An Expected Value Comparative Analysis Study on the Pricing of Commonly Purchased Insurance Policies in the United States

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Abstract: In the present study, an expected value analysis was conducted on 23 commonly purchased insurance policies which were listed in ranked order by value and percentage return. The cost of each policy was compared with its expected value which was determined by multiplying the payoff amount with probability. Policy cost, probability, and payoff estimates were obtained from mainly industry sources referenced in the review of literature. Not surprisingly, all the insurance policies had an expected loss with the more expensive policies showing a greater expected loss than the cheaper policies. Only three of the 23 commonly purchased insurance policies had a return greater than 50 cents on the dollar, and most of the insurance policies analyzed had an expected return of less than 25 cents on the dollar. Over a third of the policies had a return that was less than 10 cents on the dollar. Expected value equations showed that insurance does not provide economic value. However, many policy holders believe that insurance provides intrinsic value, evident by the fact that the insurance industry represents 12% of the entire U.S. economy. For most, purchasing insurance is not an attempt to save money, but to minimize risk.

Keywords: Insurance, Expected Value, Insurance Policies, Payoff, Probability, Cost of Payoff

INTRODUCTION AND BACKGROUND

Some things in life are certain, such as death and taxes, but what about life's unexpected events? Unfortunate events ranging from an auto accident to a death in the family can, without warning, befall anyone at any time. Given the unpredictable nature of loss, how do most obtain protection from the unexpected? The most commonly used solution is the purchase of insurance which provides a safety net for individuals as well as corporations to recuperate from significant loss.

The insurance industry represents around 12% of the $18 trillion dollar U.S. economy, making it one of the largest industries. Private healthcare insurance premiums totaled $1,123 billion (CMS, 2017) and premiums for life, health, property, and casualty insurance added another $1.1 trillion (Insurance Information Institute, 2017). Are consumers really benefiting from the purchase of insurance? What value is being derived? Are there more economical ways to spend money in order to reduce risk?

Insurance companies need to be profitable: Amounts paid out on claims must be less than the premiums policyholders pay in. Insurance companies must also cover the cost of selling and managing insurance policies while still generating profits for their stockholders. Most policy holders are comfortable with the notion of profits, but how much margin is acceptable? Insurance companies, with their complicated risk analysis and pricing models, are very aware of the expected value, but all too often, policy holders are not. This study will examine commonly purchased insurance policies and determine their expected value.

REVIEW OF COMMONLY PURCHASED INSURANCE POLICIES

Alien Abduction - The UFO Abduction Insurance Company is selling $10 million coverage for $9.99 in the event of an alien abduction. More than 5,000 people have bought the policies, which require proof that the insured has been abducted by an alien (Bronson, 2015). The expected value of a policy that costs $9.99 would be zero since no one has ever provided proof of, or made an insurance claim of, an alien abduction.

Auto Accident Damage – There was a 3.56% (Statista, 2018) probability of being in an auto accident in 2016, and the average amount of damage was $3,144 (Verisk Analytics Report, 2013). According to Value Penguin (2018), the average annual cost of an auto accident damage insurance policy in the United States was $907.38 in a 2014 study commissioned by Quadrant Information Services. The expected value of an auto accident policy that costs $907.38 would be $111.93 ($3,144 * .0356).

Auto Repair - A study by travel-services giant AAA found that the average auto repair bill was $550 (Schmitz, 2017), and an extended car warranty averaged about $525 per year (Maxwell, 2014). It has been estimated that most cars on average will need an average priced auto repair every other year. The expected value of a policy that costs $525 would be $275 ($550 / 2).

Cancer Supplemental –Supplemental cancer insurance policies cover the cost of things that medical insurance typically doesn't cover such as co-payments, co-insurance or deductibles. The average cost of a $30,000 lump-sum coverage cancer insurance policy for a 35-year-old would be around $20 a month (Fuscaldo, 2012) or about $3,600 over a ten-year time frame. According to US Mortality Files (2015) the odds of a 35-year-old getting cancer over a ten-year time frame is less than 10%. A supplemental cancer insurance policy that costs the policy holder $3,600 would have an expected value of $1,500 ($30,000 * 50% * 10%) if there was a 10% chance that 50% of the $30,000 lump-sum coverage were to be paid out.

