental care in addition to all of the benefits of Extra Care coverage.

Our products are competitive with other pet insurance products on the market. Our products are also innovative and take on the idea of "health insurance for pets" which is not standard across the industry. Many companies sell policies that cover injuries and illnesses only, but LLM offers supplementary benefits that include general wellness and dental care. Because of our more comprehensive coverage, our premiums may seem slightly higher than competitors. However, it is important to note the value of our care packages; there are fewer restrictions on treatments and more offerings than these other competitors. The benefits far outweigh the additional cost, and we expect this strategy with care packages will benefit both consumers and LLM. Consumers should have more choices because of the coverage options, and LLM should have a competitive advantage in the market by providing unique services and guidelines.

Insurance coverage is paid for through monthly premiums and cost sharing. When a customer selects their policy, they also choose a deductible amount and a coinsurance level they would like to receive for the veterinary costs. The deductible is the initial amount that the policyholder is responsible for paying each year. The deductible options are $100 and $250, for both cats and dogs. However, for cats, the $250 deductible is only offered for the Extra Care and Extra Care with Dental packages. The policyholder also chooses the amount of reimbursement they would like to receive when they take their pet to the veterinarian. The options for both cats and dogs are 70%, 80%, or 90%. This means that at a 90% coinsurance level, the pet owner is only responsible for paying 10% of the veterinary costs, after the owner has paid costs up to the deductible amount.

The purpose of the deductible and coinsurance level is to ensure that pet owners will not abuse the insurance, which would be very costly to the company. It discourages owners from bringing their cat or dog to the veterinarian for unnecessary ailments because there will always be an out of pocket cost. In addition, it is standard to put some of the responsibility of costs on the owner, so it does not compromise our competitiveness in the market.

The monthly premium is the set amount that the policyholder pays. This is determined based on the deductible level, coinsurance level, age, gender, size (dogs only), indoor vs. outdoor (cats only), and whether or not the pet has been spayed or neutered.

LLM Pet Insurance also has an annual maximum that serves as protection for the company against unusually high claim costs. For all coverage options, the annual maximum is $7,000 and for the

Extra Care and Extra Care with Dental policies, the coverage limits pets to seeing the veterinarian for a maximum of two general physical examinations and one visit for vaccinations, per year. These limitations are reasonable and should not be problematic for the large majority of our policyholders. However, they are again in place for financial protection of the company.

## Chapter 5: Underwriting

Underwriting is a process used by insurance companies to assess the risk and eligibility of all applicants. In order protect against loss, insurance companies hire underwriters to find and eliminate high risk clients who are looking to obtain a policy. Currently, LLM is only underwriting to see if the pets are healthy enough to receive a policy. However, in the future LLM will change the underwriting process to account for risk classes. In order for an individual to obtain an insurance policy, they first need to file an application and send all required documentation. From there, the underwriter evaluates the application to see if the client's level of risk is reasonable for the company to insure. The underwriter will verify that all the information from each candidate is correct ("Understanding the Insurance Underwriting Process," 2013).

Once more information is available, the company will be able to better understand all the policyholders and business as a whole. In future years, the underwriter will then decide which risk class each candidate belongs to and what premium they will pay. Such risk classes typically include: preferred, standard, rated, and declined. A preferred status refers to a client who has less risk and should pay lower premiums. Standard risk states that the candidate has average risk and should pay a regular premium. Rated status means that the policyholder has high risk and should pay a larger premium. Declined status indicates that a client is not eligible to receive the company's products and services ("Understanding the Insurance Underwriting Process," 2013). It is important to keep in mind that pets in the preferred risk class may not be still be as healthy after a couple of years. To account for this, LLM will classify these pets as standard risk after two years, and the policyholders will pay the regular premium. Pets which were originally classified as rated will continue to pay the larger premium. Ultimately, risk classes will help the company find ways to adjust its premiums at still remain profitable.

For LLM's purposes, the company will initially hire one underwriter to fulfill such duties in its first year of operation. The underwriter's responsibilities are to handle all insurance policy applications, acquire the owner demographic questionnaire and medical history of the pets. If the work load becomes overwhelming for the one employee, LLM will pay an outside underwriting company for their assistance and services to help with the process until a second underwriter is added to the LLM staff.

LLM wants to avoid insuring high risk clients to prevent future losses. High risk clients include those who are unhealthy or live in an unhealthy environment according to the medical reports and owner questionnaire. If the pet is deemed high risk, the underwriter will decline the application. Otherwise the underwriter will accept the application. In the future, once LLM is more established, the pet will be assigned a risk class. For the pet to be preferred it must be healthy, live in a healthy environment, and be pediatric or adult age. To be classified as standard, the pet must satisfy two of the preferred requirements. To be classified as rated, the pet must be a senior and either be healthy or live in a healthy environment. If the pet is unhealthy and lives in an unhealthy environment, then it will be declined.

With thousands of policyholders, there is no efficient way for the underwriter to check the overall health of all the pets in person. Therefore, the medical history is essential to determine whether or not the pet is worth the risk for the company. Untrustworthy or misleading answers on the

questionnaire and application are a major concern. LLM expects honesty and holds all owners accountable for their responses. If there is evidence indicating any type of misrepresentation, LLM has the right to deny an owner's policy. In regards to documentation, if an applicant does not submit a full medical history or questionnaire, the underwriter will deny the new policy. With underwriting and all of these future adjustments to underwriting, LLM will be able to avoid covering the riskier policyholders and make sure policyholders receive the right premium based on the amount of risk they bring.

# Chapter 6: Developing the Premiums

In our first year, it is essential that we develop premiums that will allow our company to be profitable in future years. One part of the business that greatly impacts overall company success is the pricing of the insurance products. With regards to supply and demand, setting the right price for these products can make a significant difference between making a profit or loss. If the prices are too high, not enough customers will purchase the product and the company will not earn enough revenue. On the other hand, if the prices are too low, the company faces the risk of having insufficient funds in premiums to cover all of the future claims for the year, resulting in a loss. Thus, finding the equilibrium point between supply and demand will optimize sales for our company. Another goal of LLM is to make the models user-friendly for customers so they can compare and contrast the three pet insurance packages: Emergency Care, Extra Care and Emergency Care with Dental. After each customer inputs the correct information about their cat or dog and policy information, the respective model will output three monthly premiums, one for each package. This will allow the customer to decide which plan and coverage best suits his or her needs and budget. Developing these premiums is a multi-faceted task that involves an understanding of the expected claims, cost sharing, expenses, interest rate, markup, and premium.

## 6.1 Expected Claims

In order to financially prepare for the upcoming year, an insurance company should estimate the total amount of claims expected over the fiscal year. Besides recognizing all the risks and probabilities associated with insuring a policyholder, an insurance company should also examine how significant factors vary and affect the expected claims amount. Pets can be very different so it is important to examine why certain factors would affect the frequency and severity of future claims. The main characteristics of pets that can affect future costs are as follows: previously spayed or neutered, gender, size, age, and type of cat (indoor or outdoor). In addition, LLM finds that the type of care package and number of visits to the veterinarian can significantly impact the expected claims amount.

### Spay/Neuter

Spaying and neutering changes the expected claim amount if the procedures have already been performed on the insured pet. Given that the pet has had this one-time operation, there is no follow-up procedure in the future. Thus, the expected claim total lessens because there is one less potential claim that can happen during the year for this pet. However, assuming that the pet has yet to be spayed or neutered, LLM must take into account the possibility of this claim occurring which ultimately increases the expected claim amount.

### Gender

The only scenario where gender affects the expected claim amount is when a cat or dog has yet to be spayed or neutered. The policyholder must have either the Extra Care or Extra Care with Dental package because those cover spaying and neutering. The surgical costs are different for each gender, and spaying is more expensive than neutering. This means that if the pet was not previously spayed or neutered, the expected claims for a female will be greater than a male.

## Size

There are five treatments that vary in price based on the size of the dog (small, medium, or large). Spaying and neutering, x-rays, and hospitalization treatments are all the least expensive for small dogs and the most expensive for large dogs. For other surgical procedures, the medium-sized dog has the lowest cost, followed by the small and then large dog. Table 2 displays these comparisons.

Table 2: Costs by Dog Sizes

| | Spaying or Neutering | X-Ray | Hospitalization | Other Surgeries |
|---|---|---|---|---|
| **Least Expensive** | Small Dogs | Small Dogs | Small Dogs | Medium Dogs |
| ↓ | Medium Dogs | Medium Dogs | Medium Dogs | Small Dogs |
| **Most Expensive** | Large Dogs | Large Dogs | Large Dogs | Large Dogs |

## Age

Certain claims increase or decrease with age and to account for this, there is an age vector and a reverse age vector. The age vector increases the probability of certain claims as the animal's age increases, yet the average probability of the claim over all the ages is kept the same. The claims that are impacted by the age vector are: drugs and medication, emergency care, euthanasia, hospitalization, and other surgeries. The reverse age vector decreases the incidence rates as the animal's age increases. The reverse age vector is used for spaying or neutering and deworming. The age vectors span over the life expectancy of the pet plus four years. This is because we decided it was reasonable to assume that animals will not live more than four years past their expected lifetime.

The pet's stage in life can also affect some claims. Table 3 displays the categories for each pet by age.

Table 3: Cat and Dog Stages in Life (Years)

| Stages | Cat Age | Small Dog Age | Medium Dog Age | Large Dog Age |
|---|---|---|---|---|
| **Pediatric** | 0-1 | 0-1 | 0-1 | 0-1 |
| **Adult** | 2-10 | 2-10 | 2-9 | 2-8 |
| **Senior** | 11-20 | 11-20 | 10-20 | 9-20 |

These three stages have the ability to affect certain claim amounts. Such claims include: physical examinations, vaccinations, and laboratory tests. See Table 4 below.

Table 4: Claim Costs by Age

| | Physical Examinations | Vaccinations | Laboratory Tests |
|---|---|---|---|
| **Least Expensive** | Pediatric | Pediatric | Pediatric & Adult |
| ↓ | Adult | | |
| **Most Expensive** | Senior | Adult & Senior | Senior |

## Indoor/Outdoor

Through our research, it became apparent some areas of the feline model would need adjustments based on whether the cat is an indoor or outdoor cat. We made adjustments to the incidence rates for the relevant claims. For example, an outdoor cat is more likely to need treatment to ticks, fleas, or other bugs than an indoor cat since the level of exposure is much greater.

To adjust the model, we first identified which treatments are more likely to be incurred by an outdoor cat (and less likely by an indoor cat). These include: physical examinations, flea or tick products, drugs and medication, and emergency care. Next, we chose a reasonable factor of 1.5 and 0.67 to exponentially decrease indoor and increase outdoor incidence rates, respectively. This factor scales down the incidence rate for indoor cats, and increases the incidence rate for outdoor cats. Because this factor is applied to the incidence rates, our model is more accurate in predicting the likelihood of treatment based on the type of cat.

## Care Packages

The expected claims can also differ depending on which care package the policyholder chooses. The more risks and potential claims each package covers will affect the expected claims. See Table 1 in Chapter 3 for what is covered by each care package.

## Number of Veterinary Visits

The U.S. Pet Ownership & Demographics Sourcebook provided us with the probabilities of zero, one, two, and three veterinary visits per household. We altered this data to be the probability per animal in order to keep the numbers consistent with our incidence data. First we divided the probabilities of zero, one, two, and three veterinary visits per household by the average number of cats or dogs per household. This resulted in the probabilities with the units of veterinary visits per cat and veterinary visits per dog. We then graphed the probabilities for zero, one, two, and three veterinary visits. The probabilities fit very closely with an exponential regression. We used the exponential regression to extrapolate the probabilities from 4 to 10 visits because our models calculate the expected claims for up to 10 visits. This is reasonable because the probability of a cat or dog going to the veterinarian more than 10 times in a year is negligible. Next, we adjusted the probabilities so that they all summed to one. The U.S. Pet Ownership & Demographics Sourcebook states that the expected number of veterinary visits for cats is 0.7 and for dogs is 1.6. We adjusted our probabilities in order to match this data and make the probabilities reasonable. We used these probabilities to calculate the expected claims for both cats and dogs.

## 6.2 Cost Sharing

The final but significant component in the premium calculations is cost sharing, which includes the deductible and coinsurance. Cost sharing is important because it prevents pet owners from taking advantage of the insurance company. When pet owners are responsible for a portion of the veterinary costs, they are more conscious about how often they take their pet to the veterinarian. Ultimately, this is very beneficial to the insurance company because it prevents excessive policyholder spending. As the deductible and coinsurance vary, the monthly premium also varies and can be more suited to fit the pet owner's budget. The larger deductible has lower monthly premiums because the policyholder is assuming more responsibility for costs through the deductible. Similarly, the more cost the pet owner assumes through a lower coinsurance level, the lower the monthly premium they will have to pay. As mentioned in Chapter 4, there is no $250 deductible option for cats under the Emergency Care Package. This is because less treatments options are covered, so the expected claims are rarely greater than $250, making the $250 deductible unreasonable in this situation. Therefore, the deductible of $100 would be mandatory in this scenario.

## 6.3 Expenses

LLM Pet Insurance is a startup insurance company, and with any startup company there are many upfront expenses in addition to annual operating expenses. Thus, we grouped our expenses into two categories: initial and operating (Table 6 below has a breakdown of these expenses; references for these costs are available in Appendix C). In comparison to the startup costs, our operating expenses are significantly larger. Low initial expenses will have a positive effect on the business because we should not expect to see a large loss in the first year of business.

We determined these expenses through online references. CNN.com and Indeed.com were commonly used sources. Our two most significant and important expenses are employee salaries and marketing costs. We determined marketing costs to be approximately 1.5% of our sales. We estimated that our sales would need to be approximately $3 million in order to cover our expenses, claims, and earn a profit on the policies. The salaries were based on information from Indeed.com, which provides accurate, average salaries for workers in particular industries. There are some positions that have dual purposes and will be performed by one employee. In these cases, we used the higher of the two salaries in order to be fair to these employees. Worker's compensation, social security, Medicare, and retirement costs were all based off the appropriate percentage of salary; see Table 5 below for the appropriate percentages.

Table 5: Percentage of Salary for Benefits

| Percentage of Salary | |
|---|---|
| **Worker's Compensation** | 4.30% |
| **Social Security** | 6.20% |
| **Medicare** | 1.45% |
| **Retirement** | 4.00% |

Expenses are vital for developing the premium because the premium must cover company expenses in addition to claims. We estimate that our company expenses in the first year will be $628,000. This means that the monthly expenses are approximately $52,000. These expenses are built into the premium in two ways: an amount per policy and a percent of premium. Half of the monthly expenses ($26,000) are divided equally across all policies. In order to be conservative, we assume that we will have 4,000 policies, which results in fixed expenses to be $7 per policy per month. The other half of expenses is covered as a percent of premium. This aspect of the expenses takes into consideration that more expensive policies will cover a larger portion of the expenses than inexpensive policies. The average monthly premium per policy before the markup is $51, so the other half of expenses is 14% of the average premium ($7/$51). We rounded this number to 15% for ease of calculations and to be conservative.

Table 6: Operating and Startup Expenses

| OPERATING COSTS (per year) | | | STARTUP COSTS (one time) | |
|---|---|---|---|---|
| | | | | |
| **Item/Description** | **Cost** | | **Item/Description** | **Cost** |
| Office supplies | $7,000 | | Computers | $4,200 |
| Worker's Compensation | $16,899 | | Phones (multiple lines) | $350 |
| Unemployment insurance | $3,500 | | Laptops (2) | $1,200 |
| Social Security and Medicare | $30,065 | | Copy machine/fax/printer (2) | $1,000 |
| Health insurance | $35,000 | | Legal bills for start up | $5,000 |
| Rent | $30,000 | | Desks | $3,500 |
| Utilities (gas/heat, electric) | $4,900 | | Chairs | $500 |
| Salary, Secretary/Human Resources | $38,000 | | Filing cabinets/shelves | $840 |
| Salary, Accountant | $55,000 | | Licenses | $1,000 |
| Salary, Marketing/Information Technology | $60,000 | | Coffee machine | $100 |
| Salary, Actuary | $90,000 | | Microsoft Office 2013 | $1,540 |
| Salary, Underwriter | $65,000 | | Server (database) | $800 |
| Salary, Sales | $50,000 | | Refrigerator | $600 |
| Salary, Customer Service | $35,000 | | Microwave | $60 |
| Business Insurance | $2,000 | | | |
| Advertising/marketing | $52,500 | | | |
| Accounting Software | $600 | | | |
| Actuarial modeling software (SAS) | $8,700 | | | |
| Sales expenses (not traveling) | $2,000 | | | |
| Retirement costs (DC) | $15,720 | | | |
| Technology repairs | $1,000 | | | |
| Anti-virus software | $195 | | | |
| Phone/internet | $1,200 | | | |
| Water for water cooler | $480 | | | |
| Website/email | $132 | | | |
| Other | $2,000 | | | |
| **TOTAL** | **$ 606,891** | | **TOTAL** | **$ 20,690** |

## 6.4 Interest Rate

In order to calculate the monthly premiums and the value of the premiums at the end of the first year, we needed to determine an appropriate interest rate. To define this discounting rate, we referenced Robert P. Butsic's "Determining the Proper Interest Rate for Loss Reserve Discounting: An Economic Approach". According to Butsic, the desired interest rate is roughly the United States Government security rate (1988). By averaging the 2013 United States Daily Treasury Monthly Yield Curve Rates, the monthly interest rate equals 0.0435%. This monthly rate can be converted into an annual rate of 0.5238%. The interest rate was then used for the following actuarial payment formula in order to calculate the monthly premium:

$$\text{Monthly Premium} * \ddot{a}_{\overline{n}|i} = \text{Claims Paid at the Beginning of the Year, } \textit{where } n = 12$$

## 6.5 Markup

Most insurance companies apply a markup value to their premiums in order to increase the likelihood profitability. After researching and experimenting with how the markup affects our profit, we determined a markup of 30% was reasonable. In order to determine this markup value, we first ran the simulation without any markup value. We then solved for a markup value that would give us the average profits of around $560,000 so we could give our investor a proper return on investment, which will be discussed in Chapter 8.3. The markup also lets us remain competitive in the market. The markup is applied by dividing the premiums by one minus the markup rate. A markup value of lower than 30% would increase the risk of our company of losing money and discourage investors.

$$\text{Premium with Markup} = \frac{\text{Premium without Markup}}{1 - \text{Markup}}$$

## 6.6 The Premium

The monthly premium amounts set by LLM Pet Insurance have multiple standards that need to be met. After the user inputs the data for his or her pet and chooses the desired insurance package, the respective feline or canine model will estimate the expected claim total for the year. This data is necessary because the monthly premiums need to cover this expected amount of claims at a minimum. Otherwise, LLM may not be able to fully insure its customers. In addition to claims, the premium must also be able to cover company expenses. These expenses (rent, salaries, marketing, etc.) are accounted for in the premium since this is the only source of revenue for the company.