Cell Phone Repair and Replacement - Cell phone insurance costs between $8-12 each month or an estimated $120 a year. On approved claims, repair deductibles range from $25-125 and replacement deductibles from $50 to $250 (Coleman, 2017) resulting in the average cost per deductible to be estimated at $112.50. A used phone with an estimated value of $300 would result in a net replacement cost for the insurer of $187.50 after accounting for the $112.50 deductible. According to Consumer Reports, 15% of users suffered serious damage to their cell phones (Pressman, 2017). Insurance typically doesn't cover for water damage or dropped phones. Investing a few dollars for a cell phone protective case seems to provide more value than an insurance policy. The expected value of a policy that costs $120 would be about $28.13 ($187.50 * .15).

Children's Term Life - The odds of children under the age of four dying are less than .25% over the life of a ten-year insurance policy (Frankle, 2016) so the expected value of a $100,000 term life insurance policy would be $250 ($100,000 * .0025). Insurance premiums that average about $200 a year or around $2,000 over a ten-year time frame would have an expected value of $250.

Credit Card Fraud - Marquand (2011) reported that credit card fraud protection insurance policies cost $300 a year, and federal law limits fraud liability on credit cards to $50 per card. Steele (2017) reported that there were almost 1.3 million credit card fraud causes in 2016, and Gonzalez-Garcia (2016) estimated that 174 million Americans adults have at least one credit card, which suggests that there is a .00747 chance of credit card fraud. The expected value of a $300 policy would be 37 cents ($50 * .00747).

Dental Plan - Dental Plan insurance averages about $600 a year for benefits that may top out for as little as $1,000, resulting in a $400 net benefit. A typical policy might cover just 50% for every other year oral surgery and restorative care treatment and provide no coverage cosmetic dentistry (Money Talks News, 2017). The expected value of a $600 policy would be $200 (400 * .5).

Earthquake - On average less than a thousand out of the 13 million California homes have earthquake damage in any given year (.0000769), and annual coverage rates in California a

average about $1.75 per $1,000 of coverage ($700 for a $400,000 home) and deductibles are typically 15% of the total value of the home. The current median sale price in California is just under $400,000 so the average deductible amount would be $60,000 (Blankenstein & Alba, 2014), which would be net of $340,000 if an average-priced home was completely destroyed by an earthquake. Those with non-recourse loans don't have to worry about deficiency judgments; so if an earthquake destroys their home, they can just walk away from it and let the bank foreclose. The expected value of a policy that costs $700 would be $27.20 ($340,000 * .0000769).

Fire Damage –According to Value Penguin (2018) the national average annual premium for a fire insurance policy was $1,083. There was 0.317% chance that a household experienced a fire in 2010 and the average property damage from a fire was $18,365 (Free by 50, 2012). The expected value of a policy that costs $1,083 would be $27.20 ($18,365 * .0000769).

Flood Damage – Insurance premiums vary depending on a property's flood risk. The federal government offers coverage through the National Flood Insurance Program at an average cost of about $700 per year. From 2008 to 2012, the average residential flood claim was more than $38,000 (Lankford, 2015). Homeowners insurance typically covers damage that comes from the top down—such as rain and wind damage—but it doesn't cover rising water and flooding so the probability of covered damaged is less than 1% in any given year. The expected value of a policy that costs $700 would be $380 ($38,000 * .01).

Funeral - Funeral insurance policy premiums for a $10,000 policy are three times higher for a 72-year-old than a 52-year-old. However, individuals who take out a policy at age 52 will end up paying more over their lives for a policy than if they had taken one out at age 72, but they will have coverage at an earlier age in the event of an early demise. The average cost of premiums to the age of 80 was $15,943. According to Kirsz (2014), a 61.8% probability exists of this happening, resulting in an expected value of the policy to be $9,852. As one gets older, the cost of the policy premiums become prohibitively more expensive resulting in the cancellation of 80% of funeral policies (Ryan, 2017). The expected value of a policy that costs $9,582 would be $3,820 ($10,000 * .382).

Policy Entry Age	Average Monthly Premium	Cost of Premiums to age 80
52	$45.57/month	$15,313
57	$57.38/month	$15,838
62	$77.23/month	$16,683
67	$109.91/month	$17,189
72	$153.05/month	$14,693

Hole-In-One - The average cost for insuring a $10,000 cash hole-in-one prize on a 165-yard hole for 100 golfers is approximately $225 (Oberle, 2007). The odds are 20,000 to 1

that a single golfer will hit a hole-in-one or about 200 to 1 that one out of 100 golfers will hit a hole-in-one. The expected value of a policy that costs $225 would be $20 ($10,000 * .002).