It is necessary to determine the amount LLM expects to pay in claims after the deductible and coinsurance levels are chosen. First, the deductible will be subtracted from the expected claim amount. Assuming that this result is greater than zero, the coinsurance level will be multiplied by this difference, resulting in the amount that LLM expects to pay after cost sharing.

$$\text{Claims Paid at End of Year} = \text{Max}\begin{cases}(\text{Expected Claims} - \text{Deductible}) * \text{Coinsurance} \\ 0\end{cases}$$

To determine the monthly base premium before the expenses and markup have been added in, the claims paid at the end of the year must first be valued back to the beginning of the year. Once we have this amount, we divide by a monthly annuity that uses the monthly interest rate of 0.04%. The equation below shows this relationship.

$$\text{Base Premium} * \ddot{a}_{\overline{n}|i} = \frac{\text{Claims Paid at End of Year}}{(1 + \text{Annual Effective Rate})}, where\ n = 12, i = 0.04\%$$

Next, the expenses are added and a predetermined markup of 30% will be applied to each monthly base premium. The expenses include a fixed cost and a percentage increase of premium so that the burden of total expenses is more appropriately distributed among policy holders. The markup is applied by dividing the calculated premium and expenses by one minus the markup rate. This predetermined markup is aimed to help better the chance of the company having a profitable year without making the premiums unaffordable. In addition, it serves as a precautionary measure against unusually high claims. The end result, the gross premium, is the amount that the policy is sold on the market for.

$$\text{Gross Premium} = \frac{\text{Fixed Expense per Policy} + \text{Base Premium} * (1 + \text{Expense Rate})}{1 - \text{Markup}}$$

# Chapter 7: Simulation Model

After developing the premiums for cats and dogs, we then created a simulation model to test the profitability of our business in its first year. This was necessary to help us realize if our models had been developed correctly and to see what changes (if any) could be made to make our business more profitable. Incidence probabilities were used to develop the premiums as well as average costs for certain treatments and visiting the veterinarian. The next step was to run the simulation 1,000 times to better gauge the find the likelihood of the business making a profit in its first year. Each simulation run is referred to as its own independent trial. A trial represents the potential outcome for LLM during a one year period.

## 7.1 Inputs

There were six direct inputs that were entered into the simulation before it is run. The inputs included:

1. Number of simulation trials: 1,000 – It was important to do many trials to produce more accurate estimates
2. Monthly interest rate: 0.04% – This was the same interest rate used in the feline and canine models to calculate the monthly premiums and future value of premiums
3. Markup value: 30% – The percentage by which the premium was increased
4. Fixed expense amount per policy: $7.00 – Base amount that every policy was charged
5. Percentage increase in premium to cover expense: 15% – This expense charge was based on the price of the premium
6. Annual company expenses: $628,000 – Yearly operating expenses for LLM

## 7.2 Randomizing the Number of Members

One of the first variables we addressed when developing the simulation was the number of members we would have in the first year. As part of its advertising, Veterinary Pet Insurance (VPI) compares its prices to other companies and provides information about the market share of pet insurance. Currently, there are 11 companies with market share ranging from 60.7% to 0.4% (“Compare Pet Insurance,” 2013). Because our company is a start-up company that would be new to the market, we are assuming that we would have a minimal share of the market similar to the companies with the smallest market share. We decided it would be practical to have 0.5% of the business for pet insurance, nearly the lowest share, since we are a new company. The exact number of pets that is insured is estimated to be around 1 million (Hutchins, 2013; “Media Q&A,” 2013). Since less than 1% of insured pets are animals other than cats and dogs, we assumed all insured pets are cats and dogs (“Media Q&A,” 2013). With a market of 1 million policies and 0.5% share, our company is expecting to sell 5,000 policies in the first year. This number serves as our most accurate and conservative measure and it is a realistic basis for our sales, which we expect to grow in future years.

However, the number of policies would vary so we developed a normal distribution to represent the number of members the business would have in its first year with a mean of 5,000 and a standard deviation of 750. We chose this distribution because we anticipated the number of members will be symmetric about the mean. The mean was 5,000 members because this was our expected number of

sales in the first year. To choose the standard deviation, we first figured that the range of policies in the first year was going to be between 3,500 and 6,500. We knew that this range was not exact, but we believed that 95% of the time the number of policies would fall within this range. According to the empirical rule, 95% of the distribution is within 2 standard deviations of the mean. This resulted in a standard deviation of 750. During every trial of the simulation, the number of annual members varied randomly based on this distribution.

## 7.3 Randomizing the Pets

Once the model determined the number of members for the simulation trial, the pets were then randomly developed. To randomly select a pet characteristic, we used the excel function "RAND ()" which randomly chose a real number between zero and one based on a uniform distribution. Based off the random number the function produced, the characteristic for the pet was assigned. For example, the probability of a pet insurance policy belonging to a cat was 20%. So if the random number generated were less than or equal to 0.2, then the policy would belong to a cat. If the number were greater than 0.2, the policy would belong to a dog. This method was used for developing each of the characteristics for each pet as well the amount in claims the pet would accrue during the first year.

The characteristics that were randomly chosen for each policy were the same variables used when developing the premiums. For each policy, the characteristic were if the pet was a cat or dog, gender, if the pet was previously spayed or neutered, age, size (dog only), indoor or outdoor (cat only), care package, deductible, and coinsurance. See Table 7 for the probabilities. We chose the probabilities for cats and dogs based on the percentage of pet insurance policies belonging to cats and dogs. For the size characteristic, we categorized each dog breed as small, medium, or large. Then we found the percentage of each size. For care packages, we found that it is more likely for a pet owner to choose a policy similar to our Extra Care Package. The Extra Care Package with Dental had the smallest probability because we found that dental was not a huge issue with pets or a primary concern for most pet owners.

Table 7: Pet Characteristic Probabilities

| Cat/ Dog | Gender | Spayed/ Neutered | Size (Dog Only) | Indoor/ Outdoor (Cat only) | Care Packages | Deductible | Coinsurance |
|---|---|---|---|---|---|---|---|
| Cat: 20% | Female: 50% | Spayed/ Neutered: 50% | Small: 20% | Indoor: 40% | Emergency Care: 35% | $100: 50% | 70% Level: 33% |
| Dog: 80% | Male: 50% | Not Spayed/ Neutered: 50% | Medium: 54% | Outdoor: 60% | Extra Care: 40% | $250: 50% | 80% Level: 33% |
| | | | Large: 26% | | Extra Care with Dental: 25% | | 90% Level: 33% |

From research gathered, we decided that an exponential distribution with a mean of 3.5 would best fit age probabilities. According to PetInsuranceQuotes, the average age of insured pets in the United States is 3.5 years old ("How much does pet insurance cost?," 2012). We chose an exponential distribution because it was more likely that a younger pet will be able to obtain a policy compared to an older one under this criterion. To further enforce these likelihoods, we adjusted the age probabilities between 17 and 20 year old pets to be 0.1% chance each.

After all of the characteristics of the pet were developed, the simulation then assigned an expected amount of claims for the year and a monthly premium. These were based off of the characteristics that were randomly chosen for the pet and were developed in the feline and canine models discussed in Chapter 5.

## 7.4 Randomizing Veterinary Visits

Once the characteristics of the pet were developed, the simulation randomized the claim amount the pet would accumulate over the first year. This was based on the probabilities of receiving a certain treatment while visiting the veterinarian, the average cost for the treatments, and the probabilities a pet going to the veterinarian 'x' times per year. The process for developing accumulated claims was based on whether the pet was a cat or dog, type of policy, and other pet characteristics.

The first step was to develop the cost for 10 random visits to the veterinarian for each pet. We chose 10 because the feline and canine models allowed for the pet to be seen up to 10 times per year. For each visit, we used the "RAND ()" function for each type of treatment. If the outputted number was less than the probability of that treatment occurring, then the cost assigned to that treatment was the average cost of the treatment. If the random number generated was greater than the probability, then the treatment did not occur and the cost was zero. The types of treatments that could happen during a visit were physical examinations, vaccinations, laboratory tests, drugs and medications, flea or tick treatments, emergency care, spaying or neutering, deworming, x-rays, euthanasia, hospitalization, surgical procedures, and dental cleaning/care. Next, the simulation summed up of all of the cost for the treatments for that visit based on the policy covering the pet. For example, if the cat or dog was under the Emergency Care Package, then the summation would only take into account the costs for surgery, laboratory tests, x-rays, hospitalization, drugs and medication, emergency care, and hospitalization. This process was done for 10 veterinary visits.

The simulation also calculated the number of times a pet would visit the veterinarian per year. The probabilities were from the U.S. Pet Ownership & Demographics Sourcebook and the veterinarian visits ranged from 0 to 10 times a year. Once the model determined the number of veterinary visits, the model summed up the costs associated with each of these visits to arrive at the total amount in claims the pet had accrued for the year. For example, if the random number generated two visits during the year, then the simulation would only aggregate two veterinary visits. The total summation was the total amount in claims before cost sharing, which we referred to as "claims allowed".

While developing the simulation, the number of times a pet could have the same treatment needed to be taken into consideration. For instance, if a pet was euthanized, the pet would no longer

have additional visits to the veterinarian after this procedure and all subsequent veterinary visit costs were set to zero. In addition, we limited the number of vaccinations to once per year because it was not reasonable for a pet to have these treatments more than once in a year. To address this problem, we set vaccination costs to zero if the animal was vaccinated earlier in the year. Similarly, the simulation allowed for a maximum of two physical examinations per year. Additionally, spaying and neutering are one time operations and the simulation only allowed this to happen once.

Once the amount for the claims allowed was calculated, the total claims after cost sharing was computed. To incorporate cost sharing, the simulation subtracted the deductible value for the policy from the total amount of claims. This number was then multiplied by the coinsurance amount. The maximum of this number and zero was called "claims paid" and was the amount the insurance policy will cover. In the event that claims paid were greater than $7,000, this number was used as the claims paid, since it was our maximum coverage limit. This process was repeated for every pet that is developed during the simulation trial.

## 7.5 Data Summarization and Conclusions

Once the pet, premium, and claims were developed for every pet during a simulation trial, the data was then aggregated into a representation that was more meaningful for analysis. The data that we collected for further examination were the following:

- Number of cats
- Number of dogs
- Number of veterinarian visits
- Number of each type of policy sold
- Total expected claims allowed
- Total expected claims paid
- Total claims allowed
- Total claims paid
- Total monthly premium collected

The future value of premiums was calculated using the monthly premiums collected and the interest rate. Loss ratios were then computed using the aggregated data. The first loss ratio we calculated was the expected loss ratio.

$$\text{Expected Loss Ratio} = \frac{\text{Expected Claims Paid}}{\text{Future Value of Premiums}}$$

The expected loss ratio gave us an estimate for what we expected our loss to be based on the expected claims per policy used to calculated the premiums. The second loss ratio was the actual loss ratio.

$$\text{Actual Loss Ratio} = \frac{\text{Claims Paid}}{\text{Future Value of Premiums}}$$

Actual loss ratio showed the portion of the premium that went to covering the company's claims. This ratio was also used to see how far off the company's performance was from the expected loss ratio. See Table 8 below for explanations of the loss ratios.

**Table 8: Interpretations of Loss Ratio**

| Loss Ratio | Interpretation |
|---|---|
| **< 0.5** | Premiums too high |
| **0.5 - 0.6** | Premiums just right |
| **0.6 – 0.8** | Premiums acceptable |
| **> 0.8** | Premiums too low |

Profit = Future Value of Premiums – Total Claims Paid – Annual Expenses

The last calculation was profit, which we needed to test the company's profitability. Once the simulation completed all of the trials, we then calculated LLM's chance of profitability. To do this, we added up the number of times the company's profit was greater than zero and then divide this number by the number of simulation trials.

Once the simulation was finished performing all of the trials, we analyzed the data. This included finding the average loss ratio and average profit. At first we found that our loss ratios were too high (around 0.8 or higher) and that too many of our trials resulted in negative profit so we performed a more in depth analysis on the data find a potential cause. We then made adjustments to our policies such as increasing the markup value of the premiums until we were comfortable with the profitability of the company.

# Chapter 8: Results

The simulation was a beneficial tool that we initially used to determine where we needed to make adjustments in the feline and canine models and our general business plan. It was also a key part of the overall company analysis. By running the simulation 1,000 times, we were able to more accurately predict the company's profitability. In addition, we were able to use the simulation to create splits that indicated which aspects of our products were more or less profitable. This was all valuable information to have so that our company could evaluate which pieces of our pet insurance business we should expand upon and eliminate in the future.

## 8.1 Overall Results

Based on 1,000 trial runs of our simulation, our company's average annual profit is $560,000. The span of profits is quite large, ranging from $9,000 to $1,162,000; but, it is important to note that even at our lowest profit earnings, LLM is still generating positive profit. LLM sees this as a good initial sign for the business. Looking at our profits from a confidence interval standpoint, we see that a 95% confidence interval of our profits is ($548,000, $571,000). This indicates that if the process was repeated many times, we would expect that 95% of the time the profits would fall in this interval. This interval is fairly narrow, which indicates we are very confident that our profits will be at least 545,000. Another way to analyze the success of LLM is through loss ratios. The average loss ratios range from 0.620 to 0.714 with an average of 0.667. This falls within the acceptable range for loss ratios and it not a particular point of concern for our overall analysis. Below is a histogram (Figure 1) of our profits. Our profits are separated into bins of 50,000, so this means that the first bar represents the number of profits that fell between $0 and $50,000.

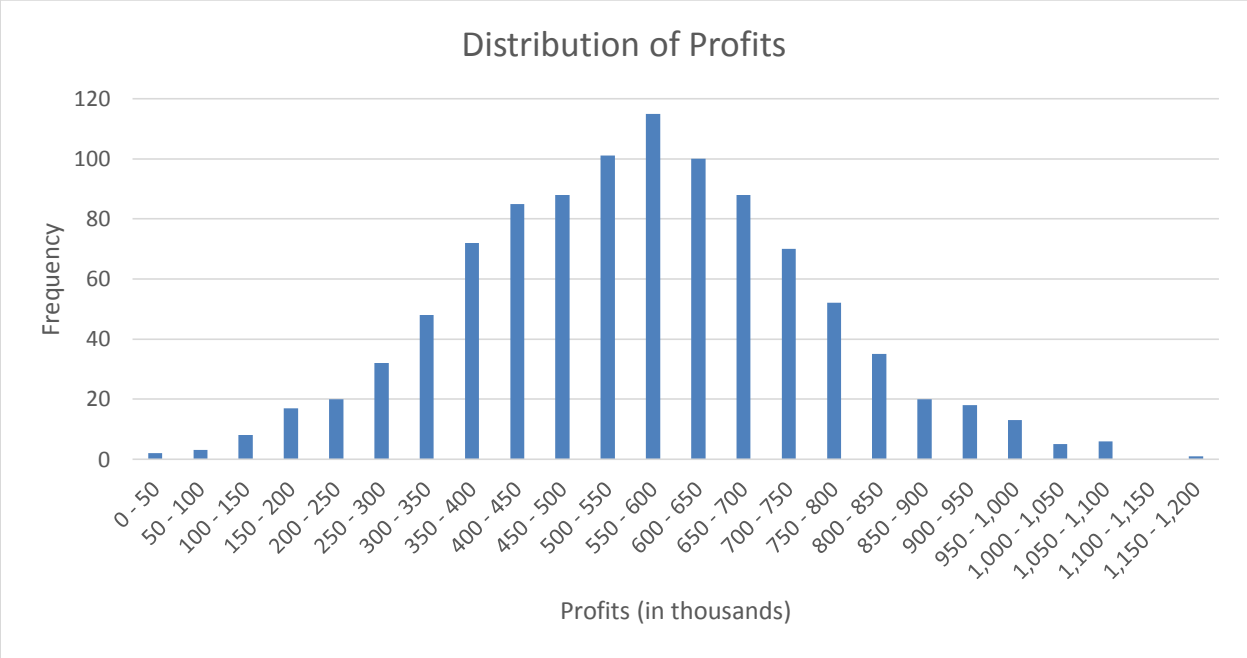


Figure 1: Distribution of Profits

We created a heat map (Figure 2) to portray how the number of policies and claims impact estimated profits. The x-axis is the number of policies, while the y-axis is claims. The profits in the center were calculated using the average premium per policy ($720 per year) and the annual company expenses of $628,000. We used the following formula to estimate profits:

| Estimated Profit = (Number of Policies)*(Average Premium per Policy) – Claims – Company Expenses |
|---|

| Claims | 500 | 1,500 | 2,500 | 3,500 | 4,500 | 5,500 | 6,500 | 7,500 |
|---|---|---|---|---|---|---|---|---|
| 4,500,000 | | -4,047,580 | -3,327,580 | -2,607,580 | -1,887,580 | -1,167,580 | -447,580 | 272,420 |
| 4,000,000 | | -3,547,580 | -2,827,580 | -2,107,580 | -1,387,580 | -667,580 | 52,420 | 772,420 |
| 3,500,000 | -3,767,580 | -3,047,580 | -2,327,580 | -1,607,580 | -887,580 | -167,580 | 552,420 | **1,272,420** |
| 3,000,000 | -3,267,580 | -2,547,580 | -1,827,580 | -1,107,580 | -387,580 | 332,420 | **1,052,420** | **1,772,420** |
| 2,500,000 | -2,767,580 | -2,047,580 | -1,327,580 | -607,580 | 112,420 | **832,420** | **1,552,420** | 2,272,420 |
| 2,000,000 | -2,267,580 | -1,547,580 | -827,580 | -107,580 | **612,420** | **1,332,420** | 2,052,420 | 2,772,420 |
| 1,500,000 | -1,767,580 | -1,047,580 | -327,580 | **392,420** | **1,112,420** | 1,832,420 | 2,552,420 | 3,272,420 |
| 1,000,000 | -1,267,580 | -547,580 | **172,420** | **892,420** | 1,612,420 | 2,332,420 | 3,052,420 | 3,772,420 |
| 500,000 | **-767,580** | **-47,580** | **672,420** | 1,392,420 | 2,112,420 | 2,832,420 | 3,552,420 | 4,272,420 |
| 0 | **-267,580** | **452,420** | 1,172,420 | 1,892,420 | 2,612,420 | 3,332,420 | 4,052,420 | 4,772,420 |