Hurricane Damage - The probability of a Florida Miami-Dade County home being completely destroyed by a hurricane is less than 1% in any given year. In Miami-Dade County, the annual premium to insure an older home valued at $150,000 is around $3,000 and has a 2% ($3,000) deductible (Moran, 2017). The expected value of a policy that costs $6,000 includes deductible would be $1,500 ($150,000 * .01).

Identity Theft– According to Steve Weisman (2017), the cost of identity theft insurance is about $17.50 per month or about $210 a year. The service provides credit monitoring by Equifax, Trans Union or Experian, and alerts victims, but does not prevent identity theft nor does it cover monetary losses. Market Watch (2014), referencing a Javelin Strategy & Research Survey, reported that 80% of the 12.6 million victims in 2012 didn't face any out-of-pocket expenses and, further, reported that according to the Bureau of Justice Statistics, it took most victims less than a day to resolve problems. According to Market Watch (2014) buying identity theft insurance is like hiring a wedding planner. One can pay someone to call florists and caterers, and in this case, contact their bank to cancel a card, or they can do it themselves. The expected value of a policy that costs $210 would be $0 since the policy does not prevent identity theft nor does it cover monetary losses.

Jewelry Loss - The annual cost to insure jewelry is about 1.5% of the reported value (Gilbert, 2018) so a $5,000 piece would cost around $75 a year to insure. Manhattan Bride (2018) reported that a Jewelers Mutual Survey found that 53% of women or around 31.8 million had their jewelry insured. Allstate Insurance Company estimated that 7 to 8% of households purchase additional coverage for items, such as jewelry (Treastersept, 2008). A U.S. Justice Department study reported that insurers paid out 200,000 claims totaling about $1 billion in insured jewelry losses (Fisher, 2009). There was an estimated .00628 (200,000 claims / 31.8 million policies) chance of a jewelry loss payout for each policy purchased with an average loss amount of $5,000. The expected value of a policy that costs $75 would be $31.45 ($5,000 * .00628).

Laptop Damage - Dell offers an all-inclusive, one-size-fits-all plan for three years of accidental damage coverage for a laptop computer, which includes priority phone support and onsite service for $349. The average cost to repair a laptop is approximately $410 without insurance. A system board can cost up to $500, a DVD drive is $200, a hard drive is $300, a multiple part replacement at bench can be upwards of $600 and an LCD display can be $450 (Perlow, 2015). The probability of a computer owner damaging his or her computer over a 3-year time frame was estimated to be less than 25% in any given year. The expected value of a policy that costs $349 would be $102.50 ($410 * .25).

Motorcycle Damage - Adding physical damage insurance to a motorcycle insurance policy will increase the cost of the policy's premium by $300 a year (Delbridge, 2017). The probability of a motorcyclist totalling his or her motorcycle and exceeding the deductible is estimated to be around 2% in any given year. Motorcycle prices can vary wildly, but, on average, one is spending between $5,000 and $10,000 (Christian, 2014). The expected value of a policy that costs $300 would be $150 ($7,500 * .2).

Pet Healthcare - The average annual premium for dog insurance across 11 of the top pet insurers was $509.40 with a $500 deductible and a $5,000 annual max and an 80% reimbursement level. According to data based on average claims from Pet First holders, the 10 most common dog treatments cost on average $252.75 each (NAPHIA, 2017). The average pet owner would have to cover the cost of the first two visits out-of-pocket before reaching the $500 deductible. The probability of a pet owner hitting the annual max of $5,000 including 80% reimbursement level was estimated to be less than 5% in any given year. The expected value of a policy that costs $509.40 would be $250 ($5,000 * .05).

Rapture Pet Care - For $135.00 one can purchase an insurance policy that will guarantee that if the Rapture occurs within ten years after purchased, a representative from Eternal Earth-Bound Pets will take care of one's pet (NPR, 2011). At one point Eternal Earth-Bound Pets reported contracts with 259 clients. The expected value of a policy that costs $135 would be zero since no one has ever provided proof of, or made an insurance claim, of being raptured.