Number of Policies

Figure 2: Heat Map of Estimated Profits

In the figure, the green represents high estimated profits, while red represents low estimated profits. There are blank cells in the upper left hand corner of the figure because LLM will pay out a maximum of $7,000 in claims per policy, so it is not possible for 500 policies to have claims of more than $3.5 million. Overall, this heat map shows that our estimated profits increase as number of policies increase.

Although there is potential for high and low profits, it is more realistic and likely for LLM's estimated profits to fall in the outlined region of the heat map. We ran 500 simulation trials for each respective number of policies on the x-axis. Then we separated each trial's total claims paid into the ranges displayed on the y-axis, and outlined where these occurred on the heat map. There is at least a 99.8% chance that LLM's profits will be inside of the outlined area. Though very unlikely, we still acknowledge the green and red areas of the heat map because these estimations are possible under certain criterion.

## 8.2 Further Analysis

Although the business is profitable and seems like a good idea at a glance, we felt it would be important to evaluate the cat and dog business separately. Upon 50 trials exclusively for cats and 50 for dogs, we found that the average profit for the cat business was –$86,000 and for dogs was $739,000. Given that dogs are 80% of business, the overall profit for these runs averages out to $574,000, which is roughly consistent with the average profits from our overall run of 1,000 trials. However, this presents a large concern for our business because it suggests that the cat business may not be a worthwhile branch of LLM. Below is a graphical display of this finding.

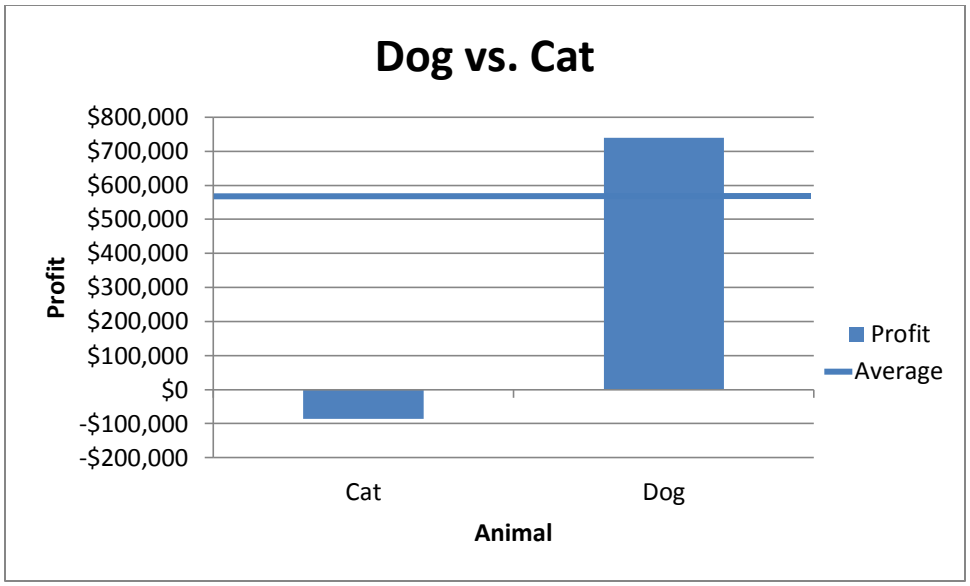


Figure 3: Profitability by Business

The next step was to investigate if there were other factors that significantly affected profitability. We felt that it would be important to test for differences between deductible, coinsurance, and care package. We tested each split was tested with 50 trials per option and we found there to be differences in profitability that may require future attention. Our results showed that it is more profitable for our company to sell policies with the $100 deductible. A likely reason for this outcome is that the premiums for policies with a $250 deductible are too low in comparison with the claims paid resulting in lower profits. With more experience, it will be possible to adjust for this in the pricing formula. For our care package options, Emergency Care was the least profitable and had average profits less than zero. Extra Care and Extra Care with Dental were both profitable for the company, but Extra Care with Dental was the most profitable. Emergency Care is the cheapest option because it is our most basic form of coverage, but it still includes the vast majority of treatments so it is likely that premiums for these plans are too low in relation to the amount of claims we have to pay. Thus, Emergency Care has a negative profit. When performing the splits for coinsurance, we found that 90% coinsurance generated profits above average, 80% generated profits consistent with our average profits, and 70% generated profits below average. This may be due to customers with the highest level of coinsurance are overcharged and those with the lowest level are undercharged, in terms of premiums. Graphs of these results can be found in Appendix B.

The cat business had already created the largest reason for concern, so we ran separate splits for indoor and outdoor cats to see how our profits were impacted. We found that indoor cats had an average profit of –$159,000 and were significantly less profitable than outdoor cats, which had a profit of –$52,000. Indoor cats appear to be less risky and therefore may also be undercharged in comparison to outdoor cats. Regardless, both profits are negative and suggest that the cat business as a whole is not profitable for LLM. The graph below shows the profits for indoor and outdoor cats; note that the "average" profit is with respect to the cat business.

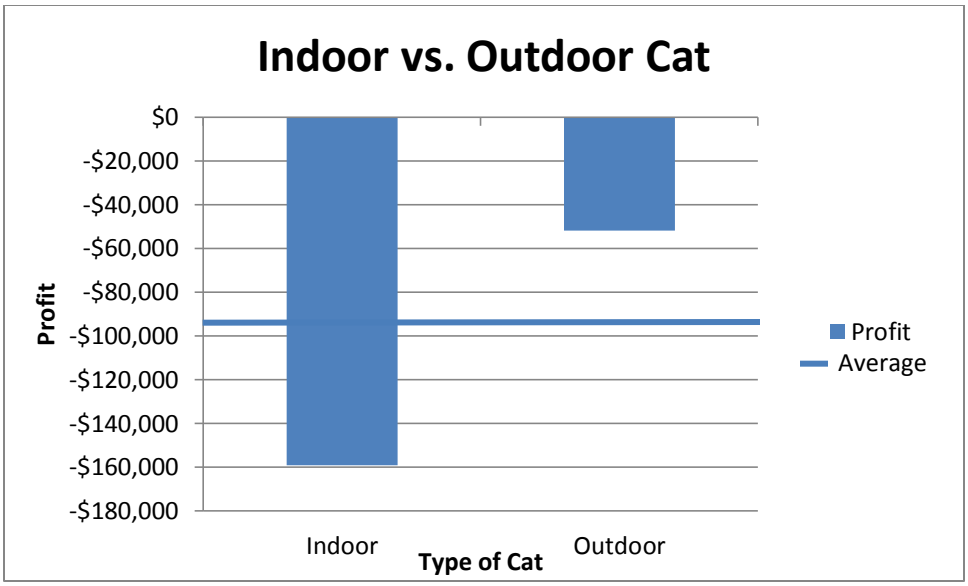


Figure 4: Profitability by Type of Cat

After researching the industry, developing the premiums, and running the simulation, LLM feels that this business is worthwhile to start. However, this is on the condition that we will continually reevaluate with adjustments, especially while the business is still in its early stages. Since there are differences in the profitability between deductible, coinsurance, and care package options, modifications should be made with company experience. The goal of this is to make the profit splits more even so that LLM is not disadvantaged by selling policies with certain deductible, coinsurance, or care package options. In regard to the cat business, we feel that profit will have to be monitored closely and if LLM is not able to make the necessary adjustments to make this branch of the business profitable, we should close this block to new business.

LLM feels our products will be competitive once we enter the pet insurance market. Our products are designed to be health insurance for pets, the care package options are comprehensive in comparison to what other companies are offering. However, the basis of our product line is similar to our competitors so we also know that our options line up with current consumer demand. In the growing pet insurance industry, LLM will be successful for many years if we fine tune our initial product line to be in sync with consumer needs and adjust our models to keep premiums competitive and profitable.

## 8.3 Return on Investment

As a start-up company, LLM is going to need initial funds to help start our pet insurance business. We plan to obtain this initial money from an investor who is enthusiastic about the future of the company. However, since the investor will be most interested in the return they can earn, LLM has outlined a return on investment plan that is informative, reliable, and appealing. Since venture capitalist investing can be quite risky, this investment return is reasonable given the amount of risk the investor is assuming. The process below outlines the steps LLM took to estimate the return for an investor.