Rental Car Coverage – According to Christie (2014),buying supplemental insurance protection adds $15 - $30 a day to the cost of the car rental and most consumers are covered by their own auto insurance. Those who aren't covered by their own insurance are likely covered by their credit card since all four major credit card issuers, Visa, American Express, MasterCard and Discover provide some form of rental car insurance coverage. The expected value of a policy that costs $22.50 would be $0 since consumers are already covered by their own auto insurance and or their credit card.

Term Life - The odds of a 30-year-old woman dying before her 40th birthday is .09% (Kierz, 2014), and the annual cost of a $100,000 insurance policy averages about $300 a year or around $3,000 over a ten-year time frame. The expected value of a policy that costs $3,000 would be $900 ($100,000 * .009)

Travel – On average, the cost of popular life-changing adventures is about $5,000 for two travelers once the cost of an upscale hotel stay, round-trip airfare, taxi rides, a day tour, and meals has been totaled (Lieberman, 2017). According to Laura Adams, senior insurance analyst for insuranceQuotes.com, one can expect to pay from 5% to 15% of the cost of a trip for travel insurance. A typical deductible is $200. A cancel-for-any-reason insurance policy has much higher premiums, increasing the cost of the trip anywhere from 20 to 50%. The average cost

per travel policy was estimated at $562.50 based on travel insurance amounting to 22.5% (35% + 10% / 2) of the trip cost, which were calculated at $2,500. These policies may also only reimburse up to 75%, but even then, not everything is returned. Sometimes travelers will only receive a credit for future travel (White, 2016). Many hotels will allow cancellations 48 hours prior to check in and airlines allow travelers to rebook with a change of ticket fee often ranging from $150 - $250.United States Travel Insurance Association reported that approximately 23 million Americans purchased travel insurance policies in the year 2007 or about 1 out of 6 policyholders (.16667) that filed for compensation (Tysdal, 2010). The savings was estimated at $737.50 based on 50% of

the policy owners purchasing the cancel-for-any-reason policy that paid out 75% with a $200 deductible. The expected value of a policy that costs $562.50 would be $112.94 ($737.50 * .16667)

RESULTS AND METHODOLOY

The present study conducted an expected value analysis on 23 commonly purchased insurance policies (shown in Table 1). The cost of the policy was compared with the expected value, which was determined by multiplying the payoff amount with probability. Policy cost, probability and payoff estimates were obtained from mostly industry sources referenced in the review of commonly purchased insurance policies section.

Table 1: Insurance Policy Expected Value Table

	Probability	Payoff	Expected Value	Cost of Policy
Alien Abduction	.00000	$10,000,000	$0	$9.99
Auto Accident Damage	.03560	$3,144	$111.93	$907.38
Auto Repair	.50000	$550	$275	$525
Cancer Supplemental	.05000	$30,000	$1,500	$3,600
Cell Phone Damage	.15000	$187.50	$28.13	$120
Children's Term Life	.00250	100,000	$250	$2,000
Credit Card Fraud	.00747	$50	$0.37	$300
Dental Coverage	.50000	$400	$200	$600
Earthquake Damage	.00008	$340,000	$27.20	$700
Fire Damage	.00317	$18,365	$58.21	$1,083
Flood Damage	.01000	$38,000	$380	$700
Funeral	.38200	$10,000	$3,820	$9,852
Identity Theft	.07000	$0	$0	$210.00
Hole-In-One Golf	.00200	$10,000	$20	$225
Hurricane Damage	.01000	$150,000	$1,500	$6,000
Jewelry Loss	.00628	$5,000	$31.45	$75
Lap-top Damage	.25000	$410	$102.50	$349
Motorcycle Damage	.02000	$7,500	$150	$300
Pet Healthcare	.05000	$5,000	$250	$509.40
Rapture Pet Care	.00000	$0	$0	$13.50
Rental Car Coverage	.00000	$0	$0	$22.50
Term-Life	.00900	100,000	$900	3,000

Only three of the 23 commonly purchased insurance policies had a return greater than 50 cents on the dollar, and most of the insurance policies analyzed had an expected return of less than 25 cents on the dollar. Over a third of the policies

had a return that was less than 10 cents on the dollar. The insurance policies are shown (Table 2) in ascending order in terms of percentage return.