First, we calculated the amount of money we need to start our business. We think that an appropriate and conservative estimate includes the following expenses: one year of operating expenses, initial expenses, and the future claims for one year. The breakdown of these costs is below. We want to be sure LLM will have enough money to cover all claims and expenses. We believe our calculation is a fair assessment of the initial amount needed to launch our business forward. This investment is $1,949,000 which we rounded up to $2 million as an extra precaution.

$$\text{Initial Investment} = 1 \text{ Year Operating Expenses} + \text{Initial Expenses} + \text{Future Claims for 1 Year}$$

$$\text{Initial Investment} = \$628{,}000 + \$21{,}000 + \$1{,}300{,}000 = \$1{,}949{,}000$$

After determining the initial investment, we calculated the present value of the company's worth. To do this, we discounted all of the company's expected future profits to time zero using a 10% interest rate. Each year's profit is approximately $560,000 based on the average profit from our simulation run. We used a 10% interest rate, which is larger than most rates on the market, to make the venture competitive with other investment opportunities. With this, we calculated our business to be worth $5.6 million and since we are asking for $2 million upfront, the investor will receive 36% of our profits annually. The equation below illustrates this calculation.

$$\text{Annual Profit Share} = \frac{\text{Initial Investment Amount}}{\text{Business Value}}$$

$$\text{Annual Profit Share} = \frac{\$2{,}000{,}000}{\$5{,}600{,}000} = 36\%$$

We found 36% of our annual profits to be approximately $200,000 and this is the amount that the investor should expect to receive annually. It is important to note that $200,000 is a target amount, not a guaranteed amount. At a market interest rate of 3.0%, and annual payments of $200,000, our investor can expect to break even by the end of 13 years. We used a 3.0% market rate based on the U.S. Treasury average 20 year bond rate for 2013 in order to keep our estimate conservative. The number of years it will take to break even was calculated using the following formula and solving for n:

$$\$2{,}000{,}000 = \$200{,}000\,\frac{(1-v^n)}{.03}, \text{ where } v = \frac{1}{1.03}$$

This entire calculation was based on the assumption that LLM only has one investor. If there is more than one investor, the annual payments would be adjusted accordingly to give the same total percent of profits to investors. We would also be sure that LLM still obtains the initial $2 million for startup costs.

## Chapter 9: Future Adjustments

There are many possibilities for the future of LLM Pet Insurance. These possibilities are uncertain because we do not know how the industry will change in the coming years, or how our business will develop. However, after selling pet insurance, we will have our own company experience data, which we can use to adjust our premiums to be more specific. For example, we could fine-tune the premiums based on locations, breeds, owner lifestyle, along with other variables. In terms of location, this would likely increase the premium if the geographical area had a high demand for pet insurance or wealthier clients. Fine-tuning the premiums based on breeds could include researching the difference between mixed and pure breed animals, and increasing the premiums for whichever has higher incidence rates. The owner's lifestyle could affect how well the animal is treated. For example, if the owner travels a great deal and leaves the animal on its own, we may charge higher premiums. On the other hand, if the owner cares for their animal as if it is their own child, then incidence rates could decrease. We will adjust premiums based on the results from our comparison analyses. There are many other possible ways to adjust the premium as LLM acquires more data about their policyholders.

It is important to keep in mind that as our company develops it may outgrow its current staff and office location. Some employees will not be greatly impacted by a large increase in policies. However, the underwriter, sales, and customer service employee may be very overwhelmed. If the number of policies increases to a point where these employees can no longer manage their work, then it will be necessary to hire additional employees or consultants. We predict we will hire additional employees once we have more than 9,000 policies. One additional underwriter, sales, and customer service employees will result in many additional expenses, both initially and ongoing because we would have to buy more equipment and have more salaries to pay each year, among other costs. These expenses sum up to approximately $180,000, yet this should be manageable due to our increase in sales. These expenses would increase even more if LLM had to relocate to a larger office, causing increased rent and moving costs.

To predict the veterinary costs for the next 10 years, we looked at the trend from 2012 to 2013 and found that on average veterinary costs increase by a factor of approximately 1.04 each year ("Pet Industry Market," 2013). We also found that realistically, we may not have 5,000 policies in the first year. Since our start-up costs are relatively small, we still expect to have profits in the first year, but realize they may be slightly less. We are confident that if this is the case, we will build to 5,000 policies by the second year. Research shows that the number of pets in the pet insurance industry is growing at a rate of 3.4% per year (Bennett, 2010). Since the smaller pet insurance companies have approximately 1% of the market share, we expect to have this portion of the market share in 10 years, which would be at least 13,000 policies. Not only will our growing business impact expenses, but also the inflation rate. The average inflation rate over the past 10 years is 2.42%, so we expect the next 10 years to have similar inflation rates ("US Inflation Calculator," 2013). In order to account for the increases in medical costs and expenses, we found that our premiums will have to increase by 1.40% per year in order to maintain an average profit of $560,000 per year.

Combining all of these predictions and trends allowed us to create a 10 year plan for LLM. The following table summarizes our plan and predictions if our starting number of policies less than 5000.

Table 9: Ten Year Trend

| Year | Number of Policies | Pet Insurance Industry (Billion Policies) | Company Claims Paid | Expenses | Average Premiums per Policy per Month |
|---|---|---|---|---|---|
| **1** | 3,500 | 1.00 | $1,662,000 | $628,000 | $60 |
| **2** | 5,000 | 1.03 | $2,374,000 | $622,000 | $61 |
| **3** | 6,000 | 1.07 | $2,849,000 | $637,000 | $62 |
| **4** | 7,000 | 1.10 | $3,324,000 | $652,000 | $63 |
| **5** | 8,000 | 1.14 | $3,799,000 | $668,000 | $63 |
| **6** | 9,000 | 1.18 | $4,273,000 | $864,000 | $64 |
| **7** | 10,000 | 1.22 | $4,748,000 | $885,000 | $65 |
| **8** | 11,000 | 1.26 | $5,223,000 | $906,000 | $66 |
| **9** | 12,000 | 1.30 | $5,698,000 | $928,000 | $67 |
| **10** | 13,000 | 1.35 | $6,173,000 | $951,000 | $68 |

# Appendices

## Appendix A: Indoor Cat Expected Claims

Table 10: Indoor Cat: Overall Expected Claims (per Visit)

**Cat** (indoor)

| Age | Age Category | Physical Examinations | Vaccinations | Laboratory Tests | Drugs or Medication | Flea or Tick Products | Emergency Care | Neuter | Spay | Deworming | X-Rays | Euthanasia | Hospitalization | Other Surgery | Dental Cleaning/Care |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | Pediatric | $ 33.86 | $ 119.74 | $ 25.64 | $ 4.81 | $ 2.30 | $ 9.47 | $ 18.70 | $28.52 | $ 1.40 | $47.66 | $ 4.51 | $ 3.24 | $ 87.27 | $ 38.86 |
| 1 | Pediatric | $ 33.86 | $ 119.74 | $ 25.64 | $ 4.87 | $ 2.30 | $ 9.58 | $ 18.53 | $28.25 | $ 1.39 | $47.66 | $ 4.56 | $ 3.28 | $ 88.25 | $ 38.86 |
| 2 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 4.92 | $ 2.30 | $ 9.69 | $ 18.36 | $27.99 | $ 1.38 | $47.66 | $ 4.61 | $ 3.32 | $ 89.24 | $ 38.86 |
| 3 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 4.98 | $ 2.30 | $ 9.79 | $ 18.19 | $27.73 | $ 1.36 | $47.66 | $ 4.66 | $ 3.35 | $ 90.22 | $ 38.86 |
| 4 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 5.03 | $ 2.30 | $ 9.90 | $ 18.01 | $27.46 | $ 1.35 | $47.66 | $ 4.71 | $ 3.39 | $ 91.21 | $ 38.86 |
| 5 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 5.09 | $ 2.30 | $ 10.01 | $ 17.84 | $27.20 | $ 1.34 | $47.66 | $ 4.76 | $ 3.43 | $ 92.19 | $ 38.86 |
| 6 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 5.14 | $ 2.30 | $ 10.11 | $ 17.67 | $26.94 | $ 1.33 | $47.66 | $ 4.81 | $ 3.46 | $ 93.18 | $ 38.86 |
| 7 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 5.19 | $ 2.30 | $ 10.22 | $ 17.50 | $26.67 | $ 1.31 | $47.66 | $ 4.86 | $ 3.50 | $ 94.16 | $ 38.86 |
| 8 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 5.25 | $ 2.30 | $ 10.33 | $ 17.32 | $26.41 | $ 1.30 | $47.66 | $ 4.92 | $ 3.54 | $ 95.15 | $ 38.86 |
| 9 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 5.30 | $ 2.30 | $ 10.43 | $ 17.15 | $26.15 | $ 1.29 | $47.66 | $ 4.97 | $ 3.57 | $ 96.13 | $ 38.86 |
| 10 | Adult | $ 34.43 | $ 138.68 | $ 25.64 | $ 5.36 | $ 2.30 | $ 10.54 | $ 16.98 | $25.88 | $ 1.27 | $47.66 | $ 5.02 | $ 3.61 | $ 97.11 | $ 38.86 |
| 11 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.41 | $ 2.30 | $ 10.65 | $ 16.81 | $25.62 | $ 1.26 | $47.66 | $ 5.07 | $ 3.65 | $ 98.10 | $ 38.86 |
| 12 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.47 | $ 2.30 | $ 10.75 | $ 16.63 | $25.36 | $ 1.25 | $47.66 | $ 5.12 | $ 3.68 | $ 99.08 | $ 38.86 |
| 13 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.52 | $ 2.30 | $ 10.86 | $ 16.46 | $25.09 | $ 1.23 | $47.66 | $ 5.17 | $ 3.72 | $ 100.07 | $ 38.86 |
| 14 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.57 | $ 2.30 | $ 10.97 | $ 16.29 | $24.83 | $ 1.22 | $47.66 | $ 5.22 | $ 3.76 | $ 101.05 | $ 38.86 |
| 15 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.63 | $ 2.30 | $ 11.07 | $ 16.11 | $24.57 | $ 1.21 | $47.66 | $ 5.27 | $ 3.79 | $ 102.04 | $ 38.86 |
| 16 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.68 | $ 2.30 | $ 11.18 | $ 15.94 | $24.31 | $ 1.20 | $47.66 | $ 5.32 | $ 3.83 | $ 103.02 | $ 38.86 |
| 17 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.74 | $ 2.30 | $ 11.29 | $ 15.77 | $24.04 | $ 1.18 | $47.66 | $ 5.37 | $ 3.87 | $ 104.01 | $ 38.86 |
| 18 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.79 | $ 2.30 | $ 11.40 | $ 15.60 | $23.78 | $ 1.17 | $47.66 | $ 5.42 | $ 3.90 | $ 104.99 | $ 38.86 |
| 19 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.85 | $ 2.30 | $ 11.50 | $ 15.42 | $23.52 | $ 1.16 | $47.66 | $ 5.47 | $ 3.94 | $ 105.97 | $ 38.86 |
| 20 | Senior | $ 34.99 | $ 138.68 | $ 51.27 | $ 5.90 | $ 2.30 | $ 11.61 | $ 15.25 | $23.25 | $ 1.14 | $47.66 | $ 5.53 | $ 3.98 | $ 106.96 | $ 38.86 |

Table 11: Indoor Cat: Expected Claims by Care Package (per Visit)

| | Neutered | | Not Neutered (Male) | | Not Neutered (Female) | |
|---|---|---|---|---|---|---|
| Age | Emergency Care | Extra Care | Extra Care w/ Dental | Extra Care | Extra Care w/ Dental | Extra Care | Extra Care w/ Dental |
| 0 | $ 136.92 | $ 254.86 | $ 284.00 | $ 268.89 | $ 298.02 | $ 276.24 | $ 305.38 |
| 1 | $ 137.84 | $ 255.78 | $ 284.91 | $ 269.67 | $ 298.81 | $ 276.96 | $ 306.10 |
| 2 | $ 138.77 | $ 271.32 | $ 300.45 | $ 285.08 | $ 314.22 | $ 292.30 | $ 321.44 |
| 3 | $ 139.69 | $ 272.23 | $ 301.37 | $ 285.87 | $ 315.00 | $ 293.02 | $ 322.16 |
| 4 | $ 140.62 | $ 273.15 | $ 302.28 | $ 286.65 | $ 315.79 | $ 293.74 | $ 322.87 |
| 5 | $ 141.54 | $ 274.06 | $ 303.20 | $ 287.44 | $ 316.57 | $ 294.46 | $ 323.59 |
| 6 | $ 142.47 | $ 274.98 | $ 304.11 | $ 288.22 | $ 317.36 | $ 295.17 | $ 324.31 |
| 7 | $ 143.39 | $ 275.89 | $ 305.03 | $ 289.01 | $ 318.14 | $ 295.89 | $ 325.03 |
| 8 | $ 144.32 | $ 276.81 | $ 305.94 | $ 289.80 | $ 318.93 | $ 296.61 | $ 325.74 |
| 9 | $ 145.24 | $ 277.72 | $ 306.86 | $ 290.58 | $ 319.72 | $ 297.33 | $ 326.46 |
| 10 | $ 146.16 | $ 278.64 | $ 307.77 | $ 291.37 | $ 320.50 | $ 298.04 | $ 327.18 |
| 11 | $ 166.31 | $ 299.19 | $ 328.33 | $ 311.79 | $ 340.93 | $ 318.40 | $ 347.54 |
| 12 | $ 167.24 | $ 300.11 | $ 329.24 | $ 312.58 | $ 341.71 | $ 319.12 | $ 348.26 |
| 13 | $ 168.16 | $ 301.02 | $ 330.16 | $ 313.37 | $ 342.50 | $ 319.84 | $ 348.97 |
| 14 | $ 169.09 | $ 301.94 | $ 331.07 | $ 314.15 | $ 343.29 | $ 320.56 | $ 349.69 |
| 15 | $ 170.01 | $ 302.85 | $ 331.99 | $ 314.94 | $ 344.07 | $ 321.27 | $ 350.41 |
| 16 | $ 170.93 | $ 303.77 | $ 332.90 | $ 315.72 | $ 344.86 | $ 321.99 | $ 351.13 |
| 17 | $ 171.86 | $ 304.68 | $ 333.82 | $ 316.51 | $ 345.64 | $ 322.71 | $ 351.84 |
| 18 | $ 172.78 | $ 305.60 | $ 334.73 | $ 317.29 | $ 346.43 | $ 323.43 | $ 352.56 |
| 19 | $ 173.71 | $ 306.51 | $ 335.65 | $ 318.08 | $ 347.21 | $ 324.14 | $ 353.28 |
| 20 | $ 174.63 | $ 307.43 | $ 336.56 | $ 318.86 | $ 348.00 | $ 324.86 | $ 354.00 |

Table 12: Indoor Cat: Expected Claims by Care Package (per Year)

| | Neutered | | | Neutered (Male) | | Neutered (Female) | |
|---|---|---|---|---|---|---|---|
| Age | Emergency Care | Extra Care | Extra Care w/ Dental | Extra Care | Extra Care w/ Dental | Extra Care | Extra Care w/ Dental |
| 0 | $ 182.61 | $ 339.91 | $ 378.77 | $ 358.61 | $ 397.47 | $ 368.42 | $ 407.28 |
| 1 | $ 183.84 | $ 341.13 | $ 379.99 | $ 359.66 | $ 398.52 | $ 369.38 | $ 408.24 |
| 2 | $ 185.07 | $ 361.85 | $ 400.71 | $ 380.21 | $ 419.07 | $ 389.84 | $ 428.70 |
| 3 | $ 186.31 | $ 363.07 | $ 401.93 | $ 381.26 | $ 420.12 | $ 390.80 | $ 429.66 |
| 4 | $ 187.54 | $ 364.29 | $ 403.15 | $ 382.31 | $ 421.16 | $ 391.76 | $ 430.61 |
| 5 | $ 188.77 | $ 365.51 | $ 404.37 | $ 383.35 | $ 422.21 | $ 392.71 | $ 431.57 |
| 6 | $ 190.01 | $ 366.73 | $ 405.59 | $ 384.40 | $ 423.26 | $ 393.67 | $ 432.53 |
| 7 | $ 191.24 | $ 367.95 | $ 406.81 | $ 385.45 | $ 424.31 | $ 394.63 | $ 433.48 |
| 8 | $ 192.47 | $ 369.17 | $ 408.03 | $ 386.50 | $ 425.35 | $ 395.58 | $ 434.44 |
| 9 | $ 193.70 | $ 370.39 | $ 409.25 | $ 387.54 | $ 426.40 | $ 396.54 | $ 435.40 |
| 10 | $ 194.94 | $ 371.61 | $ 410.47 | $ 388.59 | $ 427.45 | $ 397.50 | $ 436.35 |
| 11 | $ 221.81 | $ 399.03 | $ 437.89 | $ 415.84 | $ 454.69 | $ 424.65 | $ 463.51 |
| 12 | $ 223.04 | $ 400.25 | $ 439.11 | $ 416.88 | $ 455.74 | $ 425.61 | $ 464.47 |
| 13 | $ 224.27 | $ 401.47 | $ 440.33 | $ 417.93 | $ 456.79 | $ 426.57 | $ 465.42 |
| 14 | $ 225.51 | $ 402.69 | $ 441.55 | $ 418.98 | $ 457.84 | $ 427.52 | $ 466.38 |
| 15 | $ 226.74 | $ 403.91 | $ 442.77 | $ 420.03 | $ 458.88 | $ 428.48 | $ 467.34 |
| 16 | $ 227.97 | $ 405.13 | $ 443.99 | $ 421.07 | $ 459.93 | $ 429.44 | $ 468.29 |
| 17 | $ 229.21 | $ 406.35 | $ 445.21 | $ 422.12 | $ 460.98 | $ 430.39 | $ 469.25 |
| 18 | $ 230.44 | $ 407.57 | $ 446.43 | $ 423.17 | $ 462.03 | $ 431.35 | $ 470.21 |
| 19 | $ 231.67 | $ 408.79 | $ 447.65 | $ 424.22 | $ 463.07 | $ 432.31 | $ 471.16 |
| 20 | $ 232.91 | $ 410.01 | $ 448.87 | $ 425.26 | $ 464.12 | $ 433.26 | $ 472.12 |