Table 2: Insurance Policy Percentage Return

	Expected Value	Cost of Policy	Percentage Return
Flood Damage	$380	$700	.54286
Auto Repair	$275	$525	.52381
Motorcycle Damage	$150	$300	.50000
Pet Healthcare	$250	$509.40	.49077
Jewelry Loss	$31.45	$75	.41933
Cancer Supplemental	$1,500	$3,600	.41667

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Funeral	$3,820	$9,852	.38774
Dental Coverage	$200	$600	.33333
Term-Life	$900	3,000	.30000
Lap-top Damage	$102.50	$349	.29369
Hurricane Damage	$1,500	$6,000	.25000
Cell Phone Damage	$28.13	$120	.23441
Travel	$122.94	$562.50	.21856
Children's Term Life	$250	$2,000	.12500
Auto Accident Damage	$111.93	$907.38	.12335
Hole-In-One Golf	$20	$225	.08889
Fire Damage	$58.21	$1,083	.05374
Earthquake Damage	$27.20	$700	.03886
Credit Card Fraud	$0.37	$300	.00123
Alien Abduction	$0	$9.99	.00000
Rapture Pet Care	$0	$13.50	.00000
Rental Car Coverage	$0	$22.50	.00000
Identity Theft	$0	$210.00	.00000

Not surprisingly, all the insurance policies had an expected loss, but the more expensive policies had a greater expected loss than the less expensive policies. The insurance policies are shown (Table 3) in ascending order in terms of expected loss.

Table 3: Insurance Policy Expected Loss

	Expected Value	Cost of Policy	Expected Loss
Alien Abduction	$0	$9.99	($9.99)
Rapture Pet Care	$0	$13.50	($13.50)
Rental Car Coverage	$0	$22.50	($22.50)
Jewelry Loss	$31.45	$75	($43.55)
Cell Phone Damage	$28.13	$120	($91.87)
Motorcycle Damage	$150	$300	($150)
Hole-In-One Golf	$20	$225	($205)
Identity Theft	$0	$210.00	($210.00)
Lap-top Damage	$102.50	$349	($246.50)
Auto Repair	$275	$525	($250)
Pet Healthcare	$250	$509.40	($259.40)
Credit Card Fraud	$0.37	$300	($299.63)
Flood Damage	$380	$700	($320)
Dental Coverage	$200	$600	($400)
Travel	$122.94	$562.50	($439.56)
Earthquake Damage	$27.20	$700	($672.80)
Auto Accident Damage	$111.93	$907.38	($795.45)
Fire Damage	$58.21	$1,083	($1,024.79)
Children's Term Life	$250	$2,000	($1,750)
Term-Life	$900	3,000	($2,100)
Cancer Supplemental	$1,500	$3,600	($2,100)
Hurricane Damage	$1,500	$6,000	($4,500)
Funeral	$3,820	$9,852	($6,032)

CONCLUSION

Expected value equations indicate that insurance does not provide economic value. However, many policy holders still believe that insurance provides intrinsic value -- evident by the fact that 12% of the entire U.S. economy is represented by the insurance industry. For most, purchasing insurance is not an attempt to save money, but, rather, to minimize risk. Most would be financially better off if they saved the money spent on paying premiums in an account where they could access it in the event of a loss. However, many are unable to save, and the potential downside of not having insurance can be life-shattering. For most, the negative expected value of purchasing insurance premiums is offset by the risk of being homeless or bankrupt, or the inability to afford a life-saving surgery. Buying insurance essentially buys peace of mind.

Insurance companies are able to assume risk since the probability of a mass catastrophic event is low. An insurance company can do what individuals can't, which is to take on large amounts of diversified risk with the intent of paying out on only a manageable number of claims. By insuring many, insurers get the benefit of the law of large numbers. The larger an insurance company, the more likely they are able to achieve the expected results.

From an investment standpoint, one would not buy an asset for more than its expected value, but insurance is not an investment. Risk aversion often motivates consumers to purchase insurance in situations where laws and creditors don't require insurance coverage. It should be realized that a large percentage of individuals prefer a small loss each month in the form of insurance premiums over a small probability of a catastrophic loss sometime during their life. Buying insurance has a negative expected value in dollar terms. It is only when factoring a consumer's aversion to risk that they ignore expected value calculations.

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