## Appendix B: Graphs to Analyze Profitability

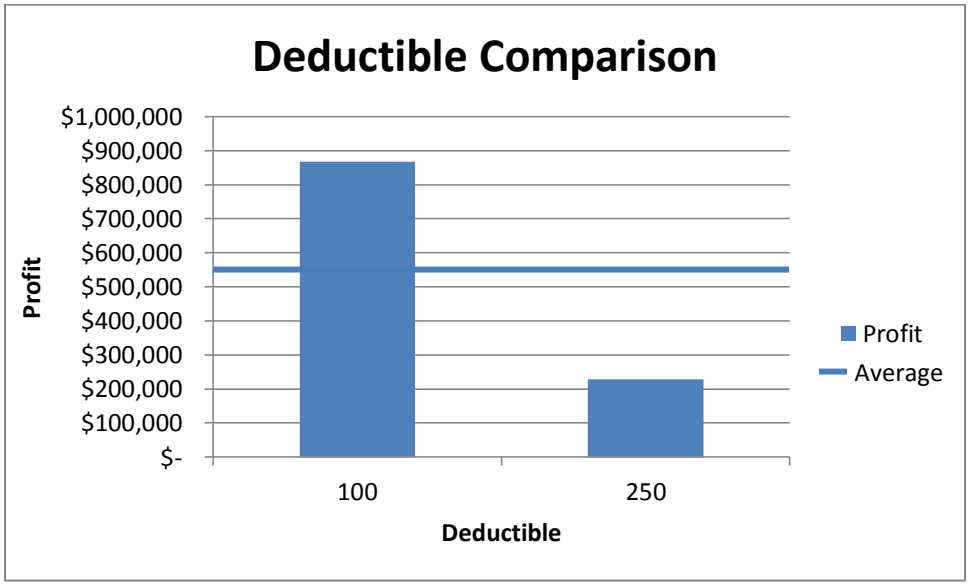


Figure 5: Profitability by Deductible

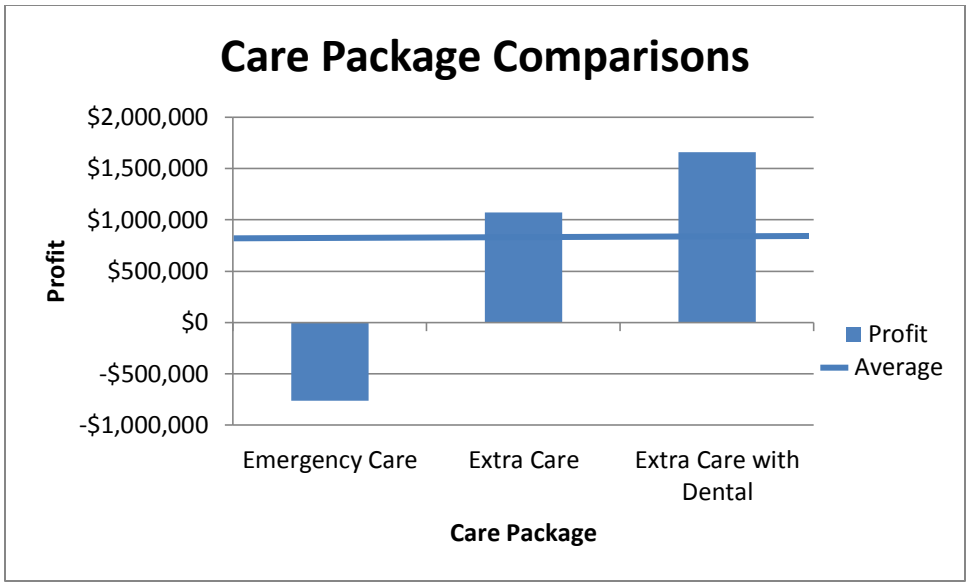


Figure 6: Profitability by Care Package

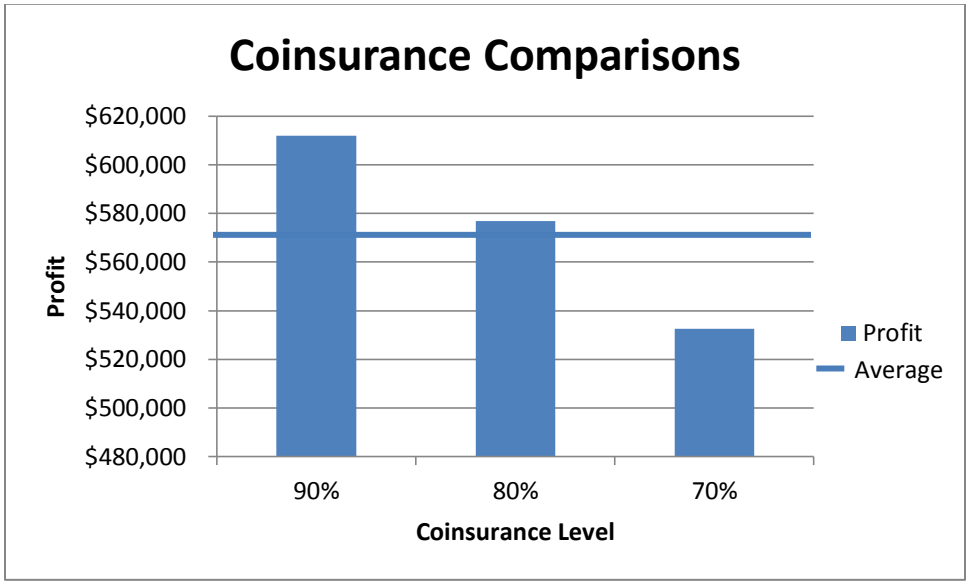


Figure 7: Profitability by Coinsurance Level

## Appendix C: Sources for Expenses

Table 13: Operating Expenses with Sources

| OPERATING COSTS (per year) | | |
|---|---|---|
| | | |
| **Item/Description** | **Cost** | **Source** |
| Office supplies | $ 7,000.00 | eSmallBusiness |
| Worker's Compensation | $ 16,899.00 | % of salary |
| Unemployment insurance | $ 3,500.00 | CNN Money |
| Social Security and Medicare | $ 30,064.50 | % of salary |
| Health insurance | $ 35,000.00 | CNN, insures individuals |
| Rent | $ 30,000.00 | Craig's list |
| Utilities (gas/heat, electric) | $ 4,900.00 | Various |
| Salary, Secretary/Human Resources | $ 38,000.00 | Indeed.com |
| Salary, Accountant | $ 55,000.00 | Indeed.com |
| Salary, Marketing/Information Technology | $ 60,000.00 | Indeed.com |
| Salary, Actuary | $ 90,000.00 | Indeed.com |
| Salary, Underwriter | $ 65,000.00 | Indeed.com |
| Salary, Sales | $ 50,000.00 | Indeed.com |
| Salary, Customer Service | $ 35,000.00 | Indeed.com |
| Business Insurance | $ 2,000.00 | Tech Insurance |
| Advertising/marketing | $ 52,500.00 | 1.5% of sales |
| Accounting Software | $ 600.00 | QuickBooks |
| Actuarial modeling software (SAS) | $ 8,700.00 | SAS |
| Sales expenses (not traveling) | $ 2,000.00 | General estimate |
| Retirement costs (DC) | $ 15,720.00 | CNN Money |
| Technology repairs | $ 1,000.00 | Staples |
| Anti-virus software | $ 195.00 | Norton |
| Phone/internet | $ 1,200.00 | Comcast |
| Water for water cooler | $ 480.00 | Poland Springs |
| Website/email | $ 132.00 | Network Solutions |
| Other | $ 2,000.00 | General estimate |
| | | |
| **TOTAL** | **$ 606,890.50** | |

Table 14: Startup Expenses with Sources

| **STARTUP COSTS (one time)** | | |
|---|---|---|
| | | |
| **Item/Description** | **Cost** | **Source** |
| Computers | $ 4,200.00 | Dell |
| Phones (multiple lines) | $ 350.00 | Best Buy |
| Laptops (2) | $ 1,200.00 | Dell |
| Copy machine/fax/printer (2) | $ 1,000.00 | Dell |
| Legal bills for start up | $ 5,000.00 | Dad |
| Desks | $ 3,500.00 | Discount Office Furniture |
| Chairs | $ 500.00 | Ikea |
| Filing cabinets/shelves | $ 840.00 | Staples |
| Licenses | $ 1,000.00 | Mass Division of Insurance |
| Coffee machine | $ 100.00 | Target |
| Microsoft Office 2013 | $ 1,540.00 | Microsoft |
| Server (database) | $ 800.00 | Dell |
| Refrigerator | $ 600.00 | Best Buy |
| Microwave | $ 60.00 | Target |
| | | |
| TOTAL | **$ 20,690.00** | |

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